



NVIDIA UFM Enterprise User Manual v6.20.0

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About This Document

NVIDIA® UFM® Enterprise is a powerful platform for managing InfiniBand scale-out computing environments. UFM enables data center operators to efficiently monitor and operate the entire fabric, boost application performance and maximize fabric resource utilization.

This user guide provides documentation for network administrators responsible for deploying, configuring, monitoring, and troubleshooting the network in their data center.

For a list of the new features, bug fixes and known issues in this release, see [Release Notes](#)

Software Download

To download the UFM software, please visit [NVIDIA's Licensing Portal](#).

If you do not have a valid license, please fill out the [NVIDIA Enterprise Account Registration](#) form to get a UFM evaluation license.

Document Revision History

For the list of changes made to this document, refer to [Document Revision History](#).

Release Notes

NVIDIA® UFM® is a powerful platform for managing InfiniBand scale-out computing environments. UFM enables data center operators to efficiently monitor and operate the entire fabric, boost application performance and maximize fabric resource utilization.

Key Features

UFM provides a central management console, including the following main features:

- Fabric dashboard including congestion detection and analysis
- Advanced real-time health and performance monitoring
- Fabric health reports
- Threshold-based alerts
- Fabric segmentation/isolation
- Quality of Service (QoS)
- Routing optimizations
- Central device management
- Task automation
- Logging
- High availability
- Daily report: Statistical information of the fabric during the last 24 hours
- Event management



Prior to installation, please verify that all prerequisites are met. Please refer to [System Requirements](#).

Changes and New Features

This section lists the new and changed features in this software version.

Note

For an archive of changes and features from previous releases, please refer to [Changes and New Features History](#).

F e a t u r e	Description
C l i e n t B a s e d A u t h e n t i c	Added support for client-based authentication based on client certificate common name (CN) associated with UFM user. For more information, refer to Client Based Authentication .

F e a t u r e	Description
a t i o n	
R u n n i n g S M a n d A M a s U n p r i v i l e g e d U s e r (F o r U F M	Added the ability to run SM and AM with least privilege, without requiring root access and support for running Docker Container with root file system in read-only mode.

F e a t u r e	Description
C o n t a i n e r O n l y)	
L o w - F r e q u e n c y (S e c o n d a r y) T e l e m e t r	Added the host_name counter to the <u>Low-Frequency (Secondary) Telemetry Fields</u> .

F e a t u r e	Description
y E n h a n c e m e n t	
m T L S S u p p o r t i n t h e g N M I P l u g i n	<p>Added support for mTLS in the gNMI plugin. For more information, refer Secure Server using mTLS and Certificate Subject Identifier.</p>
m T L	<p>Added support for mTLS authentication between the UFM and Authentication proxy. For more information, refer to Proxy Authentication.</p>

F e a t u r e	Description
S S u p p o r t f o r A u t h e n t i c a t i o n P r o x y	
D O C A - H o s t D r i v	Installation of UFM is now supported on top of DOCA-Host driver. For more information, refer to Installing UFM Server on Bare Metal Server .

F e a t u r e	Description
e r I n s t a l l a t i o n	
S e t t i n g N o d e D e s c r i p t i o n (U n m a n a g e d S	Added the ability to set node description of the unmanaged switches when MKey per port is enabled. For more information, refer to Devices Action .

F e a t u r e	Description
w i t c h e s) E n h a n c e m e n t	
E x p o s i n g S M L i n k S t a t e T r a n s i	<p>Added the ability to trigger a new event when the link changed from Active to INIT state (flapping link). For more information, refer to Appendix - Supported Port Counters and Events (added event #1321).</p>

Feature	Description
tion in UFM Events	
SQLite Health Test (UFM Health)	<p>Added a new UFM health test to detect SQLite database corruption. For more information, refer to Supported Traps and Events (added event #1612) and UFM Server Health Monitoring (added test "CheckGvSqliteCorruptionTest").</p>
UFM	<p>Added the ability to stream all UFM events to <code>logs/syslog</code>. For more information, refer to Configuring UFM Logging (added the <code>stream_all_events</code> field).</p>

F e a t u r e	Description
E v e n t s S t r e a m i n g E n h a n c e m e n t	
U F M T e l e m e t r y S e c u	Added the ability to change the telemetry endpoint protocol. For more information, refer to Changing Telemetry Endpoint Protocol .

F e a t u r e	Description
r e d E n d p o i n t	
S e t t i n g S t a t i c T o p o l o g y f o r L a r g e S c a l e	<p>Added the ability to implement and test TopoSpec on a large scale. For more information, refer to OpenSM Static Topology Configuration REST API.</p>

F e a t u r e	Description
F a b r i c s	
P o r t s C a b l e I n f o r m a t i o n (X D R s u p p o r t)	<p>Added support for showing extended cable information for XDR aggregated ports. For more information, refer to Cable Information.</p>
U F M	<p>Added a standalone script that checks if the master/standby nodes are properly configured. For more information, refer to Changing Maximum SSL Request Size when Using Client Certificate</p>

F e a t u r e	Description
H A N o d e H e a l t h C h e c k	
S S L R e n e g o t i a t i o n B u f f e r S i z e	<p>Adding the option to change the maximum request size in bytes when using client certificate. The default value is 1572864 (1536KB / 1.5MB) and the parameter name is <code>max_ssl_request_size</code>.</p>

F e a t u r e	Description	
(A p p l i c a t i o n s e t t i n g e n h a n c e m e n t)		
R E S T A P I	Links REST API and Ports REST API	Updated the HDR and NDR port name to display the port label (instead of port number) in UFM UI. For more information, refer to Links REST API and Ports REST API .
P l u g i n s	OpenSM Static Topology Configuration REST API	Enhanced the static topology REST API to show full topology difference in addition to showing difference for HCAs only. For more information, refer to OpenSM Static Topology Configuration REST API .

Plugins Changes and New Features

Plugin	Version	Changes and New Features
REST-RDMA Plugin	1.0.0-33	N/A
NDT Plugin	1.1.1-17	New Feature: Added verification for duplicated node descriptions.
UFM Telemetry Fluentd Streaming (TFS) Plugin	1.1.0-0	N/A
UFM Events Fluent Streaming (EFS) Plugin	1.0.0-6	N/A
UFM Bright Cluster Integration Plugin	1.0.0-3	N/A
IB Link Resiliency Plugin	1.1.0-2	New Features: <ul style="list-style-type: none"> • Added a new alert module for detection of flapping links, with separate configurable thresholds for switch-switch and switch-host links. • Added the option to suppress duplicate UFM event messages for a configurable number of hours. • Added a new <i>isolated-unrecoverable</i> state, indicating that an isolated link could not be reinstated for a configurable number of hours as it continues to receive failure alerts. • Added new columns to the <i>Port Level Status</i> table in the <i>Current State</i> UI tab. • Updated the format of the UFM event messages reported by the plugin. • Removed the <i>link down</i> rule from the PDR alert module and moved the <i>Symbol Errors</i> rule to be enabled by default. • Changed the default value of the <i>model_threshold</i> configuration parameter.

Plugin	Version	Changes and New Features
ClusterMinder Plugin	1.1.8	<p>New Features:</p> <ol style="list-style-type: none"> 1. Added support for GB200 Compute Tray and Switch Tray 2. Added support for XDR 3. Added support for NVOS switches amBER data 4. Added support for HOST DTS ad-hoc mode collect data from NVIDIA-SMI 5. Performance improvements and bug fixes
Sysinfo Plugin	1.1.1	N/A
SNMP Plugin	1.0.0-3	N/A
Packet Level Monitoring Collector (PMC) Plugin	1.19.18	N/A

Plugin	Version	Changes and New Features
GNMI-Telemetry Plugin	1.3.1-0	<p>New Features:</p> <ul style="list-style-type: none"> Added a new configuration flag to always return all the queried data in every heartbeat when subscribing to on change. The default value is false. Added support for reading the log file name and path from the configurations. Sampling for events and inventory has been disabled. A new configuration flag, <code>disable_events_inventory</code>, has been added to the <code>/opt/ufm/files/conf/gnmi_telemetry.ini</code> configuration file. Added the ability to configure telemetry sampling rates for individual endpoints via the <code>/opt/ufm/files/conf/gnmi_telemetry.ini</code> configuration file
UFM Telemetry Manager (UTM) Plugin	1.19.10	N/A
UFM Consumer Plugin	1.0.0-16	N/A
Fast-API Plugin	1.0.0-2	N/A
UFM Light Plugin	1.1.0-2	N/A
Key Performance Indexes (KPI) Plugin	1.0.7-2	N/A
UFM Events Grafana Dashboard Plugin	1.0.2-0	<p>Limitations:</p> <ul style="list-style-type: none"> Not supported on UFM Gen 2.0 FluentD fails with RHEL9 OS.

Note

The items listed in the table below apply to all UFM license types.

Note

For bare metal installation of UFM, it is required to install MLNX_OFED 5.X (or newer) before the UFM installation.

Please make sure to use the UFM installation package that is compatible with your setup, as detailed in [Bare Metal Deployment Requirements](#).

Unsupported Functionalities/Features

The following distributions are no longer supported in UFM:

- RH7.0-RH7.7 / CentOS7.0-CentOS7.7
- SLES12 / SLES 15
- EulerOS2.2 / EulerOS2.3
- Ubuntu18.04

Deprecated Features:

- Mellanox Care (MCare) Integration
- UFM on VM (UFM with remote fabric collector)
- Logical server auditing
- The UFM high availability script - **`/etc/init.d/ufmha`** - is no longer supported

- The **UFM Multi-site portal** feature is no longer supported. The Multi-Subnet feature can be used instead
- As of UFM Enterprise v6.19.0, the Autonomous Link Maintenance (**ALM**) and **PDR Deterministic** plugins are no longer supported.
- The **GRPC-Streamer plugin** is deprecated.
- As of UFM Enterprise v6.18.0, **UFM Agent discovery** will be disabled by default, and managed switches will be discovered in-band
- As of UFM Enterprise v6.18.0, the `ibdiagpath` diagnostic utility is deprecated
- As of UFM Enterprise version 6.14.0, **UFM Monitoring Mode** is deprecated and is no longer supported
- As of UFM Enterprise v6.12.0, the **Logical Elements tab** is removed
- Removed the following fabric validation tests: **CheckPortCounters & CheckEffectiveBER**

Note

In order to continue working with `/etc/init.d/ufmha` options, use the same options using the `/etc/init.d/ufmd` script.

For example:

Instead of using `/etc/init.d/ufmha model_restart`, please use `/etc/init.d/ufmd model_restart` (on the primary UFM server)

Instead of using `/etc/init.d/ufmha sharp_restart`, please use `/etc/init.d/ufmd sharp_restart` (on the primary UFM server)

The same goes for any other option that was supported on the `/etc/init.d/ufmha` script

Installation Notes

Supported Devices

Supported NVIDIA Externally Managed Switches

Type	Model	Latest Tested Firmware Version
NDR switches	<ul style="list-style-type: none">MQM9790	31.2014.1090
HDR switches	<ul style="list-style-type: none">MQM8790	27.2012.4036
EDR switches	<ul style="list-style-type: none">SB7790SB7890	15.2010.4402

Supported NVIDIA Internally Managed Switches

Type	Model	Latest Tested OS Version
XDR switches	<ul style="list-style-type: none">Q3200_RAQ3400_RA	NVOS-25.02.2002
NDR switches	<ul style="list-style-type: none">MQM9700	MLNX-OS 3.12.1002 NVOS 25.01.4000
HDR switches	<ul style="list-style-type: none">MQ8700MCS8500TQ8100-HS2FTQ8200-HS2F	MLNX-OS 3.12.1002
EDR switches	<ul style="list-style-type: none">SB7700SB7780SB7800CS7500CS7510CS7520	MLNX-OS 3.10.4400

System Requirements

Bare Metal Deployment Requirements

Platform	Type and Version
OS (Relevant for Standalone and High-Availability deployments)	64-bit OS: <ul style="list-style-type: none">• RedHat 8• RedHat 9• Ubuntu 20.04• Ubuntu 22.04• Ubuntu 24.04• Debian 10• Oracle Enterprise Linux 8.10
CPU ^(a)	x86_64
HCA ^s	<ul style="list-style-type: none">• NVIDIA ConnectX[®]-5 with Firmware 16.35.4506 and above• NVIDIA ConnectX[®]-6 with Firmware 20.44.0982 and above• NVIDIA ConnectX[®]-7 with Firmware 28.44.0982 and above• NVIDIA ConnectX[®]-8 with Firmware 40.44.0992 and above• NVIDIA Mezzanine Board with Four ConnectX-7 ASICs for Multi-GPU Connectivity (CEDAR) with Firmware 28.36.0394 and above• NVIDIA BlueField with Firmware 24.33.900 and above• NVIDIA BlueField-2 with Firmware 24.33.900 and above• NVIDIA BlueField-3 with Firmware 32.43.1000 and above
OFED ^(b)	<ul style="list-style-type: none">• MLNX_OFED23.x• MLNX_OFED24.x• MLNX_OFED25.x

i Note

(a) CPU requirements refer to resources consumed by UFM. You can also dedicate a subset of cores on a multicore server. For example, 4 cores for UFM on a 16-core server.

(b) For supported HCAs in each MLNX_OFED version, please refer to MLNX_OFED Release Notes.

(c) UFM v6.15.0 is the last version to support NVIDIA ConnectX-4 adapter cards

i Note

For running SHARP Aggregation Manager within UFM, it is recommended to use MLNX_OFED-5.4.X version or newer.

i Note

Installation of UFM on minimal OS distribution is not supported.

i Note

UFM does not support systems in which NetworkManager service is enabled.

Before installing UFM on RedHat OS, make sure to disable the service.

Docker Installation Requirements

UFM Docker Container is supported on the standard docker environment (engine).

The following operating systems were tested with Docker Container (as standalone container):

Component	Type and Version
Supported OS	<ul style="list-style-type: none">• RHEL8• RHEL9• Ubuntu20.04• Ubuntu22.04• Ubuntu24.04• Debian 10• Oracle Enterprise Linux 8.10

Note

For UFM Docker Container installation in HA mode, please refer to [Bare Metal Deployment Requirements](#) for the list of operating systems and kernels which support HA.

Note

On some Ubuntu OSs, Docker is installed via SNAP, which might lead to errors when trying to use UFM Plugins.

To solve this issue, perform the following:

1. Remove Docker installed via SNAP, run:

```
snap remove --purge docker
```

2. Update the local package index, run :

```
apt update
```

3. Install native Docker, run:

```
apt install-y docker.io
```

Podman Installation

Note

Podman is tested on Oracle Linux 8.10 distribution.

Installation Instructions

Since Docker and Podman are mutually exclusive, ensure that any existing Docker packages are removed before installing Podman. You can do this with the following command:

```
yum remove $(rpm -qa | grep docker)
```

Once Docker is removed, proceed with the installation of Podman and the Podman Docker-compatible CLI using the following commands:

```
dnf install podman podman-docker
```

Finally, enable and start the Podman socket to allow for socket-based communication:

```
systemctl enable --now podman.socket
```

After installing Podman, the deployment of [UFM Docker Containers](#) and [UFM Plugins](#) should function in the same way as the corresponding Docker deployments.

UFM Server Resource Requirements per Cluster Size

Fabric Size	CPU Requirements*	Memory Requirements	Disk Space Requirements	
			Minimum	Recommended
Up to 1000 nodes	4-core server	4 GB	20 GB	50 GB

Fabric Size	CPU Requirements*	Memory Requirements	Disk Space Requirements	
1000-5000 nodes	8-core server	16 GB	40 GB	120 GB
5000-10000 nodes	16-core server	32 GB	80 GB	160 GB
Above 10000 nodes	Contact NVIDIA Support			

UFM GUI Client Requirements

The platform and GUI requirements are detailed in the following tables:

Platform	Details
Browser	Edge, Internet Explorer, Firefox, Chrome, Opera, Safari
Memory	<ul style="list-style-type: none"> • Minimum: 8 GB • Recommended: 16 GB

MFT Package Version

Platform	Details
MFT	Integrated with MFT version 4.31.0-149

UFM SM Version

Platform	Type and Version
SM	UFM package includes SM version 5.22.11

Note

Assuming the SM is connected to the production cluster, it can handle any events (IB traps) coming from the fabric that is being built; such events should not affect the routing on the production cluster. If events occurred in the production cluster, the routing could be changed.

However, NVIDIA recommends isolating fabric sections to allow faster bring-ups, **faster troubleshooting and misconfiguration avoidance** that can cause routing errors. Isolation provides clearer SM and CollectX logs, avoiding warnings/errors from masking real production issues.

UFM NVIDIA SHARP Software Version

Platform	Type and Version
NVIDIA A [®] Scalable Hierarchical Aggregation and Reduc	UFM package includes NVIDIA SHARP software version 3.10.3

Platform	Type and Version
tion Protocol (SHARP) TM	

Used Ports by UFM Server

For a list of ports used by the UFM Server for internal and external communication, refer to [Appendix – Used Ports](#)

Software Update from Prior Versions

The installer detects versions previously installed on the machine and prompts you to run a clean install of the new version or to upgrade while keeping user data and configuration unchanged.

The upgrade from previous versions maintains the existing database and configuration, allowing a seamless upgrade process.

Info

Upgrading UFM Enterprise software version is supported up to two previous GA software versions (GA -1 or -2).

For example, if you wish to upgrade to UFM Enterprise v6.17.0, it is possible to do so only from UFM Enterprise v6.16.0 or v6.15.0.

Note

Due to a possible conflict, SM and SHARP installed by the MLNX_OFED must be uninstalled. The installation procedure will

detect and print all MLNX_OFED packages that must be removed.

Bug Fixes in This Release

Ref #	Description
4255774	Description: Fixed issue with inability to retrieve HDR and NDR switch temperature.
	Keywords: Temperature, Switch
	Discovered in Release: v6.18.0-5
4244365	Description: Fixed issue with <code>ufm_rest_roles.json</code> file not being recognized by UFM after upgrade.
	Keywords: <code>ufm_rest_roles.json</code>
	Discovered in Release: v6.19.5
4180474	Description: Fixed the issue where missing (not presented) fan was not generating a warning in UFM.
	Keywords: Fan, Failure, Warning
	Discovered in Release: v6.16.0

For HA related bug fixes, refer to [UFM High-Availability Release Notes v5.8.0](#).

Known Issues in This Release

Ref #	Description
4261896	Description: XDR optical cable transceivers (Wolverine) information is not exposed in UFM (for both REST API and Web UI)
	Keywords: Cable, Transceiver, Info, Wolverine
	Workaround: N/A
	Discovered in Release: 6.20.0

Ref #	Description
4289083	Description: ibdiagnet, a diagnostic tool for InfiniBand networks, fails to discover unmanaged switches when a specific VS key is enabled, resulting in incomplete network discovery.
	Keywords: ibdiagnet, Unmanaged Switches, VS key
	Workaround: N/A
	Discovered in Release: 6.20.0
4221551	Description: Removed the " <code>-f/--force</code> " option for upgrading UFM plugins
	Keywords: Plugin, Upgrade, <code>--force</code>
	Workaround: For upgrading UFM plugins, please refer to the instruction provided in UFM Plugin Upgrade Procedure .
	Discovered in Release: 6.20.0

Info

For a list of known issues from previous releases, please refer to [Known Issues History](#).

Changes and New Features History

Note

The items listed in the table below apply to all UFM license types.

Feature	Description
Rev 6.19.6	
ConnectX-8 Support	Added support for ConnectX-8
Rev 6.19.0	
Telemetry Enhancements	Added the ability to zoom into XDR aggregated ports and view telemetry data per related plane ports. For more information, refer to XDR Per-Plane Zoom-In .
	Added integration with UTM plugin to avoid intermittent port zero counter values. Refer Telemetry .
	Added support for automatic handling of telemetry discovery in case of topology changes.
Managing Unhealthy Ports in XDR IB Clusters	Added the ability to set XDR aggregated ports as healthy or unhealthy. For more information, refer to Unhealthy Ports Window .
Switch Management via Web UI	Added a configurable option for accessing managed switch CLI and Web-UI via UFM Web-UI. For more information, refer to Devices Window .
Switch In-Service Upgrade Events	Added support for two new events - isolating and de-isolating actions of switch in-service upgrade. Refer to Threshold-Crossing Events Reference .
Global API for UFM Plugins Management	Added API for managing UFM plugins via UFM Multi-subnet consumer. Refer to Multi-Subnet UFM .
Module Temperature Events Update	Updated the naming and thresholds of the Module Temperature threshold reached events. Refer to Appendix - Supported Port Counters and Events .
Persistency for Certificate Authorities (CAs) Certificates	Added support for CAs certificate persistency, ensuring the same CA certificates are used in case of UFM HA failover/takeover. Refer to Setting Up SSL and CA Certificates in UFM .
SM Configuration Validation	Added support for automatic validation of SM configuration on HCAs. The Validation can be done upon demand via Fabric Validation . Refer to Events & Alarms → SM Configuration Events.
Supported Operating Systems	Added support for UFM HA Ubuntu24.04 and Debian 10 operating systems. Refer to Installation Notes .

Feature	Description
	Added support for UFM on CentOS Stream 10.
Podman Support	Added Podman support for Oracle. Refer to Podman Installation .
Plugin Health Test Enhancement	Updated the health test of the REST over RDMA plugin to test if the plugin is operating properly. For more information, refer to UFM Server Health Monitoring .
Software Upgrade - API Request Update	Extended the password length limitation from 20 to 64 characters for the following UFM actions: software upgrade, firmware upgrade, OFED upgrade, and profile update.
OpenSM static topology configuration REST API	Added support for managing OpenSM static topology configuration using REST API. Refer to the UFM REST API Documentation .
Rev 6.18.0	
UFM Reports Enhancements	Added an option for excluding unhealthy ports from UFM reports based on <code>ibdiagnet</code> (for example: Fabric Health report, Fabric Validation tests). For more information, refer to Excluding Unhealthy Ports from Fabric Health Report .
Telemetry Enhancements	Added support for Egress Queue depth indications (as part of UFM secondary telemetry instance). For more information, refer to Exposing Performance Histogram Counters .
	Added support for Extended Port VL Xmit Time Congestion counters (as part of UFM secondary telemetry instance).
UFM Configuration Adjustments	Added the option for auto-setting of UFM configuration based on fabric size (large scale, small scale). For more information, refer to Adjusting UFM Configuration Files Based on Fabric Size .
UFM Container Timezone	The UFM Container has been updated to operate in the host machine's time zone instead of UTC.
UFM Events	Added the ability to update thresholds, severities, and durations (TTL) for selected UFM Events.
	Added a new UFM event for indicating asymmetric Adaptive Routing (based on SM trap). For more information, refer to Appendix - Supported Port Counters and Events .
Topology Changes Reports Enhancements	Enhanced the topology change indication from the master topology and enabled a quick drill-down to the associated

Feature	Description	
	topology change report. For more information, refer to Topology Compare Tab and Events & Alarms .	
Multi-Subnet UFM	Added support for running UFM Fabric validation Tests from UFM Multi-Subnet Consumer. For more information, refer to Multi-Subnet UFM .	
UFM Docker Container Deployment	Added support for deploying UFM as a docker on Oracle Linux 8. For more information, refer to Installation Notes .	
UFM-HA	HA Deployment: Added support for deploying UFM HA on Ubuntu24.04.	
	HA Configuration: Added configurable failover criteria (management interface loss-of-link).	
UFM System Dump Analyser	Introduced an internal debugging tool for more efficient analysis of UFM system dumps.	
Plugins	REST-RDMA Plugin	Added support for client certificate authentication when communicating between the client and the REST over RDMA plugin server.
	UFM Light Plugin	Added support for UFM Light Plugin to create a reduced UFM model and deliver a high-performance REST API.
	Key Performance Indexes (KPI) Plugin	Added support for the KPI plugin which periodically collects telemetry metrics and topology data from one or multiple UFM Telemetry and UFM clusters to calculate high-level Key Performance Indicators (KPIs).
	DTS Plugin	Added support for the ClusterMind plugin which collects telemetry data from multiple data sources and aggregates, streams and visualizes the backend.
	Packet Level Monitoring Collector (PMC) Plugin	Added the option to collect PHY link-down event indications through fast-recovery notification channels.
	UFM Plugins Management	Added support for UFM plugin management using the

Feature	Description
	<p><code>manage_ufm_plugins.sh</code> script.</p> <p>Plugins Bundle</p> <p>Added support for a single deployment of plugins to extend functionalities of the UFM ecosystem.</p>
REST APIs	<p>UFM-Forge Integration</p> <p>Added support for setting SM resource limitation. For more information, refer to the Physical-Virtual GUID Mapping REST API.</p>
	<p>SHARP Jobs Performance Analysis</p> <p>Added a new REST API which expose SHARP Job statistics data. For more information, refer to NVIDIA SHARP REST API</p>
	<p>UFM Logging</p> <p>Added caller (IP Address) and duration logging info for all REST API calls.</p>
	<p>UFM Version API Enhancement</p> <p>Added a REST API to retrieve the versions of major UFM components and enabled plugins.</p>
Rev 6.17.0	
XDR Support	<p>Added XDR support readiness (based on XDR setup simulations only).</p>
	<p>Added support for UFM Network topology planarized network.</p>
Switch NVOS Support	<p>Added support for NVOS switches in UFM.</p>
Device Access	<p>Added the ability to record two sets of switch login credentials on UFM. Refer to Device Access</p>
UFM Authentication Server	<p>The authentication server is enabled by default. Refer to Configurations of the UFM Authentication Server.</p>
InfiniBand Cluster Procedures Automation	<p>Upon UFM startup, the following procedures are initiated:</p> <ul style="list-style-type: none"> • Generate default Fabric health - Refer to Fabric Health Tab • Validate cluster topology - Refer to Topology Compare Tab • Obtain and keep the UFM's initial system dump - Refer to UFM System Dump Tab
Secondary Telemetry	<ul style="list-style-type: none"> • Added the " <code>rq_general_error</code> " field to support retrieving the number of packet drops due to MPR mismatch.

Feature	Description
	<ul style="list-style-type: none"> • Added support for reporting cable length information for NDR optic cables. • Added support for retrieving cable information for downed ports. • Added switch/module power usage data in UFM telemetry. <p>For more information, refer to Low-Frequency (Secondary) Telemetry Fields.</p>
Events Simulation	Added the ability to simulate any event from the Events policy tab. Refer to Events Policy Simulation .
Unhealthy Port Enhancement	Added the ability to display valid unhealthy port information (eliminating non-zero port values) when added manually. Refer to Unhealthy Ports Window .
UFM High Availability	Added support for UFM HA to configure IPv4 and IPv6 concurrently to provide Virtual IP address. Refer to UFM High-Availability User Guide .
REST APIs	Unhealthy Ports REST API: Added the ability to return device state (healthy/unhealthy). Refer to NVIDIA UFM Enterprise REST API Guide → Unhealthy Ports REST API
	Add switch/module power usage data in UFM telemetry. Refer to NVIDIA UFM Enterprise REST API Guide → Systems REST API
Plugins	Enhanced Plugins management infrastructure.
	GNMI-Telemetry Plugin : Added support for streaming gNMI events and restricted authentication via client SAN pinning/filtering on the gNMI plugin server-side.
	UFM Telemetry Manager (UTM) Plugin : Added a new plugin to monitor and manage running UFM Telemetry instances.
	UFM Consumer Plugin : Added a new plugin that serves as a Multi-Subnet consumer within UFM, offering all the functionalities available for Multi-Subnet UFM.
	PDR Deterministic Plugin: Updated high BER analysis with the up-to-date high BER algorithm.
	Autonomous Link Maintenance (ALM) Plugin: Added the following capabilities: <ul style="list-style-type: none"> • Model configuration • Configure to reset both ports after isolation

Feature	Description
	<ul style="list-style-type: none"> Reflect model performance to the user
	UFM Telemetry Fluentd Streaming (TFS) Plugin : Added an option to the TFS to stream the data using the CLX C streamer instead of the Python streamer.

Bug Fixes History

Ref. #	Description
	Rev 6.19.6
	N/A
	Rev 6.19.0
4033094	Description: Resolved issue with the Fabric Analysis Report failure because the <code>setDriverAndCapabilities()</code> method expects 1 positional argument, but 2 were provided.
	Keywords: Fabric Analysis Report, Failure, <code>setDriverAndCapabilities()</code>
	Discovered in Release: 6.15.4-4
4032348	Description: Fixed issue with irrelevant threshold value for event the "Module Temperature High Threshold" Reached event (Unmanaged IB switches only).
	Keywords: Threshold, Event, Module Temperature High Threshold
	Discovered in Release: 6.15.2
4052978	Description: Fixed issue with UFM PKey programming failure with HTTP 413 error (Content Too Large).
	Keywords: PKey Programming, Failure
	Discovered in Release: 6.17.2

Ref. #	Description
4061936	Description: Fixed issue with inability to delete PKeys prefixed with one or more 0's when added via resources/pkeys/add API.
	Keywords: PKey, Deletion, resources/pkeys/add API
	Discovered in Release: 6.18.0-5
4031555	Description: Fixed issue where the UFM webUI could only detect 7 out of 8 HCAs on the server after a reboot.
	Keywords: WebUI, HCA, Reboot
	Discovered in Release: 6.15.1-4
4095217	Description: Fixed issue causing UFM error (Unexpected exception) during object history updates.
	Keywords: UFM Error, Unexpected Exception, History, Update
	Discovered in Release: 6.18.0
Rev 6.18.0	
4012915	Description: Fixed bug in SMTP configuration
	Keywords: SMTP, Configuration
	Discovered in Release: v6.17.1
3985023	Description: Fixed the issue where GUIDs could not be assigned to empty keys in the REST API
	Keywords: REST API, GUID, Empty Keys
	Discovered in Release: v6.17.2
3959780	Description: Fixed the issue with missing telemetry data on the dashboard after installing UFM Enterprise v6.17.1
	Keywords: Telemetry, Data, Dashboard
	Discovered in Release: v6.17.1
3912416	Description: Fixed the issue where the Web UI frequently exits after the admin password was

Ref. #	Description
	changed
	Keywords: WebUI, Exit, Password
	Discovered in Release: v6.17.0
3881365	Description: Fixed the issue with the CloudX REST API malfunctioning when deleting a port associated with a PKey
	Keywords: CloudX, REST API, PKey, Port
	Discovered in Release: v6.15.2
Rev 6.17.0	
3912416	Description: Fixed issue with the authentication server being repeatedly restarted by the UFM health check after the default admin password is changed
	Keywords: Authentication, Server, Disable
	Discovered in Release: v6.17.0
3863958	Description: Fixed issue where IB-IB go to INIT states due to failed UFM failover after enabling SHARP with PKeys
	Keywords: SHARP, PKey, IB-IB Link, Failover
	Discovered in Release: v6.16.0
3850673	Description: Fixed issue where multiple ports go down simultaneously (link-downed counter increment)
	Keywords: Ports, down, simultaneous
	Discovered in Release: v6.15.1
3850217	Description: Fixed issues with ALM plugin (disabled handling topology changes and limited the number of trials of creating dynamic telemetry sessions by configurable variables)
	Keywords: ALM Plugin
	Discovered in Release: v6.15.0
3826544	Description: Fixed node info discovery issue

Ref. #	Description
	Keywords: Node, Info, Discovery
	Discovered in Release: v6.16.0
3826069	Description: Fixed HCA port naming convention inconsistencies in UFM WebUI
	Keywords: HCA port, Port name, WebUI
	Discovered in Release: v6.15.2
3816196	Description: Fixed issue where UFM creates empty PKeys by UFM Rest API
	Keywords: Empty, PKey, REST API
	Discovered in Release: v6.15.2
3811475	Description: Fixed issue where UFM loggings REST API omits additional contents of the log when it spans over multiple lines
	Keywords: UFM Loggings, REST API, Span over, Multiple Lines
	Discovered in Release: v6.15.3
3803527	Description: Fixed issue with Create History REST API while collecting SM Logs Error
	Keywords: Create History, SM Log Error
	Discovered in Release: v6.15.3
3752196	Description: Fixed intermittent UFM REST API Failures
	Keywords: UFM REST API, Failures
	Discovered in Release: v6.16.0
3864876	Description: Fixed issue with UFM events not appearing in remote syslog
	Keywords: UFM Events, Remote syslog
	Discovered in Release: v6.15.1
3809574:	Description: Fixed WebUI issues in the "Power" column
	Keywords: WebUI, Power

Ref. #	Description
	Discovered in Release: v6.16.0
3766079	Description: Fixed issue with UFM not showing SSH user/pass tab
	Keywords: SSH, User/Pass Tab
	Discovered in Release: v6.15.0
3916656	Description: Fixed issue with releasing lock without acquiring when handling MC join requests from unknown source.
	Keywords: MC, lock
	Discovered in Release: v6.17.0

Known Issues History

Ref #	Issue
Rev 6.19.6	
42240 81	Description: Burning of XDR cables using XDR switch is not supported.
	Keywords: XDR, Cables, Switch
	Workaround: N/A
	Discovered in Release: 6.19.6
33979 81	Description: Showing extended cable information for aggregated XDR switch port is not supported by UFM.
	Keywords: XDR, Cable Information, Switch
	Workaround: N/A
	Discovered in Release: 6.19.6
Rev 6.19.0	
41192 14	<p>Description: In case of pulling telemetry data from the UFM server (High or low-frequency instances), the loopback/local host IP should be used instead of the hostname or host IP. Example of High-Frequency (Primary) Telemetry Instance:</p> <pre>#curl -s 127.0.0.1:9001/csv/cset/converted_enterprise</pre>

Ref #	Issue
	<p data-bbox="284 218 1159 254">Example of Low-Frequency (Secondary) Telemetry Instance:</p> <pre data-bbox="284 296 867 344">#curl -s 127.0.0.1:9002/csv/xcset/low_freq_debug</pre> <p data-bbox="284 443 948 478">Keywords: Localloop IP, Telemetry, Local Host</p> <p data-bbox="284 506 537 541">Workaround: N/A</p> <p data-bbox="284 569 716 604">Discovered in Release: 6.19.0</p>
41518 47	<p data-bbox="284 625 1089 661">Description: Primary Telemetry is not updated properly</p> <p data-bbox="284 688 716 724">Keywords: Primary Telemetry</p> <p data-bbox="284 751 1430 1010">Workaround: Comment out or remove the line that defines <code>CLX_RESTART_FILE</code> in the <code>/opt/ufm/files/conf/telemetry/primary_env.cfg</code> configuration file. This change should be made before starting UFM. If UFM is already running, restart the telemetry service for the change to take effect by running <code>/etc/init.d/ufmd ufm_telemetry_restart</code>.</p> <p data-bbox="284 1037 716 1073">Discovered in Release: 6.19.0</p>
41578 55	<p data-bbox="284 1102 1409 1213">Description: The High-Frequency (Primary) Telemetry instance is missing the necessary environment variable in UTM (non-legacy) mode, which causes an incorrect sample rate.</p> <pre data-bbox="284 1262 662 1310">CLX_EXPORT_API_BASE_FREQ=1</pre> <p data-bbox="284 1381 591 1417">Keywords: Telemetry</p> <p data-bbox="284 1444 477 1480">Workaround:</p> <ol data-bbox="331 1514 1425 1598" style="list-style-type: none"> <li data-bbox="331 1514 1425 1598">1. Add the following line to the file <code>/opt/ufm/files/conf/telemetry_defaults/primary_env.cfg</code>: <pre data-bbox="284 1640 662 1688">CLX_EXPORT_API_BASE_FREQ=1</pre> <ol data-bbox="331 1745 862 1780" style="list-style-type: none"> <li data-bbox="331 1745 862 1780">1. Afterward, execute the command: <pre data-bbox="284 1829 737 1877">/etc/init.d/ufmd ufm_telemetry_restart</pre>

Ref #	Issue
	Discovered in Release: 6.19.0
41726 77	Description: UFM Telemetry server experiencing slowdowns in data collection and response to requests
	Keywords: Telemetry, Slowdown, Data Collection
	Workaround: Implement the following configuration update on both the primary and secondary telemetry:
	plugin_env_CLX_METADATA_CHECK_FILE_RATE_SEC=300
	Then, restart UFM or UFM Telemetry.
	Discovered in Release: 6.19.0
41619 21	Description: VL15 counters are returned NA due to invalid parsing of the response.
	Keywords: L15 counters, Management Traffic, ibdiagnet
	Workaround: N/A
	Discovered in Release: 6.19.0
Rev 6.18.0	
39911 99	Description: Dynamic Telemetry instances are not recovered during the backup/restore procedure
	Keywords: Dynamic Telemetry, Backup, Restore
	Workaround: N/A
	Discovered in Release: 6.17.5
Rev 6.17.0	
38593 62	Description: UFM TFS endpoint dashboard report Switch port TX/RX rate reach Tbps
	Keywords: TFS, Switch Port, TX/RX
	Workaround: N/A
	Discovered in Release: v6.15.1
38813 65	Description: Malfunctioning of the rest API when deleting port associated to a pkey
	Keywords: CloudX, API, Bare-Metal

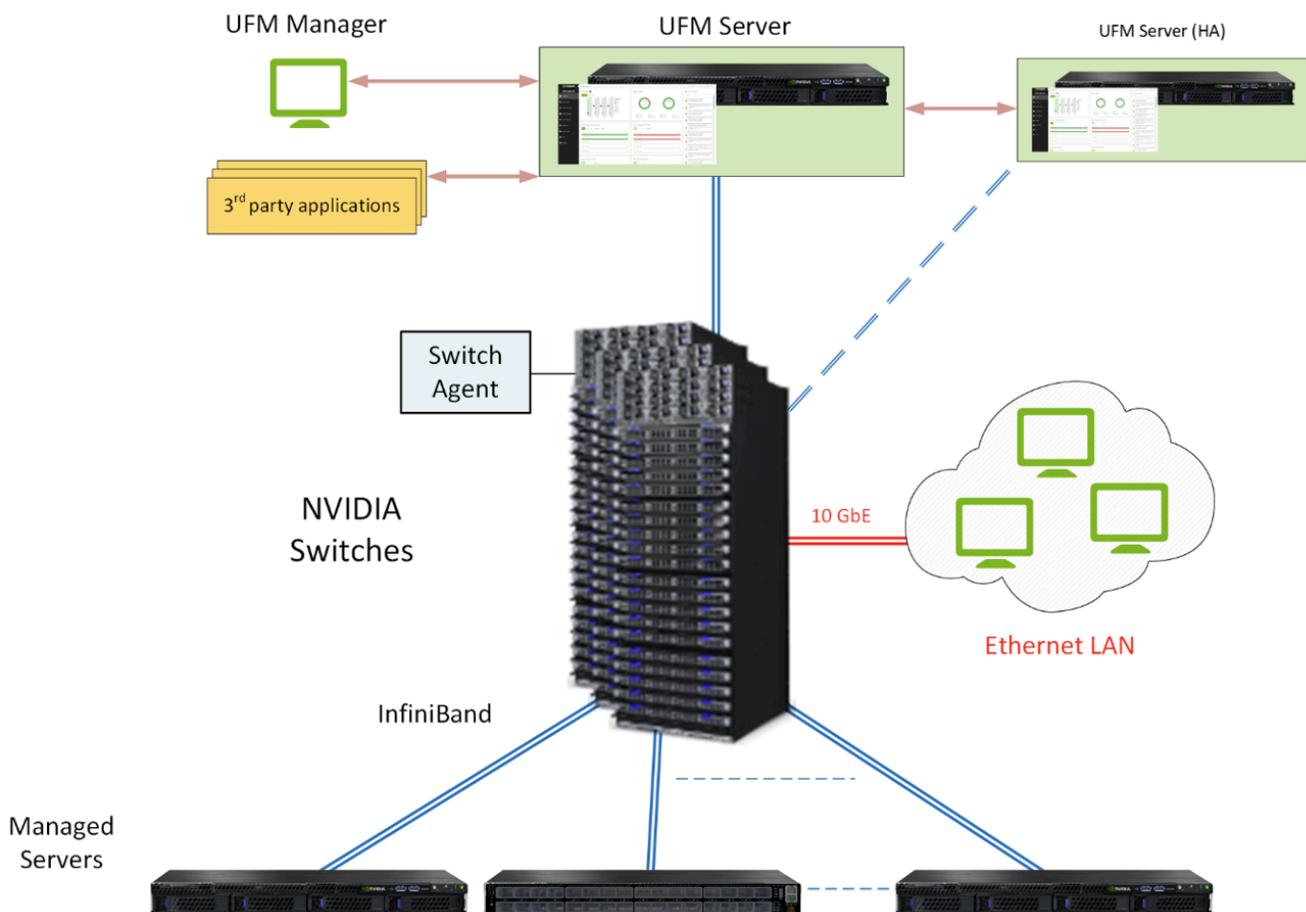
Ref #	Issue
	Workaround: N/A
	Discovered in Release: v6.15.2
38628 47	Description: UFM reports wrong cable length for NDR optical cables connected to Quantum-2 NDR switch
	Keywords: NDR, Optical Cables, Quantum-2, Switch
	Workaround: N/A
	Discovered in Release: v6.17.0

UFM Overview

Scale-Out Your Fabric with Unified Fabric Manager

NVIDIA®UFM is a host-based solution that provides all the management functionalities required for managing fabrics.

Fabric Topology with UFM



UFM Server is a server on which UFM is installed and has complete visibility over the fabric to manage routing on all devices.

UFM HA Server is a UFM installed server on a secondary server for High Availability deployment.

Managed Switching Devices are fabric switches, gateways, and routers managed by UFM.

Managed Servers are the compute nodes in the fabric on which the various applications are running, and UFM manages all servers connected to the fabric.

UFM Host Agent is an optional component that can be installed on the Managed Servers. UFM Host Agent provides local host data and host device management functionality.

The UFM Host Agent provides the following functionality:

- Discovery of IP address, CPU, and memory parameters on host
- Collection of CPU/Memory/Disk performance statistics on host
- Upgrading HCA Firmware and OFED remotely
- Creating an IP interface on top of the InfiniBand partition

UFM Switch Agent is an embedded component in NVIDIA switches that allows IP address discovery on the switch and allows UFM to communicate with the switch. For more information, please refer to [Device Management Feature Support](#).

UFM Benefits

Benefit	Description
Central Console for Fabric Management	UFM provides all fabric management functions in one central console. The ability to monitor, troubleshoot, configure and optimize all fabric aspects is available via one interface. UFM's central dashboard provides a one-view fabric-wide status view.
In-Depth Fabric Visibility and Control	UFM includes an advanced granular monitoring engine that provides real-time access to switch and host data, enabling cluster-wide monitoring of fabric health and performance, real-time identification of fabric-related errors and failures, quick problem resolution via granular threshold-based alerts and a fabric utilization dashboard.
Advanced Traffic Analysis	Fabric congestion is difficult to detect when using traditional management tools, resulting in unnoticed congestion and fabric under-utilization. UFM's unique traffic map quickly

Benefit	Description
	identifies traffic trends, traffic bottlenecks, and congestion events spreading over the fabric, which enables the administrator to identify and resolve problems promptly and accurately.
Enables Multiple Isolated Application Environments on a Shared Fabric	Consolidating multiple clusters into a single environment with multi-tenant data centers and heterogeneous application landscapes requires specific policies for the different parts of the fabric. UFM enables segmentation of the fabric into isolated partitions, increasing traffic security and application performance.
Service-Oriented Automatic Resource Provisioning	UFM uses a logical fabric model to manage the fabric as a set of business-related entities, such as time critical applications or services. The logical fabric model enables fabric monitoring and performance optimization on the application level rather than just at the individual port or device level. Managing the fabric using the logical fabric model provides improved visibility into fabric performance and potential bottlenecks, improved performance due to application-centric optimizations, quicker troubleshooting and higher fabric utilization.
Quick Resolution of Fabric Problems	UFM provides comprehensive information from switches and hosts, showing errors and traffic issues such as congestion. The information is presented in a concise manner over a unified dashboard and configurable monitoring sessions. The monitored data can be correlated per job and customer, and threshold-based alarms can be set.
Seamless Failover Handling	Failovers are handled seamlessly and are transparent to both the user and the applications running on the fabric, significantly lowering downtime. The seamless failover makes UFM in conjunction with other Mellanox products, a robust, production-ready solution for the most demanding data center environments.

Benefit	Description
Open Architecture	UFM provides an advanced Web Service interface and CLI that integrate with external management tools. The combination enables data center administrators to consolidate management dashboards while flawlessly sharing information among the various management applications, synchronizing overall resource scheduling, and simplifying provisioning and administration.

Main Functionality Modules

Module	Description
Fabric Dashboard	UFM's central dashboard provides a one-view fabric-wide status view. The dashboard shows fabric utilization status, performance metrics, fabric-wide events, and fabric health alerts. The dashboard enables you to efficiently monitor the fabric from a single screen and serves as a starting point for event or metric exploration.
Fabric Segmentation (PKey Management)	In the PKey Management view you can define and configure the segmentation of the fabric by associating ports to specific defined PKeys. You can add, remove, or update the association of ports to the related PKeys and update the qos_parameters for PKey (mtu, rate, service_level).
Fabric Discovery and Physical View	UFM discovers the devices on the fabric and populates the views with the discovered entities. In the physical view of the fabric, you can view the physical fabric topology, model the data center floor, and manage all the physical-oriented events.
Central Device Management	UFM provides the ability to centrally access switches and hosts, and perform maintenance tasks such as firmware and software upgrade, shutdown and restart.

Module	Description
Monitoring	<p>UFM includes an advanced granular monitoring engine that provides real-time access to switch and server data. Fabric and device health, traffic information and fabric utilization are collected, aggregated and turned into meaningful information.</p>
Configuration	<p>In-depth fabric configuration can be performed from the Settings view, such as routing algorithm selection and access credentials. The Event Policy Table, one of the major components of the Configuration view, enables you to define threshold-based alerts on a variety of counters and fabric events. The fabric administrator or recipient of the alerts can quickly identify potential errors and failures, and actively act to solve them.</p>
Fabric Health	<p>The fabric health tab contains valuable functions for fabric bring-up and on-going fabric operations. It includes one-click fabric health status reporting, UFM Server reporting, database and logs' snapshots and more.</p>
Logging	<p>The Logging view enables you to view detailed logs and alarms that are filtered and sorted by category, providing visibility into traffic and device events as well as into UFM server activity history.</p>
High Availability	<p>In the event of a failover, when the primary (active) UFM server goes down or is disconnected from the fabric, UFM's High Availability (HA) capability allows for a secondary (standby) UFM server to immediately and seamlessly take over fabric management tasks. Failovers are handled seamlessly and are transparent to both the user and the applications running in the fabric. UFM's High Availability capability, when combined with NVIDIA's High Availability switching solutions allows for non-disruptive operation of complex and demanding data center environments.</p>

Please refer to the following sections for UFM's main functionalities:

- [Events and Alarms](#)
- [Reports](#)
- [Telemetry](#)

Getting Familiar with UFM's Data Model

Overview of Data Model

UFM enables the fabric administrator to manage the fabric based on discovery data collected from the fabric. This data is mapped into model elements (objects) available to the end user via UFM REST API and UFM Web UI.

UFM Model Basics

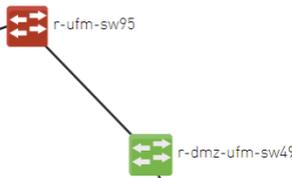
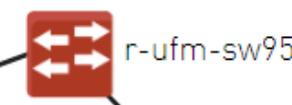
The fabric managed by UFM consists of a set of physical and logical objects, including their connections. The Object Model has a hierarchical object-oriented tree structure with objects as the tree elements. Each object defines an abstraction for physical or logical fabric elements.

Physical Model

The Physical Model represents the physical resources and connectivity topology of the Network. UFM enables discovery, monitoring and configuration of the managed physical objects.

Physical Objects

Icon	Name	Description
N/A	Port Object	Represents the external physical port on switch or on Host Channel Adapter (HCA). A port is identified by its number. UFM provides InfiniBand standard management and monitoring capabilities on the port level.

Icon	Name	Description
N/A	Module Object	Represents the Field Removable Unit, Line card, and Network card on switch or HCA on host. For NVIDIA Switches, Line and Network Cards are modeled as modules.
	Link Object	Represents the physical connection between two active ports.
N/A	Cable Object	Represents the physical cable or the transceiver connected to one of the link edges.
	Computer Object	Represents the computer (host) connected to the Fabric. The UFM Agent installed on the host provides extended monitoring and management capabilities. Hosts without agents are limited to InfiniBand standard management and monitoring capabilities.
	Switch Object	Represents the switch chassis in the Fabric. A Switch object is created for every NVIDIA Switch. Switches of other vendors are represented as InfiniBand Switches and limited by InfiniBand standard management and monitoring capabilities.
	Rack Object	Represents the arbitrary group of switches or computers. When linked devices are shown as a group, the link is shown between the group and the peer object.

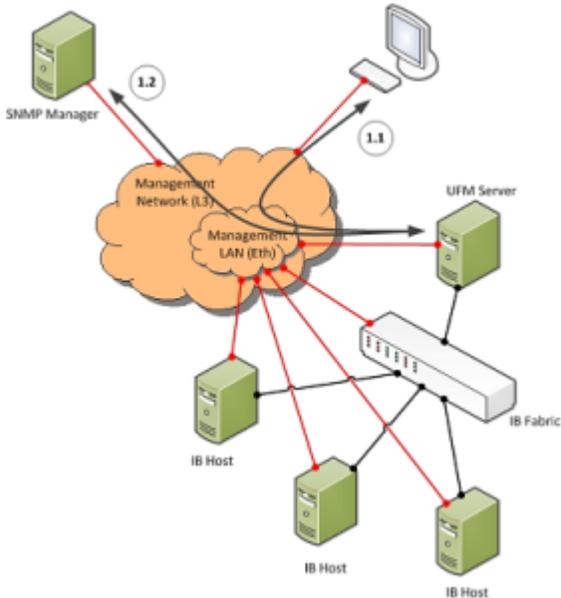
UFM Communication Requirements

This chapter describes how the UFM server communicates with InfiniBand fabric components.

UFM Server Communication with Clients

The UFM Server communicates with clients over IP. The UFM Server can belong to a separate IP network, which can also be behind the firewall.

UFM Server Communication with Clients



UFM Server Communication with UFM Web UI Client

Communication between the UFM Server and the UFM web UI client is HTTP(s) based. The only requirement is that TCP port 80 (443) must not be blocked.

UFM Server Communication with SNMP Trap Managers

The UFM Server can send SNMP traps to configured SNMP Trap Manager(s). By default, the traps are sent to the standard UDP port 162. However, the user can configure the destination port. If the specified port is blocked, UFM Server traps will not reach their destination.

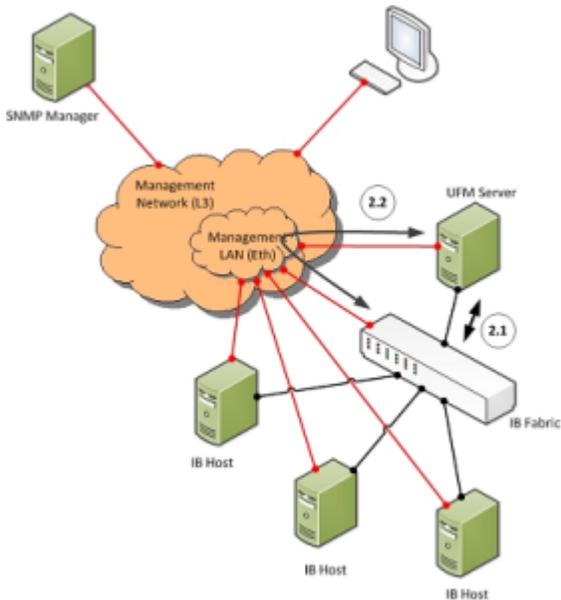
Summary of UFM Server Communication with Clients

Affected Service	Network	Address / Service / Port	Direction
Web UI Client	Out-of-band management*	HTTP / 80 HTTPS / 443	Bi-directional
SNMP Trap Notification	Out-of-band management*	UDP / 162 (configurable)	UFM Server to SNMP Manager

*If the client machine is connected to the IB fabric, IPoIB can also be used.

UFM Server Communication with InfiniBand Switches

UFM Server Communication with InfiniBand Switches



UFM Server InfiniBand Communication with Switch

The UFM Server must be connected directly to the InfiniBand fabric (via an InfiniBand switch). The UFM Server sends the standard InfiniBand Management Datagrams (MAD) to the switch and receives InfiniBand traps in response.

UFM Server Communication with Switch Management Software (Optional)

The UFM Server auto-negotiates with the switch management software on Mellanox Grid Director switches. The communication is bound to the switch Ethernet management port.

The UFM Server sends a multicast notification to MCast address 224.0.23.172, port 6306 (configurable). The switch management replies to UFM (via port 6306) with a unicast message that contains the switch GUID and IP address. After auto-negotiation, the UFM server uses Switch JSON API (HTTPS based) to retrieve inventory data and to apply switch actions (software upgrade and reboot) on the managed switch.

The following Device Management tasks are dependent on successful communication as described above:

- Switch IP discovery
- FRU Discovery (PSU, FAN, status, temperature)
- Software and firmware upgrades

The UFM Server manages IB Switch Devices over **HTTPS** (default port **443** – configurable) and / or SSH (default port 22 – configurable).

UFM Server Communication with Externally Managed Switches (Optional)

UFM server uses lbdagnet tool to discover chassis information (PSU, FAN, status, temperature) of the externally managed switches.

By monitoring chassis information data, UFM can trigger selected events when module failure occurs or a specific sensor value is above threshold.

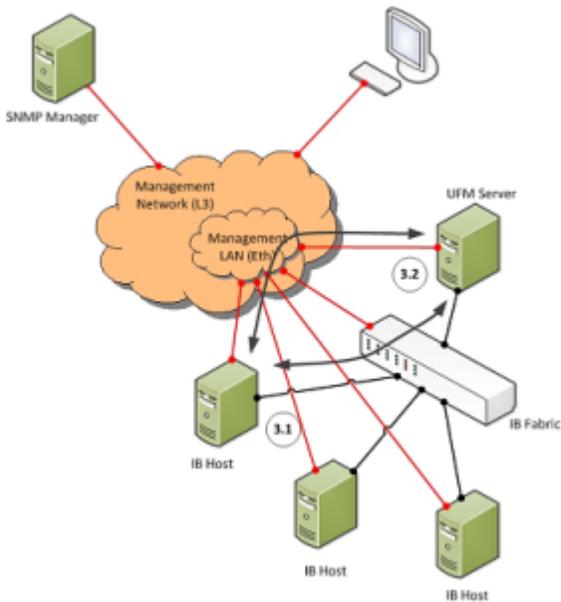
Summary of UFM Server Communication with InfiniBand Switches

Affected Service	Network	Address / Service / Port	Direction
InfiniBand Management / Monitoring	InfiniBand	Management Datagrams	Bi-directional

Affected Service	Network	Address / Service / Port	Direction
Switch IP Address Discovery (auto-negotiation with switch management software)	Out-of-band management	Multicast 224.0.23.172, TCP / 6306 (configurable)	Multicast: UFM Server to switch TCP: Bi-directional
Switch Chassis Management / Monitoring	Out-of-band management	TCP / UDP / 6306 (configurable) SNMP / 161 (configurable) SSH / 22 (configurable)	Bi-directional

UFM Server Communication with InfiniBand Hosts

UFM Server Communication with InfiniBand Hosts



UFM Server InfiniBand Communication with HCAs

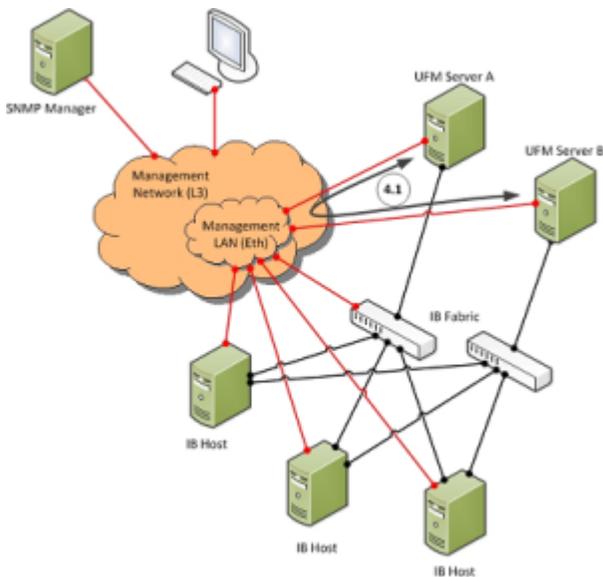
The UFM Server must be connected directly to the InfiniBand fabric. The UFM Server sends the standard InfiniBand Management Datagrams (MADs) to the Host Card Adapters (HCAs) and receives InfiniBand traps.

UFM Server Communication with InfiniBand Hosts

Affected Service	Network	Address / Service / Port	Direction
InfiniBand Management / Monitoring	InfiniBand	Management Datagrams	Bi-directional

UFM Server High Availability (HA) Active—Standby Communication

UFM Server HA Active—Standby Communication



UFM Server HA Active—Standby Communication

UFM Active — Standby communication enables two services: heartbeat and DRBD.

- *heartbeat* is used for auto-negotiation and keep-alive messaging between active and standby servers. *heartbeat* uses port 694 (udp).
- DRBD is used for low-level data (disk) synchronization between active and standby servers. DRBD uses port 8888 (tcp).

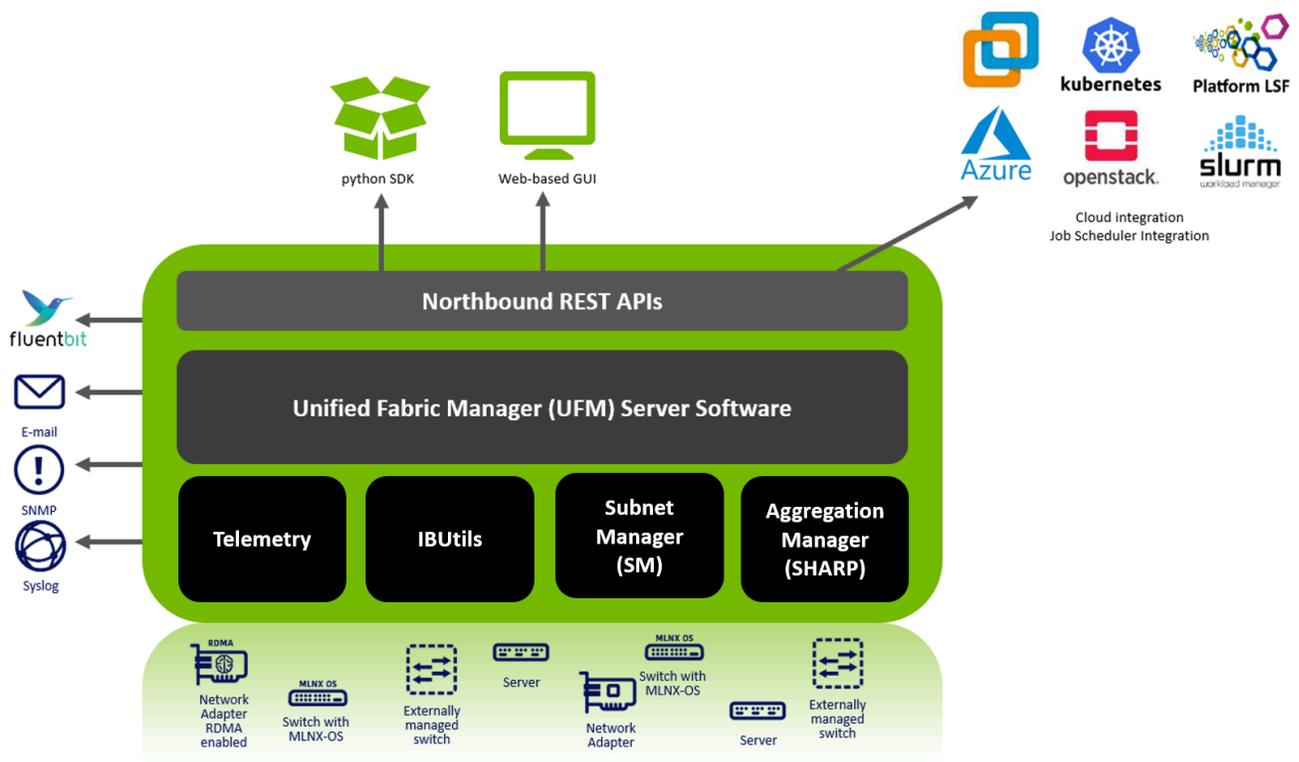
Affected Service	Network	Address / Service / Port	Direction
UFM HA heartbeat	Out-of-band management*	UDP / 694	Bi-directional
UFM HA DRBD	Out-of-band management*	TCP / 8888	Bi-directional

*An IPoIB network can be used for HA, but this is not recommended, since any InfiniBand failure might cause split brain and lack of synchronization between the active and standby servers.

UFM Software Architecture

The following figure shows the UFM high-level software architecture with the main software components and protocols. Only the main logical functional blocks are displayed and do not necessarily correspond to system processes and threads.

UFM High-Level Software Architecture



Graphical User Interface

UFM User Interface is a web application based on JavaScript and Angular JS, which is supported by any Web Browser. The Web application uses a standard REST API provided by the UFM server.

Client Tier API

Third-party clients are managed by the REST API.

Client Tier SDK Tools

Support for UFM's API and a set of tools that enhance UFM functionality and interoperability with third-party applications are provided as part of UFM.

UFM Server

UFM server is a central data repository and management server that manages all physical and logical data. UFM-SDN Appliance receives all data from the Device and Network tiers and invokes Device and Network tier components for management and configuration tasks. UFM-SDN Appliance uses a database for data persistency. The UFM-SDN Appliance is built on the Python twisted framework.

Subnet Manager

Subnet Manager (SM) is the InfiniBand "Routing Engine", a key component used for fabric bring-up and routing management. UFM uses the Open Fabric community OpenSM Subnet Manager. UFM uses a plug-in API for runtime management and fabric data export.

NVIDIA Scalable Hierarchical Aggregation and Reduction Protocol (SHARP)[™] Aggregation Manager

NVIDIA Scalable Hierarchical Aggregation and Reduction Protocol (SHARP) is a technology that improves the performance of mathematical and machine learning applications by offloading collective operations from the CPU to the switch network.

Aggregation Manager (AM) is a key component of NVIDIA SHARP software, used for NVIDIA SHARP resources management.

For further information about NVIDIA SHARP AM, refer to [Appendix – NVIDIA SHARP Integration](#).

Performance Manager

The UFM Performance Manager component collects performance data from the managed fabric devices and sends the data to the UFM-SDN Appliance for fabric-wide analysis and display of the data.

Device Manager

The Device Manager implements the set of common device management tasks on various devices with varying management interfaces. The Device Manager uses SSH protocol and operates native device CLI (command-line interface) commands.

UFM Switch Agent

UFM Switch Agent is an integrated part of NVIDIA switch software. The agent supports system parameter discovery and device management functionality on switches.

Communication Protocols

UFM uses the following communication protocols:

- Web UI communicates with the UFM server utilizing **Web Services** carried on **REST API**.
- The UFM server communicates with the switch Agent located on managed switches by proprietary **TCP/UDP**-based discovery and monitoring protocol and **SSH**.
- Monitoring data is sent by the switch Agent to UFM server Listener by a proprietary **TCP**-based protocol.

UFM Web UI Overview

The UFM Web User Interface (GUI) lets you access UFM through a web browser, where you can visualize your network and interact with the display using a keyboard and mouse.

The UFM WebUI is supported on Google Chrome and TBD. It is designed to be viewed on a display with a minimum resolution of 1920 × 1080 pixels.

- [Access the WebUI](#)
- [Web UI Layout](#)

- [Set User Preferences](#)

Access the WebUI

UFM Web UI Supported Browsers

UFM Web UI is supported on all the following web browsers: Internet Explorer, Firefox, Chrome and Opera.

For optimal UFM Web UI performance, make sure you are using the latest version available of Google Chrome.

For more information, see *UFM User Manual*.

Launching UFM Web UI Session

Before accessing the UFM Web UI:

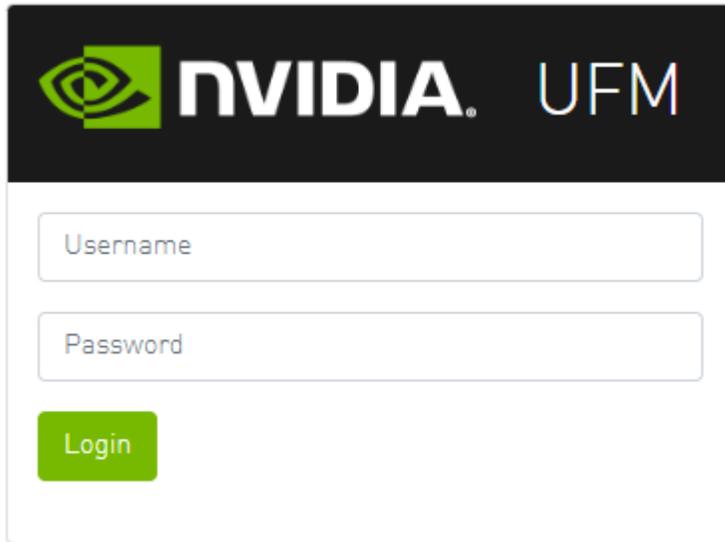
- If required, you can change the configuration of the connection (port and protocol) between the UFM server and the APACHE server in the file *gv.cfg*:
 - *ws_protocol* = http or https
 - Setting the parameter *ws_protocol* to *http* allows unsecured access
 - Setting the parameter *ws_protocol* to *https* denies unsecured access.
 - *ws_port* = port number

 **To launch a UFM Web UI session, do the following:**

1. Launch the Web UI by entering the following URL in your browser:

http://<UFM_server_IP>/ufm

https://<UFM_server_IP>/ufm



The image shows a login form for NVIDIA UFM. At the top, there is a black header with the NVIDIA logo (a green eye-like shape) and the text 'nVIDIA. UFM'. Below the header, there are two white input fields with rounded corners. The first field is labeled 'Username' and the second is labeled 'Password'. Below the password field is a green button with the text 'Login' in white.

2. In the Login page, enter your **User Name** and your predefined user **Password** and click **Login**.

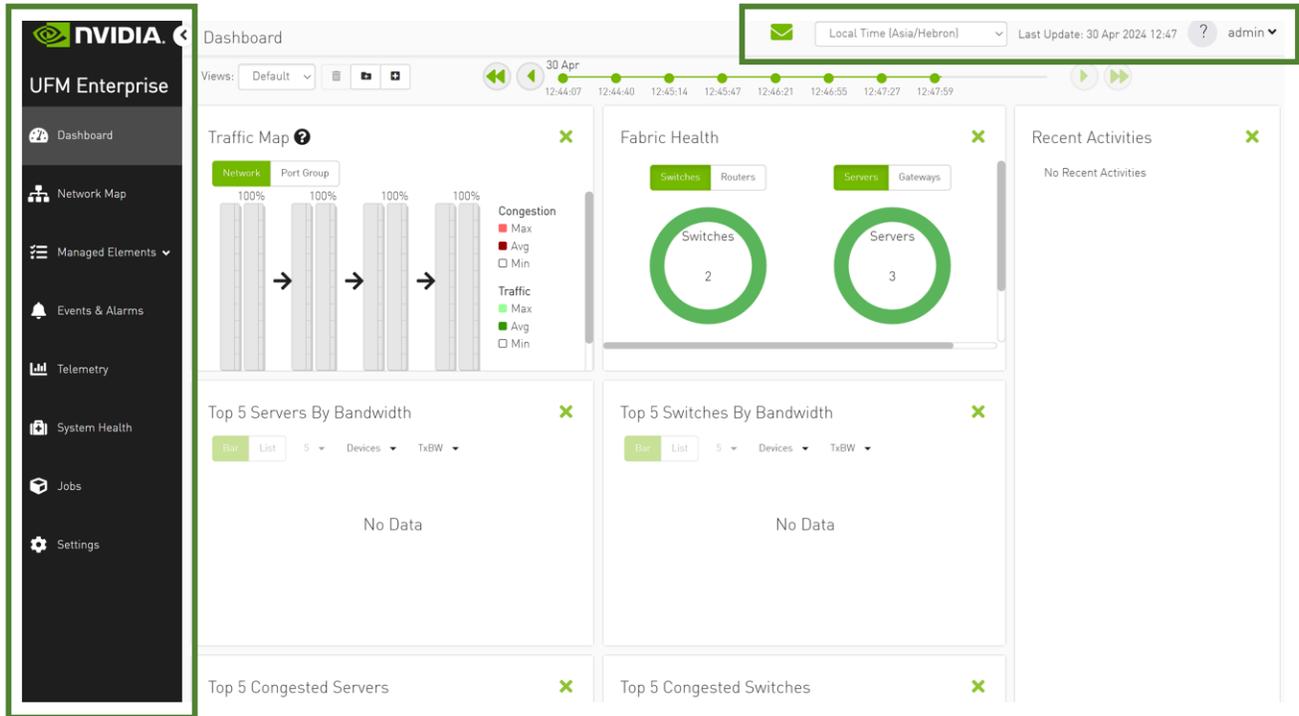
Once you have entered your user name and password, the main window shows the UFM Dashboard. For more information, see the [Fabric Dashboard](#).

WebUI Layout

The UFM WebUI contains two main areas:

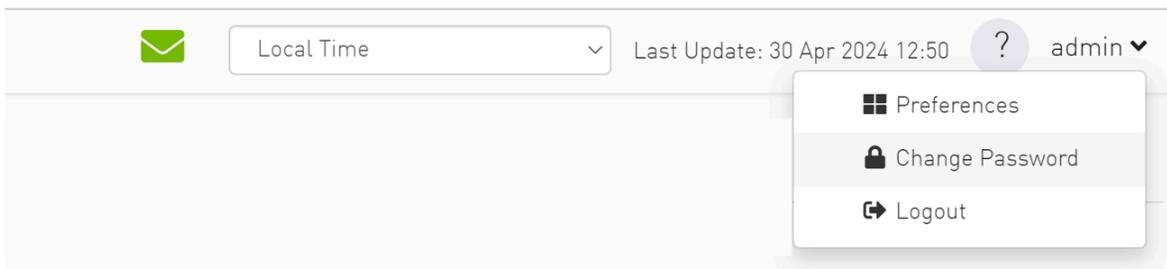
1. Top Bar - Contains local time zone and user information on the top right side of the screen.
2. Sidebar Menu - Contains a taskbar accessible from a sidebar menu on the left side of the screen. For more information on each tab, refer to [UFM Web UI](#).

Sidebar Menu



Top Bar

Each user can customize the UFM display, time zone, and date format, change their account password, and manage their preferences. For details, refer to [Set User Preferences](#).



Sidebar Menu

Tab Icon	Description
 Dashboard	Provides a summary view of the fabric status.
	Provides a hierarchical topology view of the fabric.

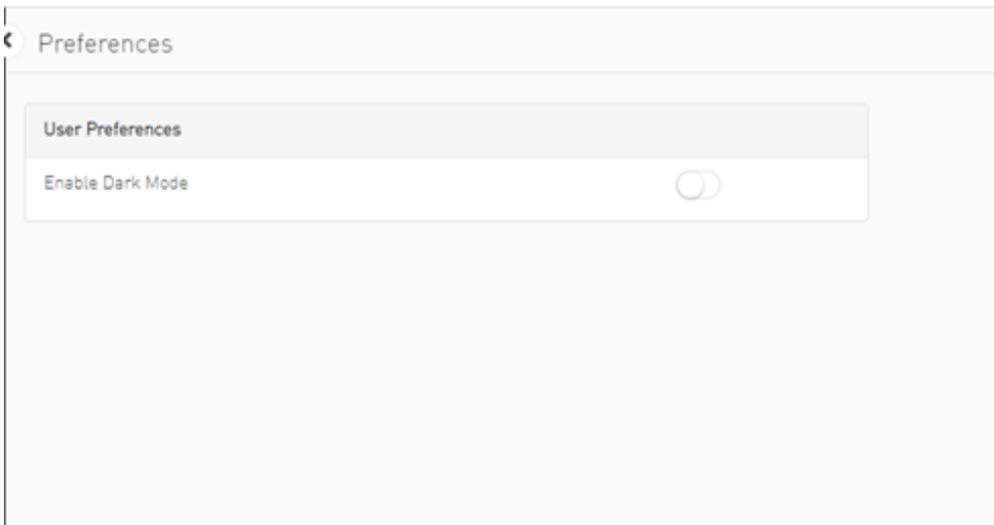
Tab Icon	Description
 Network Map	
 Managed Elements	Provides information on all fabric devices. This information is presented in a table format.
 Logical Elements	Provides information on all logical servers. This information is presented in a table format.
 Events & Alarms	Provides information on the events & alarms generated by the system.
 Telemetry	Enables establishing monitoring sessions on devices or ports.
 System Health	Enables running and viewing fabric reports, UFM reports, and system logs. You can also back up UFM configuration files.
 Jobs	Provides information on all jobs created, as a result of UFM actions.
 Settings	Enables configuring UFM server and UFM fabric settings, including events policy, device access, network management, subnet manager, and user management

Set User Preferences

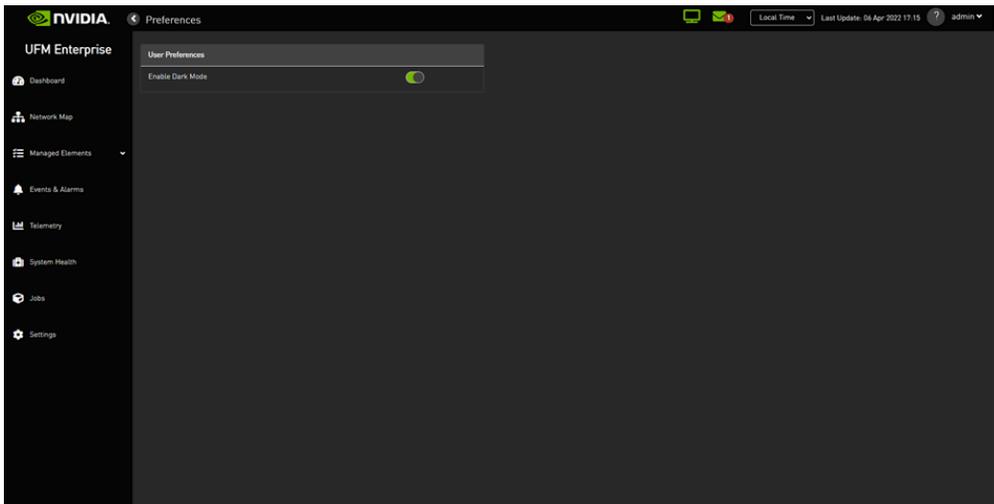
This section describes how to customize your UFM display settings and change your password,

Dark/Light Theme

1. Select **Preferences**.



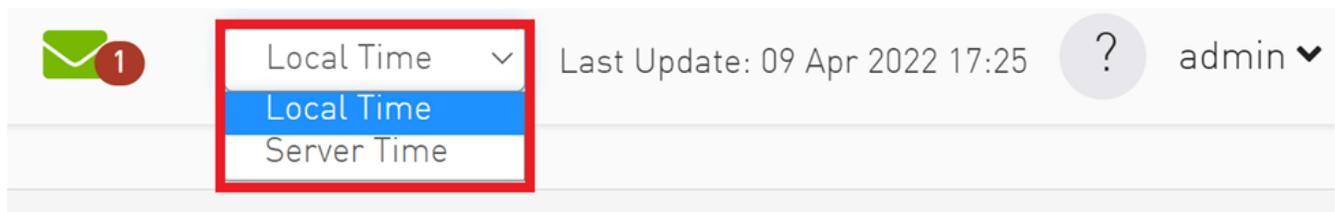
2. In **User Preferences**, enable dark mode for UFM presentation in a dark theme. The following figure shows the dark theme:



Time Zone Converter

Allows you to unify all times in UFM like events and alarms, ibdiagnet, telemetry and logs. You can switch between local and machine time.

In the status bar drop-down menu, switch between local and server/machine time.



Events & Alarms Local Time Last Update: 09 Apr 2022 17:25 admin

Alarms

Clear All Alarms Refresh Displayed Columns CSV

Severity	Date/Time ↓	Alarm Name	Source	Source Type	Reason	Count
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Warning	2022-04-05 15:26:47	Unhealthy IB...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1
Warning	2022-04-05 15:26:27	Unhealthy IB...	default(3) / Switch: SwitchIB Mell	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1

Events & Alarms Server Time Last Update: 09 Apr 2022 11:31 admin

Alarms

Clear All Alarms Refresh Displayed Columns CSV

Severity	Date/Time ↓	Alarm Name	Source	Source Type	Reason	Count
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Warning	2022-04-05 9:26:47	Unhealthy IB...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1
Warning	2022-04-05 9:26:27	Unhealthy IB...	default(3) / Switch: SwitchIB Mell	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1

Note

In the screenshots, the difference between Server Time and Local Time is 6 hours.

Table Enhancements

Look and Feel Improvements

All Displayed Columns

Severity	Name	GUID	Type	Model	IP	Firmware Ve...
<input checked="" type="checkbox"/> Info	r-hyp-sw-01	0x248a070300...	switch	MSB7700	N/A	N/A
<input checked="" type="checkbox"/> Info	SwitchIB Mell...	0xe41d2d0300...	switch	EDR	N/A	N/A
<input checked="" type="checkbox"/> Info	ufm-host86	0x7cfe9003002...	host	Computer	192.168....	N/A
<input checked="" type="checkbox"/> Info	r-ufm254-hyp...	0x043f720300d...	host	Computer	N/A	N/A
<input checked="" type="checkbox"/> Info	r-ufm254-hyp...	0x0c42a10300...	host	Computer	N/A	N/A

Viewing 1-5 of 5

Displayed Columns

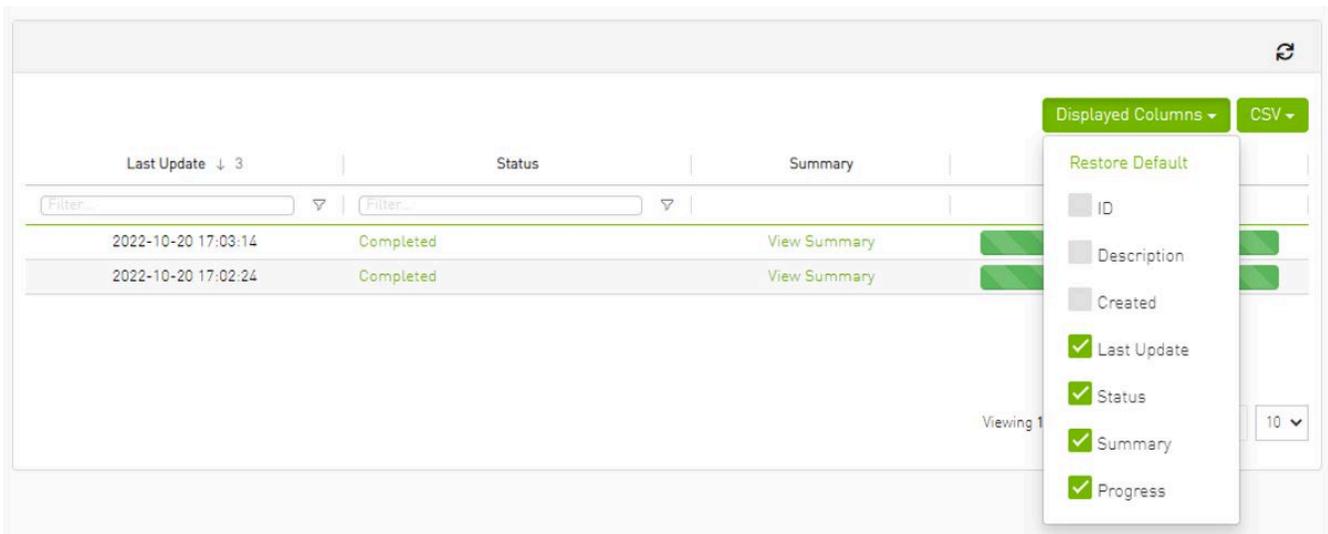
Displayed Columns

ID ↓ 1	Description	Created ↓ 2	Last Update ↓ 3	Status	Summary
2	mark_device_healthy	2022-10-20 17:03:14	2022-10-20 17:03:14	Completed	View Summary
1	mark_device_unhealthy	2022-10-20 17:02:24	2022-10-20 17:02:24	Completed	View Summary

Viewing 1 of 2

Restore Default

- ID
- Description
- Created
- Last Update
- Status
- Summary
- Progress



Note

Displayed columns of all tables are persistent per user, with the option to restore defaults.

Export All Data as CSV

There are two options for exporting as CSV

- All Data: all data returned from server.
- Displayed Data: only displayed rows.

>

All Displayed Columns CSV

S...	Name	GUID	Type	Model	IP	
<input type="checkbox"/>	Filter...	Filter...	Filter...	Filter...	Filter...	
<input checked="" type="checkbox"/>	r-hyp-sw-01	0x248a070300...	switch	MSB7700	N/A	N/A
<input checked="" type="checkbox"/>	SwitchIB Mell...	0xe41d2d0300...	switch	EDR	N/A	N/A
<input checked="" type="checkbox"/>	ufm-host86	0x7cfe9003002...	host	Computer	192.168.1.30	N/A
<input checked="" type="checkbox"/>	r-ufm254-hyp...	0x043f720300d...	host	Computer	N/A	N/A
<input checked="" type="checkbox"/>	r-ufm254-hyp...	0x0c42a10300...	host	Computer	N/A	N/A

Viewing 1-5 of 5 10

UFM Installation and Configuration

UFM® software includes Server and Agent components. UFM Server software should be installed on a central management node. For optimal performance, and to minimize interference with other applications, it is recommended to use a dedicated server for UFM. The UFM Agent is an optional component and should be installed on fabric nodes. The UFM Agent should not be installed on the Management server.

The following sections provide step-by-step instructions for installing and activating the license file, installing the UFM server software, and installing the UFM Agent.

Prerequisites for UFM Server Software Installation

Please refer to [Installation Notes](#) for information on system prerequisites.

UFM Installation Steps

To install the UFM software:

1. [Download UFM Software and License File](#)
2. [Install the UFM Server Software and Activate the Software License](#)
3. [Perform initial configuration](#)
4. [Run the UFM server software](#)

UFM Installation Steps

- [Downloading UFM Software and License File](#)
- [Installing UFM Server Software](#)

Downloading UFM Software and License File

Before you obtain a license for the UFM® software, prepare a list of servers with the MAC address of each server on which you plan to install the UFM software. These MAC addresses are requested during the licensing procedure.

Obtaining License

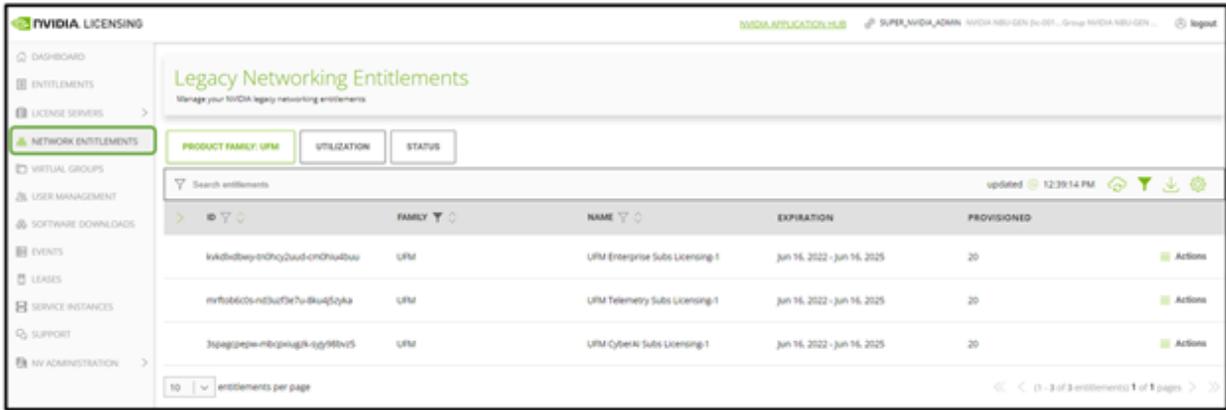
UFM is licensed per managed device according to the UFM license agreement.

When you purchase UFM, you will receive an email with instructions on obtaining your product license. A valid UFM license is a prerequisite for the installation and operation of UFM.

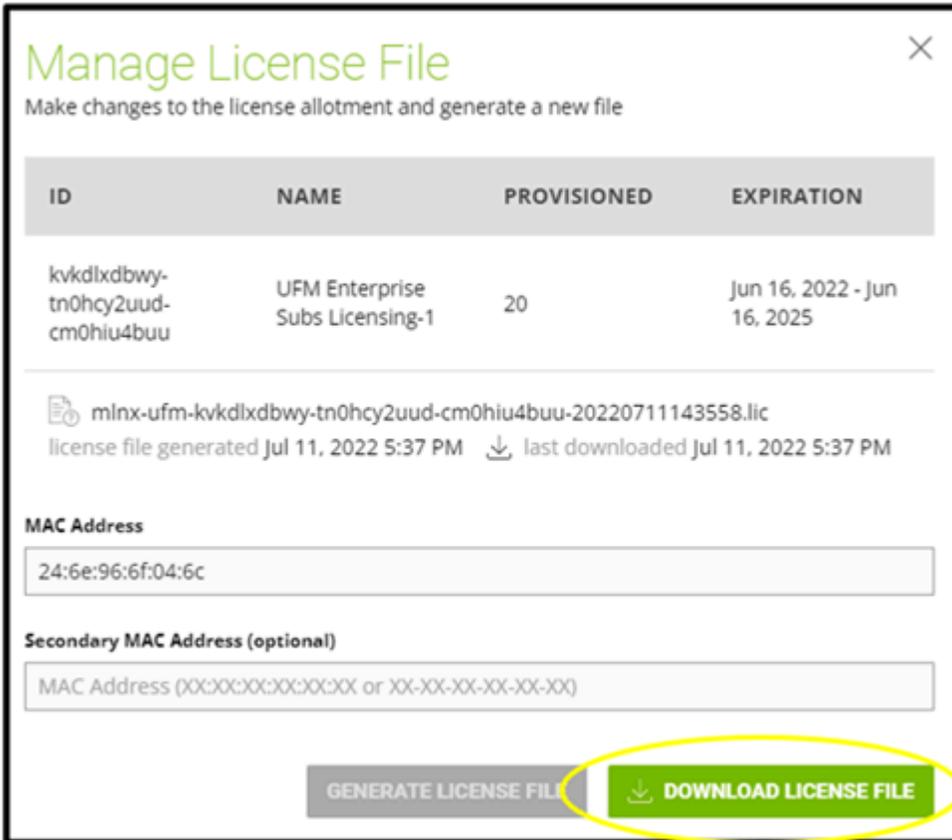
UFM licenses are per managed node and are aggregative. If you install an additional license, the system adds the previous node number and the new node number and manages the sum of the nodes. For example, if you install a license for 10 managed nodes and an additional license for 15 nodes, UFM will be licensed for up to 25 managed nodes.

To obtain the license:

1. Go to NVIDIA's [Licensing and Download Portal](#) and log in as specified in the licensing email you received.
 - If you did not receive your NVIDIA Licensing and Download Portal login information, contact your product reseller.
2. If you purchased UFM directly from NVIDIA and you did not receive the login information, contact enterprisesupport@nvidia.com. Click on the Network Entitlements tab. You'll see a list with the serial licenses of all your software products and software product license information and status.



3. Select the license you want to activate and click on the “Actions” button.
4. In the MAC Address field, enter the MAC address of the delegated license-registered host. If applicable, in the HA MAC Address field, enter your High Availability (HA) server MAC address. If you have more than one NIC installed on a UFM Server, use any of the MAC addresses.



5. Click on Generate License File to create the license key file for the software.
6. Click on Download License File and save it on your local computer.

If you replace your NIC or UFM server, repeat the process of generating the license to set new MAC addresses. You can only regenerate a license two times. To regenerate the license after that, contact NVIDIA Sales Administration at enterprisesupport@nvidia.com.

Downloading UFM Software

i Note

Due to internal packaging incompatibility, this release has two different packages for each of the supported distributions:

- One for UFM deployments over MLNX_OFED 5.X (or newer)

Please make sure to use the UFM installation package compatible to your setup.

This software download process applies to software updates and first-time installation.

If you own the UFM Media Kit and this is your first-time installation, skip this section.

To download the UFM software:

1. Click on Software Downloads, filter the product family to UFM, and select the relevant version of the software. Click on Download.

The screenshot shows the NVIDIA Licensing Software Downloads page. The page title is "Software Downloads" and it displays a table of available software downloads. The table has columns for Platform, Platform Version, Product Version, Description, and Release Date. The "PRODUCT FAMILY: UFM" filter is selected, and the "PRODUCT VERSION" column is circled in yellow. The table lists five software packages for UFM Enterprise 6.9 and UFM Enterprise 6.9 on various platforms (Other, RHEL/CentOS, Ubuntu 18, and CyberAI Appliance).

PLATFORM	PLATFORM VERSION	PRODUCT VERSION	DESCRIPTION	RELEASE DATE	
Other		6.9	UFM SW Enterprise 6.9	May 4, 2022	Download
RHEL/CentOS		6.9	UFM SW Enterprise 6.9 RHEL 7	May 4, 2022	Download
RHEL/CentOS		6.9	UFM SW Enterprise 6.9 RHEL 8	May 4, 2022	Download
Ubuntu	18	6.9	UFM SW Enterprise 6.9 Ubuntu 18	May 4, 2022	Download
CyberAI Appliance		2	UFM SW CyberAI 2.0	May 3, 2022	Download

2. Save the file on your local drive.
3. Click Close.

Installing UFM Server Software

The default UFM® installation directory is */opt/ufm*.

For instructions on installing the UFM server software, please refer to following instructions per desired installation mode.

- [Installing UFM Server on Bare Metal Server](#)
 - [Installing UFM on Bare Metal Server- Standalone Mode](#)
 - [Installing UFM on Bare Metal Server - High Availability Mode](#)
- [Installing UFM Docker Container Mode](#)
 - [Installing UFM on Docker Container - Standalone Mode](#)
 - [Installing UFM on Docker Container - High Availability Mode](#)

The following processes might be interrupted during the installation process:

- httpd (Apache2 in Ubuntu)
- dhcpd

Note

To install UFM over static IPv4 configuration (instead of DHCP) please refer to [Configuring UFM Over Static IPv4 Address](#) before installation.

After installation:

1. Activate the software license
2. [Perform initial configuration](#)

Note

Before you run UFM, ensure that all ports used by the UFM server for internal and external communication are open and available. For the list of ports, see [Appendix – Used Ports](#).

Prerequisites for UFM Server Software Bare Metal Installation

Verify that a supported version of Linux is installed on your machine. For details, see UFM System Requirements.

The following table lists the packages that must be installed on your machine (according to the system OS) before you install the UFM server software.

Prerequisites for UFM Server Software Installation

Verify that a supported version of Linux is installed on your machine. For details, see UFM System Requirements.

The following table lists the packages that must be installed on your machine (according to the system OS) before you install the UFM server software.

RedHat 8	RedHat 9	Ubuntu 20.04	Ubuntu 22.04
acl	acl	acl	acl
apr-util-openssl	apr-util-openssl	apache2	apache2
bc	bc	bc	bc
dos2unix	dos2unix	chrpath	chrpath
gnutls	gnutls	cron	cron
httpd	httpd	dos2unix	dos2unix
iptables	iptables-nft	gawk	gawk
jansson	jansson	lftp	lftp
lftp	lftp	libcurl4	libcurl4

RedHat 8	RedHat 9	Ubuntu 20.04	Ubuntu 22.04
libnsl	libnsl	logrotate	logrotate
libxml2	libxml2	python3	python3
libxslt	libxslt	qperf	qperf
mod_session	mod_session	rsync	rsync
mod_ssl	mod_ssl	snmpd	snmpd
net-snmp	net-snmp	sqlite3	sqlite3
net-snmp-libs	net-snmp-libs	sshpass	sshpass
net-snmp-utils	net-snmp-utils	ssl-cert	ssl-cert
net-tools	net-tools	sudo	sudo
php	php	telnet	telnet
psmisc	psmisc	zip	zip
python36	python3		
qperf	qperf		
rsync	rsync		
sqlite	sqlite		
sshpass	sshpass		
sudo	sudo		
telnet	telnet		
zip	zip		

Note

On some Ubuntu OSs, Docker is installed via SNAP, which might lead to errors when trying to use UFM Plugins.

To solve this issue, perform the following:

1. Remove Docker installed via SNAP, run:

```
snap remove --purge docker
```

2. Update the local package index, run :

```
apt update
```

3. Install native Docker, run:

```
apt install-y docker.io
```

In addition, ensure the following before you begin installation:

- The computer hostname is not defined as 127.0.0.1 and localhost is defined as 127.0.0.1.
- The hostname must NOT appear on the loopback address line. An example of the loopback address is: 127.0.0.1 localhost.localdomain localhost.
- Disable the firewall service (`/etc/init.d/iptables stop`), or ensure that the required ports are open (see the prerequisite script, refer to [Used Ports](#)).
- Disable SELinux.
- If more than one fabric is managed by different UFM instances, set up different management network spaces for each fabric (not the same LAN).
- Uninstall any previously installed Subnet Manager from the UFM server machine.
- NVIDIA Host Infiniband Networking packages (MLNX_OFED 5.x version or NVIDIA DOCA 2.9.0 or greater) is installed prior to installing UFM.
- As of UFM v.6.12.0, it is **NOT mandatory** to configure the IPoIB fabric interface with an IP address.

In cases where the IP is configured, it is **mandatory** that the IP is permanently configured and that it starts automatically upon server reboot (the IPoIB fabric interface should be active even if the network is down).

 **Note**

The user can set a persistent IP address using Netplan (mainly for Ubuntu systems) or modifying the interface network script (RedHat systems).

- The default NVIDIA Host InfiniBand Networking package provided by MLNX_OFED installation includes OpenSM. Remove MLNX_OFED OpenSM before UFM installation like the following examples:

RedHat:

```
rpm -e opensm-3.3.9.MLNX_20111006_e52d5fc-0.1
```

Ubuntu:

```
apt purge opensm
```

- If using NVIDIA Host InfiniBand Networking packages provided by DOCA package, install the drivers and UFM dedicated package only.

RedHat:

```
yum install doca-ufm doca-kernel
```

Ubuntu:

```
apt update
apt install doca-ufm doca-kernel
```

By default, `ib0` and `eth0` are configured as primary access points for the UFM management. If different management and/or InfiniBand interfaces (including bond interfaces) are used as the primary access points, you should modify the configuration file by running the script `/opt/ufm/scripts/change_fabric_config.sh` as described in the section [Configuring General Settings](#) in `gv.cfg`.

Change the UFM Agent interface to the Ethernet and/or IPoIB interfaces used for communication with UFM Agent:

```
ufma_interfaces = ib0,eth0
```

Additional Prerequisites for UFM High Availability Installation

- Reliable and high-capacity out-of-band IP connectivity between the UFM Primary and Secondary servers (1 Gb Ethernet is recommended). This connectivity is used for DRBD synchronization.
- Format two identical servers with dedicated disk partitions for UFM replication. Since the UFM configuration file is replicated to the standby server, both master and standby servers must have the same interfaces.
- Allocate exactly the same size partition on both servers (master and slave) for the replicated data. See [UFM Server Requirements](#) for the recommended partition size.

Partitions should not be mounted and must be zeroed (the file system should not be installed on the partitions). For disk partitioning, see the Linux user manual (`man fdisk`).

- We recommend establishing a passwordless SSH (via `/root/.ssh/authorized_keys` file) between the two servers before the installation.
- In fabrics consisting of multiple tiers of switches, it is recommended that the management ports (`ib0`) of the primary and secondary UFM server be connected to different fabric switches on the same tier (the outermost edge in CLOS 5 designs).

This is because by default, UFM manages the IB fabric via ib0, port 1 of the HCA. Failure or disconnect of ib0, the IB management port, causes a failure condition in UFM resulting in HA failover.

When the management ports (ib0) of the primary and secondary UFM server are connected to the same switch, a failure of this switch will result in a disconnect of both UFM from the fabric, and therefore UFM will not be able to manage the fabric.

Note

Subnet Manager is running over the native InfiniBand layer, therefore bonding the IpoIB interfaces will not provide high availability. For additional information, please refer to section UFM Failover to Another Port.

The UFM installation includes the InfiniBand Performance Management module (IBPM). This module is responsible for reporting performance information back to UFM and upper layer applications. When available, this process is offloaded to the non-management port (default ib1) of the UFM server. Failure or disconnect of the non-management port (ib1) on the primary UFM server will not cause UFM to failover. By default, the UFM Health Monitoring process is configured to try to restart the IBPM. For more information, see UFM Health Configuration in the UFM User Manual.

Installing UFM Server on Bare Metal Server

Installing UFM server on Bare Metal server can be done with the following modes:

- [Installing UFM on Bare Metal Server - High Availability Mode](#)
- [Installing UFM on Bare Metal Server- Standalone Mode](#)

Installing UFM on Bare Metal Server - High Availability Mode

Before installing UFM server software in High-Availability mode, ensure that the [Additional Prerequisites for UFM High Availability Installation](#) are met.

The UFM High-Availability configuration requires dual-link connectivity based on two separate interfaces between the two UFM HA nodes. This configuration comprises of a primary link that is exclusively reserved for DRBD operations and a secondary link designated for backup purposes. Crucially, it is imperative that communication between the servers is established in a bidirectional manner across both interfaces and validated through user-initiated testing, such as a 'ping' command or other suitable alternatives before HA configuration can be implemented. In cases where only one link is available among the two UFM HA nodes/servers, manually configure UFM with a single link. Refer to [Configure HA without SSH Trust \(Single Link Configuration\)](#).

Note

UFM HA package requires a dedicated partition with the same name for DRBD on both servers. This guide uses `/dev/sda5` as an example.

1. On both servers, Install UFM Enterprise in Stand Alone (SA) mode.

Note

Do not start UFM service.

2. Install the latest pcs and drbd-utils and resource-agents-extra drivers on both servers.

For Ubuntu:

```
apt install pcs pacemaker drbd-utils resource-agents-extra
```

For CentOS/Red Hat:

```
yum install pcs pacemaker drbd84-utils kmod-drbd84 resource-agents-extra
```

OR

```
yum install pcs pacemaker drbd90-utils kmod-drbd90 resource-agents-extra
```

3. Download UFM-HA latest package from using this command:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.tgz
```

For sha256:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.sha256
```

 **Note**

For more information on the UFM-HA package and all installation and configuration options, please refer to [UFM High-Availability User Guide](#).

4. Extract the downloaded UFM-HA package on both servers under `/tmp/.`
5. Go to the directory you extracted `/tmp/ufm_ha_XXX` and run the installation script. For example, if your DRBD partition is `/dev/sda5` run:

```
./install.sh -l /opt/ufm/files/ -d /dev/sda5 -p enterprise
```

6. Configure the HA cluster. There are the three methods:

- [Configure HA with SSH Trust \(Dual Link Configuration\)](#) - Requires passwordless SSH connection between the servers.
- [Configure HA without SSH Trust \(Dual Link Configuration\)](#) - Does not require passwordless SSH connection between the servers, but asks you to run configuration commands on both servers.
- [Configure HA without SSH Trust \(Single Link Configuration\)](#) - Can be used in cases where only one link is available among the two UFM HA nodes/servers.

Configure HA with SSH Trust (Dual Link Configuration)

1.

1. On the **master server only**, configure the HA nodes. To do so, from `/tmp`, run the `configure_ha_nodes.sh` command as shown in the below example

```
configure_ha_nodes.sh \  
--cluster-password 12345678 \  
--master-primary-ip 10.10.10.1 \  
--standby-primary-ip 10.10.10.2 \  
--master-secondary-ip 192.168.10.1 \  
--standby-secondary -ip 192.168.10.2 \  
--no-vip
```

 **Note**

The script `configure_ha_nodes.sh` is located under `/usr/local/bin/`, therefore, by default, you do not need to use the full path to run it.

(i) Note

The `--cluster-password` must be at least 8 characters long.

(i) Note

To set up a Virtual IP for UFM and gain access to UFM through this IP, regardless of which server is running UFM, you may employ the `--no-vip` OR `--virtual-ip` command and provide an IP address as an argument. This can be achieved by navigating to `https://<Virtual-IP>/ufm` on your web browser.

(i) Note

When using back-to-back ports with local IP addresses for HA sync interfaces, ensure that you add your IP addresses and hostnames to the `/etc/hosts` file. This is needed to allow the HA configuration to resolve hostnames correctly based on the IP addresses you are using.

(i) Note

`configure_ha_nodes.sh` requires SSH connection to the standby server. If SSH trust is not configured, then you are prompted to enter the SSH password of the standby server during configuration runtime

2. Depending on the size of your partition, wait for the configuration process to complete and DRBD sync to finish.

Configure HA without SSH Trust (Dual Link Configuration)

If you cannot establish an SSH trust between your HA servers, you can use **ufm_ha_cluster directly to configure HA. To configure HA, follow the below instructions:**

Note

Please change the variables in the commands below based on your setup.

- 1.

1. [On Standby Server] Run the following command to configure Standby Server:

```
ufm_ha_cluster config -r standby \  
--local-primary-ip 10.10.50.1 \  
--peer-primary-ip 10.10.50.2 \  
--local-secondary-ip 192.168.10.1 \  
--peer-secondary-ip 192.168.10.2 \  
--hacluster-pwd 123456789 \  
--no-vip
```

2. [On Master Server] Run the following command to configure Master Server:

```
ufm_ha_cluster config -r master --local-primary-ip
10.10.50.1 \  
--peer-primary-ip 10.10.50.2 \  
--local-secondary-ip 192.168.10.1 \  
--peer-secondary-ip 192.168.10.2 \  
--hacluster-pwd 123456789 \  
--no-vip
```

You must wait until after configuration for DRBD sync to finish, depending on the size of your partition. To check the DRBD sync status, run:

```
ufm_ha_cluster status
```

Configure HA without SSH Trust (Single Link Configuration)

Warning

This is not the recommended configuration and, in case of network failure, it might cause HA cluster split brain.

If you cannot establish an SSH trust between your HA servers, you can use **ufm_ha_cluster directly to configure HA. To configure HA, follow the below instructions:**

Note

Please change the variables in the commands below based on your setup.

1.

1. [On Standby Server] Run the following command to configure Standby Server:

```
ufm_ha_cluster config \  
-r standby \  
-e 10.212.145.5 \  
-l 10.212.145.6 \  
--enable-single-link
```

2. [On Master Server] Run the following command to configure Master Server:

```
ufm_ha_cluster config -r master \  
-e 10.212.145.6 \  
-l 10.212.145.5 \  
-i 10.212.145.50 \  
--enable-single-link
```

You must wait until after configuration for DRBD sync to finish, depending on the size of your partition. To check the DRBD sync status, run:

```
ufm_ha_cluster status
```

Starting HA Cluster

- To start UFM HA cluster:

```
ufm_ha_cluster start
```

- To check UFM HA cluster status:

```
ufm_ha_cluster status
```

Stopping UFM HA cluster:

```
ufm_ha_cluster stop
```

Note

For complete details on high availability, refer to [NVIDIA UFM High-Availability User Guide](#).

Installing UFM on Bare Metal Server-Standalone Mode

To install the UFM server software as a standalone for InfiniBand:

1. Create a temporary directory (for example */tmp/ufm*).
2. Open the UFM software zip file that you downloaded. The zip file contains the following installation files:
 - RedHat 7/CentOS 7/OEL 7: *ufm-X.X-XXX.el7.x86_64.tgz*
 - RedHat 8/Centos 8: *ufm-X.X-XXX.el8.x86_64.tgz*
 - Ubuntu 18.04: *ufm-X.X-XXX.Ubuntu18.x86_64.tgz*
 - Ubuntu 20.04: *ufm-X.X-XXX.Ubuntu20.x86_64.tgz*
 - Ubuntu 22.04: *ufm-X.X-XXX.Ubuntu22.x86_64.tgz*

3. Extract the installation file for your system's OS to the temporary directory that you created.
4. From within the temporary directory, run the following command as root:

```
./install.sh
```

Note

Running with the option "-o ib" is no longer required. For automatic installation, use the -q flag.

For “quiet” installation -q flag can be added (automatically answer yes for each question the installer asks).

Note

Export MULTISUBNET_CONSUMER=1 environment variable before running the installation script to install the UFM server in Multisubnet Consumer mode.

The UFM software is installed. You can now remove the temporary directory.

Installing UFM Docker Container Mode

General Prerequisites

- UFM dedicated NVIDIA Host InfiniBand Networking packages provided by DOCA-Host must be installed on the server that will run UFM Docker.

RedHat:

```
yum install doca-ufm doca-kernel
```

Ubuntu:

```
apt install doca-ufm doca-kernel
```

- For UFM to work, you must have an InfiniBand port configured with an IP address and in "up" state.

Note

For InfiniBand support, please refer to [DOCA-Host](#) , or [MLNX_OFED](#) guides.

- Make sure to stop the following services before running UFM Docker container, as it utilizes the same default ports that they do: Pacemaker, httpd, OpenSM, and Carbon.
- If firewall is running on the host, please make sure to add an allow rule for UFM used ports (listed below):

Note

If the default ports used by UFM are changed in UFM configuration files, make sure to open the modified ports on the host firewall.

- 80 (TCP) and 443 (TCP) are used by WS clients (Apache Web Server)
- 8000 (UDP) is used by the UFM server to listen for REST API requests (redirected by Apache web server)

- 6306 (UDP) is used for multicast request communication with the latest UFM Agents
- 8005 (UDP) is used as a UFM monitoring listening port
- 8888 (TCP) is used by DRBD to communicate between the UFM Primary and Standby servers
- 2022 (TCP) is used for SSH

Prerequisites for Upgrading UFM Docker Container

- Supported versions for upgrade are UFM v.6.10.0 and above.
- UFM files directory from previous container version mounted on the host.

Step 1: Loading UFM Docker Image

To load the UFM docker image, pull the latest image from docker hub:

```
docker pull mellanox/ufm-enterprise:latest
```

Note

You can see full usage screen for ufm-installation by running the container with `-h` or `-help` flag:

```
docker run --rm mellanox/ufm-enterprise-  
installer:latest -h
```

If an Internet connection is not available, perform the following:

- Copy the UFM image to your machine.

- Load the image from the file using this command:

```
docker image load -i <image-path>
```

Step 2: Installing UFM Docker

Installation Command Usage

```
docker run -it --name=ufm_installer --rm \  
-v /var/run/docker.sock:/var/run/docker.sock \  
-v /etc/systemd/system:/etc/systemd_files/ \  
-v /opt/ufm/files:/installation/ufm_files/ \  
-v [LICENSE_DIRECTORY]:/installation/ufm_licenses/ \  
mellanox/ufm-enterprise:latest \  
--install [OPTIONS]
```

Modify the variables in the installation command as follows:

- `[UFM_LICENSES_DIR]`: UFM license file or files location.

Note

Example: If your license file or files are located under `/downloads/ufm_license_files/` then you must set this volume to be

```
-v  
/downloads/ufm_license_files:/installation/ufm_licenses/
```

- `[OPTIONS]`: UFM installation options. For more details see the table below.

Command Options

Flag	Description	Default Value
<code>--install</code>	Flag to indicate that UFM should perform the installation	N/A
<code>-f --fabric-interface</code>	IB fabric interface name.	ib0
<code>-g --mgmt-interface</code>	Management interface name.	eth0
<code>-m --multisubnet-consumer</code>	UFM Multisubnet Consumer mode	N/A
<code>--local-certs-dir <directory></code>	A directory on the host that contains the SSL certificate and key (<code>server.crt</code> and <code>server.key</code>) and the ca-intermediate certificate (<code>ca-intermediate.crt</code>), all in PEM format.	N/A
<code>-h --help</code>	Show help	N/A

Options applicable only on Podman Unprivileged User Installation

Flag	Description	Default Value
<code>--rootless</code>	Flag to indicate that the installation should be rootless.	N/A
<code>--plugin-path</code>	Path to the plugin data created in the previous step.	N/A
<code>--ufm-user</code>	The user that will run UFM on the host (e.g., <code>ufmadm</code>).	N/A

Flag	Description	Default Value
-- ufm- group	The user group that will run UFM on the host (e.g., <code>ufmadm</code>).	N/A

Installation Modes

UFM Enterprise installer supports several deployment modes:

- [Installing UFM on Docker Container - High Availability Mode](#)
- [Installing UFM on Docker Container - Standalone Mode](#)

Installing UFM on Docker Container - High Availability Mode

Pre-Deployments Requirements

- Install **pacemaker**, **pcs**, and **drbd-utils** on both servers

For Ubuntu:

```
apt install pcs pacemaker drbd-utils
```

For CentOS/Red Hat:

```
yum install pcs pacemaker drbd84-utils kmod-drbd84
```

OR

```
yum install pcs pacemaker drbd90-utils kmod-drbd90
```

- A partition for DRBD on each server (**with the same name** on both servers) such as `/dev/sdd1`. Recommended partition size is 10-20 GB, otherwise DRBD sync will take a long time to complete.
- CLI command `hostname -i` must return the IP address of the management interface used for pacemaker sync correctly (update `/etc/hosts/` file with machine IP)
- Create the directory on each server under `/opt/ufm/files/` with read/write permissions on each server. This directory will be used by UFM to mount UFM files, and it will be synced by DRBD.
- Disable the firewall service (`/etc/init.d/iptables` stop), or ensure that the required ports are open (see the prerequisite script).
- Disable SELinux.

Installing UFM Containers

On the main server, install UFM Enterprise container with the command below:

```
docker run -it --name=ufm_installer --rm \  
-v /var/run/docker.sock:/var/run/docker.sock \  
-v /etc/systemd/system:/etc/systemd_files/ \  
-v /opt/ufm/files:/installation/ufm_files/ \  
-v /tmp/license_file:/installation/ufm_licenses/ \  
mellanox/ufm-enterprise:latest \  
--install
```

On the standby (secondary) server, install the UFM Enterprise container like the following example with the command below:

```
docker run -it --name=ufm_installer --rm \  
-v /var/run/docker.sock:/var/run/docker.sock \  
-v /etc/systemd/system/:/etc/systemd_files/ \  
-v /opt/ufm/files/:/installation/ufm_files/ \  
mellanox/ufm-enterprise:latest \  
--install
```

Downloading UFM HA Package

Download the UFM-HA package on both servers using the following command:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.tgz
```

For sha256:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.sha256
```

Installing UFM HA Package

For more information on the UFM-HA package and all installation and configuration options, please refer to [UFM High Availability User Guide](#).

1. [On Both Servers] Extract the downloaded UFM-HA package under `/tmp/`
2. [On Both Servers] Go to the extracted directory `/tmp/ufm_ha_XXX` and run the installation script. For example, if your DRBD partition is `/dev/sda5` run the following command:

```
./install.sh -l /opt/ufm/files/ -d /dev/sda5 -p enterprise
```

Configuring UFM HA

There are the three methods to configure the HA cluster:

- [Configure HA with SSH Trust \(Dual Link Configuration\)](#) - Requires passwordless SSH connection between the servers.
- [Configure HA without SSH Trust \(Dual Link Configuration\)](#) - Does not require passwordless SSH connection between the servers, but asks you to run configuration commands on both servers.
- [Configure HA without SSH Trust \(Single Link Configuration\)](#) - Can be used in cases where only one link is available among the two UFM HA nodes/servers.

Configure HA with SSH Trust (Dual Link Configuration)

1. On the **master server only**, configure the HA nodes. To do so, from /tmp, run the `configure_ha_nodes.sh` command as shown in the below example

```
configure_ha_nodes.sh \  
--cluster-password 12345678 \  
--master-primary-ip 10.10.50.1 \  
--standby-primary-ip 10.10.50.2 \  
--master-secondary-ip 192.168.10.1 \  
--standby-secondary-ip 192.168.10.2 \  
--no-vip
```

Note

The script `configure_ha_nodes.sh` is located under `/usr/local/bin/`, therefore, by default, you do not need to use the full path to run it.

Note

The `--cluster-password` must be at least 8 characters long.

Note

When using back-to-back ports with local IP addresses for HA sync interfaces, ensure that you add your IP addresses and hostnames to the `/etc/hosts` file. This is needed to allow the HA configuration to resolve hostnames correctly based on the IP addresses you are using.

Note

`configure_ha_nodes.sh` requires SSH connection to the standby server. If SSH trust is not configured, then you are prompted to enter the SSH password of the standby server during configuration runtime

2. Depending on the size of your partition, wait for the configuration process to complete and DRBD sync to finish. To check the DRBD sync status, run:

```
ufm_ha_cluster status
```

Configure HA without SSH Trust (Dual Link Configuration)

If you cannot establish an SSH trust between your HA servers, you can use `ufm_ha_cluster` directly to configure HA. You can see all the options for configuring HA in the Help menu:

```
ufm_ha_cluster config -h
```

To configure HA, follow the below instructions:

Note

Please change the variables in the commands below based on your setup.

1. [On **Standby Server**] Run the following command to configure **Standby Server**:

```
ufm_ha_cluster config -r standby -e <peer ip address> -l  
<local ip address> -p <cluster_password>
```

2. [On **Master Server**] Run the following command to configure **Master Server**:

```
ufm_ha_cluster config -r master -e <peer ip address> -l  
<local ip address> -p <cluster_password> -i <virtual ip  
address>
```

Configure HA without SSH Trust (Single Link Configuration)

Warning

This is not the recommended configuration and, in case of network failure, it might cause HA cluster split brain.

If you cannot establish an SSH trust between your HA servers, you can use **ufm_ha_cluster directly to configure HA. To configure HA, follow the below instructions:**

Note

Please change the variables in the commands below based on your setup.

1.

1. [On **Standby Server**] Run the following command to configure **Standby Server**:

```
ufm_ha_cluster config \  
-r standby \  
-e 10.212.145.5 \  
-l 10.212.145.6 \  
--enable-single-link
```

2. [On **Master Server**] Run the following command to configure **Master Server**:

```
ufm_ha_cluster config -r master \  
-e 10.212.145.6 \  
-l 10.212.145.5 \  
-i 10.212.145.50 \  
--enable-single-link
```

You must wait until after configuration for DRBD sync to finish, depending on the size of your partition. To check the DRBD sync status, run:

```
ufm_ha_cluster status
```

IPv6 Example:

```
ufm_ha_cluster config -r standby -l  
fcfc:fcfc:209:224:20c:29ff:fee7:d5f2 -e  
fcfc:fcfc:209:224:20c:29ff:feeb:4962 --enable-single-link -  
p some_secret
```

Starting HA Cluster

- To start UFM HA cluster:

```
ufm_ha_cluster start
```

- To check UFM HA cluster status:

```
ufm_ha_cluster status
```

- To stop UFM HA cluster:

```
ufm_ha_cluster stop
```

- To uninstall UFM HA, first stop the cluster and then run the uninstallation command as follows:

```
/opt/ufm/ufm_ha/uninstall_ha.sh
```

Installing UFM on Docker Container - Standalone Mode

1. Copy only your UFM license file(s) to a temporary directory which we're going to use in the installation command. For example: `/tmp/license_file/`
2. Run the UFM installation command according to the following example which will also configure UFM fabric interface to be `ib1`:

```
docker run -it --name=ufm_installer --rm \  
            -v \  
            /var/run/docker.sock:/var/run/docker.sock \  
            -v \  
            /etc/systemd/system:/etc/systemd_files/ \  
            -v \  
            /opt/ufm/files:/installation/ufm_files/ \  
            -v \  
            /tmp/license_file:/installation/ufm_licenses/ \  
            mellanox/ufm-enterprise:latest \  
            --install \  
            --fabric-interface ib1
```

3. Reload systemd:

```
systemctl daemon-reload
```

4. To Start UFM Enterprise service run:

```
systemctl start ufm-enterprise
```

Installing UFM on Podman Using Unprivileged User While Setting Client Certificate Authentication

1. Copy only your UFM license file(s) to a temporary directory which we're going to use in the installation command. For example: `/tmp/license_file/`
2. Run the UFM installation command according to the following example which will also configure UFM fabric interface to be `ib0`:

```
sudo -u ufmadm podman run -it --rm --name=ufm_installer \  
                        -v /run/podman-ufm/podman-ufm.sock:/var/run/docker.sock \  
                        -v \  
/opt/ufm/://installation/ufm_files/ \  
                        -v \  
/opt/ufm/systemd:/etc/systemd_files/ \  
                        mellanox/ufm-enterprise:latest \  
                        --install \  
                        --fabric-interface ib0 \  
                        --mgmt-interface enp1s0 \  
                        --rootless \  
                        --plugin-path \  
/opt/ufm/ufm_plugins_data \  
                        --ufm-user ufmadm \  
                        --ufm-group ufmadm \  
                        --local-certs-dir /ufm_certs
```

3. Reload systemd on the host:

```
systemctl daemon-reload
```

4. To start UFM Enterprise service on the host, run:

```
systemctl start ufm-enterprise
```

Replacing the Standby Node

- Install the HA package for the new node (standby).
- Disconnect the standby node (the old standby) and run the following command on the master node:

```
ufm_ha_cluster detach
```

- Configure the new standby node; please refer to the relevant section depending on the installation
- Connect the new standby to the cluster by running the command on the master node:

```
ufm_ha_cluster attach -l <local primary ip address> -e <peer primary ip address> -E <peer secondary ip address> -p <clust
```

Activating Software License

1. Before starting the UFM software, copy your license file(s) downloaded from [NVIDIA Licensing and Download Portal](#) (*volt-ufm-
<serial-number>.lic*) to the master server

under the `/opt/ufm/files/licenses` directory. We recommend that you back up the license file(s).

In High Availability mode, the license files are replicated to the standby machine automatically. Your software is now activated.

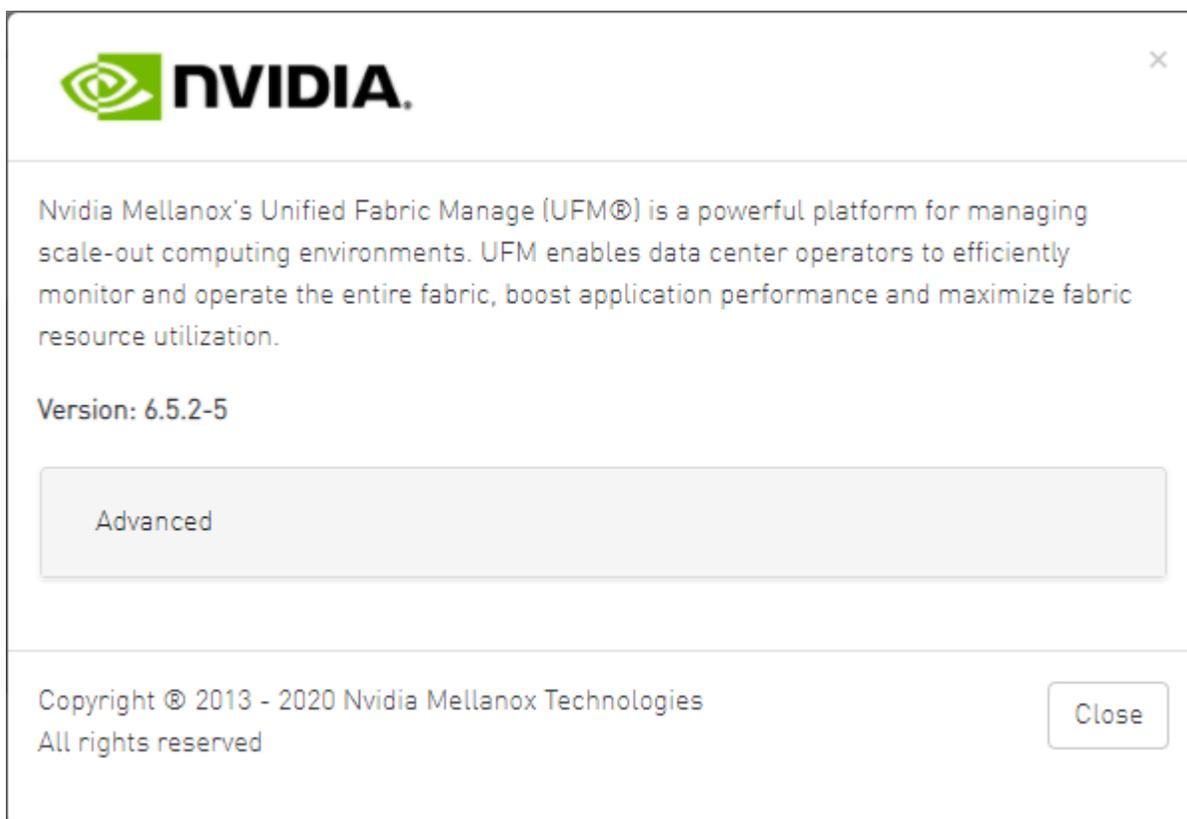
2. Run the UFM software as described in the following sections.

Note

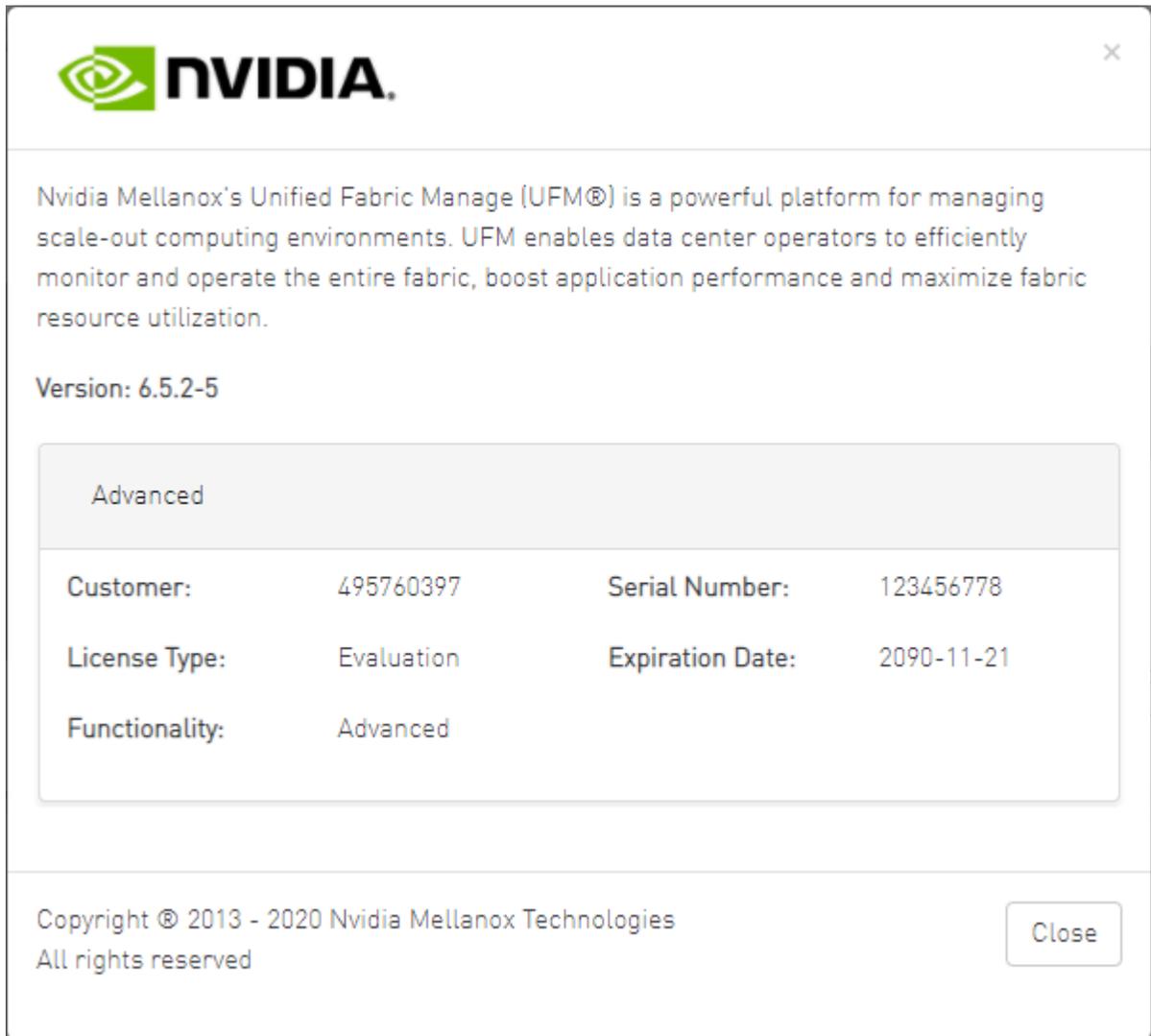
When a UFM license is not provided for activation upon the first UFM installation, the UFM runs on an auto-generated evaluation license which expires after 30 days from the first start-up of the UFM.

Licensing

1. After installing and activating your software, you can view your licenses in the Web UI by clicking the About icon () in the main window.



2. To view the advanced license information, click the Advanced button. The advanced license details will be displayed below.



The screenshot shows a dialog box with the NVIDIA logo at the top left. Below the logo is a paragraph of text: "Nvidia Mellanox's Unified Fabric Manage (UFM®) is a powerful platform for managing scale-out computing environments. UFM enables data center operators to efficiently monitor and operate the entire fabric, boost application performance and maximize fabric resource utilization." Below this text is the version number "Version: 6.5.2-5". In the center, there is a table with a header row labeled "Advanced". The table contains the following information:

Advanced			
Customer:	495760397	Serial Number:	123456778
License Type:	Evaluation	Expiration Date:	2090-11-21
Functionality:	Advanced		

At the bottom left of the dialog box, it says "Copyright © 2013 - 2020 Nvidia Mellanox Technologies All rights reserved". At the bottom right, there is a "Close" button.

3. Product Functionality is updated only after startup. If you replace the UFM license, UFM continues to work in the previous mode until the UFM server is restarted.

To view license information from the CLI:



Run CLI Command "**ufmlicense**" to display information about all installed licenses on the UFM server under /opt/ufm/files/licenses. This includes invalid and expired license information.

There are two UFM HA licenses where each license includes 2 different MACs: one for the primary machine and one for the standby machine.

In a given time, for each license, only one MACs is detected to be "Valid" (exists on the local machine) where the other MAC is detected as "Invalid" (exist on the standby machine).

See below *output example when running the CLI command* `ufmlicense` in SA and HA Modes.

HA Mode Output Example:

```
[root@ip-10-224-16-49-dg11 ~]# docker exec -ti ufm bash
root@ ip-10-224-16-49-dg11~# ufmlicense
|-----|
|NVIDIA Corp|xxxxxxx-xxxxxxx|UFM Enterprise|Subscription |e4:43:4b:18:3c:e0|2025-08-29 |128 |3 Years
|Invalid |
|-----|
|NVIDIA Corp|xxxxxxx-xxxxxxx|UFM Enterprise|Subscription |e4:43:4b:18:49:a0|2025-08-29 |128 |3 Years
|Valid |
|-----|
|NVIDIA Corp|xxxxxxx-xxxxxxx|UFM Enterprise|Subscription |e4:43:4b:18:3c:e0|2025-07-13 |128 |3 |Invalid
|
|-----|
|BBK Electronics Corp Ltd|xxxxxxx-xxxxxxx|UFM Enterprise|Subscription |e4:43:4b:18:49:a0|2025-07-13 |128
|3 |Valid |
```

SA Mode Output Example:

```
root@ufm-production:~# ufmlicense
|-----|
|-----|
| Customer ID | SN | swName | Type
| MAC Address | Exp. Date |Limit| Functionality | Status
|
|-----|
|-----|
|495760397 |123456778 |UFM Enterprise |Evaluation
|NA |2090-11-21 |1024 |Advanced |Valid |
|-----|
|-----|
```

To remove a license:



Delete the license file from `/opt/ufm/files/licenses`.

UFM Configuration

- [Initial Configuration](#)
- [Optional Configurations](#)

Initial Configuration

After installing the UFM® server software and before running UFM, perform the following:

- Mandatory Configuration:
 - Configure General Settings in `gv.cfg`
- [Optional Configurations](#):
 - General Configuration options
 - Quality of Service
 - Activate and Enable Lossy Configuration Manager (Advanced License Only)
 - Activate and Enable Congestion Control Manager (Advanced License Only)

Configuring Fabric Interface

In most common cases, UFM is run in management mode; the UFM SM manages the InfiniBand fabric. In such cases, the only mandatory configuration is setting the **`fabric_interface`** parameter.

The fabric interface should be set to one of the InfiniBand IPoIB interfaces, which connect the UFM/SM to the fabric:

```
fabric_interface = ib0
```

Note

- By default, `fabric_interface` is set to `ib0`
- `fabric_interface` must be up and running before UFM startup. Otherwise, UFM will not be able to run.

For additional configuration options, please refer to the [Optional Configurations](#).

Optional Configurations

General Settings in `gv.cfg`

Configure general settings in the `conf/gv.cfg` file.

Note

When running UFM in HA mode, the `gv.cfg` file is replicated to the standby server.

Enabling SHARP Aggregation Manager

SHARP Aggregation Manager is disabled by default. To enable it, set:

```
[Sharp]
sharp_enabled = true
```

Note

Upon startup of UFM or SHARP Aggregation Manager, UFM will resend all existing tenant allocations to SHARP AM.

Enabling Predefined Groups

```
enable_predefined_groups = true
```

Note

By default, pre-defined groups are enabled. In very large-scale fabrics, pre-defined groups can be disabled in order to allow faster startup of UFM.

Enabling Multi-NIC Host Grouping

```
multinic_host_enabled = true
```

Note

Upon first installation of UFM 6.4.1 and above, multi-NIC host grouping is enabled by default. However, if a user is upgrading from an older version, then this feature will be disabled for them.

(i) Note

It is recommended to set the value of this parameter before running UFM for the first time.

Defining Node Description Black-List

(i) Note

Node descriptions from the black-list should not be used for Multi-NIC grouping.

During the process of host reboot or initialization/bringup, the majority of HCAs receive a default label rather than an actual, real description. To prevent the formation of incorrect multi-NIC groups based on these default labels, this feature offers the option to establish a blacklist containing possible node descriptions that should be avoided when grouping Multi-NIC HCAs during host startup. Once a legitimate node description is assigned to the host, the HCAs are organized into multi-NIC hosts based on their respective descriptions. It is recommended to configure this parameter before initiating the UFM for the first time.

For instance, nodes initially identified with descriptions listed in the `exclude_multinic_desc` will not be initially included in Multi-NIC host groups until they obtain an updated, genuine node description.

Modify the `exclude_multinic_desc` parameter in the `cv.fg` file:

```
exclude_multinic_desc = localhost, generic_name_1, generic_name_2
```

Running UFM Over IPv6 Network Protocol

The default multicast address is configured to an IPv4 address. To run over IPv6, this must be changed to the following in section UFMAgent of gv.cfg.

```
[UFMAgent]
...
# if ufmagent works in ipv6 please set this multicast address to
FF05:0:0:0:0:0:0:15F
mcast_addr = FF05:0:0:0:0:0:0:15F
```

Adding SM Plugin (e.g. lossymgr) to event_plugin_name Option

The following options allow users to set the SM plugin options via the UFM configuration. Once SM is started by UFM, it will start the SM plugin with the specified options.

```
# Event plugin name(s)
event_plugin_name osmufmpi lossymgr
```

Add the plug-in options file to the `event_plugin_options` option:

```
# Options string that would be passed to the plugin(s)
event_plugin_options --lossy_mgr -f <lossy-mgr-options-file-name>
```

These plug-in parameters are copied to the opensm.conf file in Management mode only.

Multi-port SM

SM can use up to eight-port interfaces for fabric configuration. These interfaces can be provided via `/opt/ufm/conf/gv.cfg`. The users can specify multiple IPoIB interfaces or

bond interfaces in `/opt/ufm/conf/gv.cfg`, subsequently, the UFM translates them to GUIDs and adds them to the SM configuration file (`/opt/ufm/conf/opensm/opensm.conf`). If users specify more than eight interfaces, the extra interfaces are ignored.

```
[Server]
```

```
# disabled (default) | enabled (configure opensm with multiple GUIDs) | ha_enabled (configure multiport SM with high availability)
```

```
multi_port_sm = disabled
```

```
# When enabling multi_port_sm, specify here the additional fabric interfaces for OpenSM conf
```

```
# Example: ib1,ib2,ib5 (OpenSM will support the first 8 GUIDs where first GUID will
```

```
# be extracted the fabric_interface, and remaining GUIDs from additional_fabric_interfaces
```

```
additional_fabric_interfaces =
```

Note

UFM treats bonds as a group of IPoIB interfaces. So, for example, if `bond0` consists of the interfaces `ib4` and `ib8`, then expect to see GUIDs for `ib4` and `ib8` in `opensm.conf`.

Note

Duplicate interface names are ignored (e.g. `ib1,ib1,ib1,ib2,ib1 = ib1,ib2`).

Configuring UDP Buffer

This section is relevant only in cases where `telemetry_provider=ibpm`. (By default, `telemetry_provider=telemetry`).

To work with large-scale fabrics, users should set the `set_udp_buffer` flag under the [IBPM] section to "yes" for the UFM to set the buffer size (default is "no").

```
# By default, UFM does not set the UDP buffer size. For large
scale fabrics
# it is recommended to increase the buffer size to 4MB (4194304
bits).
set_udp_buffer = yes
# UDP buffer size
udp_buffer_size = 4194304
```

Virtualization

This allows for supporting virtual ports in UFM.

```
[Virtualization]
# By enabling this flag, UFM will discover all the virtual ports
assigned for all hypervisors in the fabric
enable = false
# Interval for checking whether any virtual ports were changed in
the fabric
interval = 60
```

Static SM LID

Users may configure a specific value for the SM LID so that the UFM SM uses it upon UFM startup.

```
[SubnetManager]
# 1- Zero value (Default): Disable static SM LID functionality
and allow the SM to run with any LID.
#   Example: sm_lid=0
# 2- Non-zero value: Enable static SM LID functionality so SM
will use this LID upon UFM startup.
sm_lid=0
```

Note

To configure an external SM (UFM server running in `sm_only` mode), users must manually configure the `opensm.conf` file (`/opt/ufm/conf/opensm/opensm.conf`) and align the value of `master_sm_lid` to the value used for `sm_lid` in `gv.cfg` on the main UFM server.

Configuring Log Rotation

This section enables setting up the log files rotate policy. By default, log rotation runs once a day by cron scheduler.

```
[logrotate]
#max_files specifies the number of times to rotate a file before
it is deleted (this definition will be applied to
#SM and SHARP Aggregation Manager logs, running in the scope of
UFM).
#A count of 0 (zero) means no copies are retained. A count of 15
means fifteen copies are retained (default is 15)
max_files = 15
```

```
#With max_size, the log file is rotated when the specified size
is reached (this definition will be applied to
#SM and SHARP Aggregation Manager logs, running in the scope of
UFM). Size may be specified in bytes (default),
#kilobytes (for example: 100k), or megabytes (for example: 10M).
if not specified logs will be rotated once a day.
max_size = 3
```

Configuring UFM Logging

The [Logging] section in the gv.cfg enables setting the UFM logging configurations.

Field	Default Value	Value Options	Description
level	WARNING	CRITICAL, ERROR, WARNING, INFO, DEBUG	The definition of the maub logging level for UFM components.
smclient_level	WARNING	CRITICAL, ERROR, WARNING, INFO, DEBUG	The logging level for SM client log messages
event_log_level	INFO	CRITICAL, ERROR, WARNING, INFO, DEBUG	The logging level for UFM events log messages
rest_log_level	INFO	CRITICAL, ERROR, WARNING, INFO, DEBUG	The Logging level for REST API related log messages
authentication_service_log_level	INFO	CRITICAL, ERROR, WARNING, INFO, DEBUG	The logging level for UFM authentication log messages
log_dir	/opt/ufm/files/log	N/A	It is possible to change the

Field	Default Value	Value Options	Description
			<p>default path to the UFM log directory.</p> <p>The configured log_dir must have read, write and execute permission for ufmapp user (ufmapp group).</p> <p>In case of HA, UFM should be located in the directory which is replicated between the UFM master and standby servers.</p> <p>A change of the default UFM log directory may affect UFM dump creation and inclusion of UFM logs in dump.</p>
max_history_lines	100000	N/A	The maximum number of lines in log files to be shown in UI output for UFM logging.
stream_all_events	FALSE	TRUE, FALSE	Enabling this parameter will stream all events to the UFM logs and syslog, regardless of whether the

Field	Default Value	Value Options	Description
			event is alarmable.

```
[Logging]
# Optional logging levels: CRITICAL, ERROR, WARNING, INFO, DEBUG.
level = WARNING
smclient_level = WARNING
event_log_level = INFO
rest_log_level = INFO
authentication_service_log_level = INFO
# The configured log_dir must have read, write and execute
permission for ufmapp user (ufmapp group).
log_dir = /opt/ufm/files/log
max_history_lines = 100000
stream_all_events = FALSE
```

Configuring UFM Over Static IPv4 Address

Follow this procedure to to run UFM on a static IP configuration instead of DHCP:

1. Modify the defined management Ethernet interface network script to be static. Run:

```
# vi /etc/sysconfig/network-scripts/ifcfg-enp1s0
```

Update the required interface with the static IP configuration (IP address, netmask, broadcast, and gateway):

```
NAME="enp1s0"DEVICE="enp1s0"
ONBOOT="yes"
BOOTPROTO="static"
IPADDR="10.209.37.153"
```

```
NETMASK="255.255.252.0"
BROADCAST="10.209.39.255"
GATEWAY="10.209.36.1"
TYPE=Ethernet
DEFROUTE="yes"
```

2. Add host entries to the `/etc/hosts` file. Run:

```
# vi /etc/hosts
127.0.0.1    localhost localhost.localdomain localhost4
localhost4.localhost4
::1         localhost localhost.localdomain localhost6
localhost6.localhost6

10.209.37.153 <hostname>
```

3. Check hostname. Run:

```
# vi /etc/hostname
<hostname>
```

4. Set up DNS resolution at `/etc/resolv.conf`. Run:

```
# vi /etc/resolv.conf
search mtr.labs.mlnx
nameserver 8.8.8.8
```

5. Restart network service. Run:

```
service network restart
```

6. Check Configuration. Run:

```
# hostname  
<hostname>  
# hostname -i  
10.209.37.153
```

Configuring Syslog

This configuration enables the UFM to send log messages to syslog, including remote syslog. The configuration described below is located in the [Logging] section of the `gv.cfg` file.

Field	Default Value	Value Options	Description
<code>syslog</code>	false	True or False	Enables/disables UFM syslog option
<code>syslog_addr</code>	/dev/log # for remote rsyslog_hostname: 514	N/A	UFM syslog configuration (syslog_addr) For working

Field	Default Value	Value Options	Description
			<p>with local syslog, set value to: /dev/l og For working with external machine, set value to: host:p ort Important note: the default remote syslog server port is 514 As the UFM log messages could be sent</p>

Field	Default Value	Value Options	Description
			<p>to remote server, change the rsyslog configuration on the remote server. The /etc/rsyslog.conf file should be edited and two sections should be uncommented as shown below:</p> <pre># # Provides UDP syslog</pre>

Field	Default Value	Value Options	Description
			reception \$Mod Load imudp \$UDP Server rRun 514 # Provides TCP syslog reception \$Mod Load imtcp \$Input TCPS server Run 514 Restart the remote syslog service, run: service rsyslog restart

Field	Default Value	Value Options	Description
ufm_syslog	false	True or False	Sets syslog option for main UFM process logging messages - False - Not to send. True: Send
smclient_syslog	false	True or False	Sets syslog option for Open SM logging messages - False - Not to send. True: Send
event_syslog	false	True or False	Sets syslog option for events logging messages

Field	Default Value	Value Options	Description
			ages - False - Not to send. True: Send
<code>rest_syslog</code>	false	True or False	Sets syslog option for UFM REST API logging messages - False - Not to send. True: Send
<code>authentication_syslog</code>	false	True or False	Set syslog option for UFM authentication logging messages. False - Not to send. True: Send

Field	Default Value	Value Options	Description
syslog_level	WARNING	CRITICAL, ERROR, WARNING, INFO, DEBUG	Sets global syslog messages logging level. The syslog level is common for all the UFM components. The syslog level that is sent to syslog is the highest among the syslog level and component log level defined in the above

Field	Default Value	Value Options	Description
			section.
syslog_facility	LOG_USER	LOG_KERN, LOG_USER, LOG_MAIL, LOG_DAEMON, LOG_AUTH, LOG_SYSLOG, LOG_LPR, LOG_NEWS, LOG_UUCP, LOG_CRON, LOG_AUTHPRIV, LOG_FTP, LOG_NTP, LOG_SECURITY, LOG_CONSOLE, LOG_SOLCRON	Includes the remote syslog package header value for log message facility.

```

syslog = false
#syslog configuration (syslog_addr)
# For working with local syslog, set value to: /dev/log
# For working with external machine, set value to: host:port
syslog_addr = /dev/log
# The configured log_dir must have read, write and execute
permission for ufmapp user (ufmapp group).
log_dir = /opt/ufm/files/log
# Main ufm log.
ufm_syslog = false
smclient_syslog = false
event_syslog = false
rest_syslog = false
authentication_syslog = false
syslog_level = WARNING
# Syslog facility. By default - LOG_USER

```

```
# possible facility codes:
LOG_KERN, LOG_USER, LOG_MAIL, LOG_DAEMON, LOG_AUTH, LOG_SYSLOG,
# LOG_LPR, LOG_NEWS, LOG_UUCP, LOG_CRON, LOG_AUTHPRIV, LOG_FTP,
LOG_NTP, LOG_SECURITY, LOG_CONSOLE, LOG_SOLCRON
# for reference https://en.wikipedia.org/wiki/Syslog
syslog_facility = LOG_USER
```

Excluding Unhealthy Ports from Fabric Health Report

In `gv.cfg` file there is a section named **UnhealthyPorts** and parameters in this section are used for unhealthy ports managing in UFM.

Unhealthy port state could be defined by used using UI or REST API request or reported by OpenSM or ibutilities.

UFM has an ability to check periodically fabric ports healthiness and to report unhealthy ports out or to perform automatically predefined isolation action for unhealthy ports.

In addition, using `exclude_unhealthy_ports` key in **UnhealthyPorts** section unhealthy ports could be excluded from ibdiagnet report.

By default, the value for this parameter is set as *false*. It means that unhealthy ports will appear in ibdiagnet reports, but if need to exclude unhealthy port from ibdiagnet reports

this parameter should be set to true and UFM server should be restarted so this action will take effect.

UFM starting flow will configure indiagnet configuration file with appropriate parameters and unhealthy ports will not appear in UFM health and Fabric health reports.

```
[UnhealthyPorts]
enable_ibdiagnet = true
log_level = INFO
syslog = false
# scheduling_mode possible values: fixed_time/interval.
# If fixed_time - ibdiagnet will run every 24 hours on the
specified time - <fixed_time>.
```

```

# If interval - ibdiagnet will run first time after <start_delay>
minutes from UFM startup and every <interval> hours (default
scheduling mode).
scheduling_mode = interval
# First ibdiagnet start delay interval (minutes)
start_delay = 5
# ibdiagnet run interval (hours)
interval = 3
# ibdiagnet run at a fixed time (example: 23:17:35)
fixed_time = 23:00:00
# By enabling this flag all the discovered high ber ports will be
marked as unhealthy automatically by UFM
high_ber_ports_auto_isolation = false
# Auto isolation mode - which type of ports should be isolated.
# Options: switch-switch, switch-host, all (default: switch-switch).
auto_isolation_mode = switch-switch
# Trigger Partial Switch ASIC Failure whenever number of
unhealthy ports exceed the defined percent of the total number of
the switch ports.
switch_asic_fault_threshold = 20
# exclude unhealthy ports from ibdiagnet reports
exclude_unhealthy_ports=false

```

Configuration Examples in gv.cfg

The following show examples of configuration settings in the gv.cfg file:

- Polling interval for Fabric Dashboard information

```
ui_polling_interval = 30
```

- **[Optional]** UFM Server local IP address resolution (by default, the UFM resolves the address by gethostip). UFM Web UI should have access to this address.

```
ws_address = <specific IP address>
```

- HTTP/HTTPS Port Configuration

```
# WebServices Protocol (http/https) and Port  
ws_port = 8088  
ws_protocol = http
```

- Connection (port and protocol) between the UFM server and the APACHE server

```
ws_protocol = <http or https>  
ws_port = <port number>
```

For more information, see [Launching a UFM Web UI Session](#).

- SNMP `get-community` string for switches (fabric wide or per switch)

```
# default snmp access point for all devices  
[SNMP]  
port = 161  
gcommunity = public
```

- Enhanced Event Management (Alarmed Devices Group)

```
[Server]  
auto_remove_from_alerted = yes
```

- Log verbosity

```
[Logging]
# optional logging levels
#CRITICAL, ERROR, WARNING, INFO, DEBUG
level = INFO
```

For more information, see [UFM Logs](#).

- Settings for saving port counters to a CSV file

```
[CSV]
write_interval = 60
ext_ports_only = no
```

- Max number of CSV files (UFM Advanced)

```
[CSV]
max_files = 1
```

Note

The access credentials that are defined in the following sections of the conf/gv.cfg file are used only for initialization:

- SSH_Server
- SSH_Switch
- TELNET
- IPMI
- SNMP

- MLNX_OS

To modify these access credentials, use the UFM Web UI. For more information, see "[Device Access](#)".

- Configuring the UFM communication protocol with MLNX-OS switches. The available protocols are:
 - http
 - https (default protocol for secure communication)

F

➤ ***or configuring the UFM communication protocol after fresh installation and prior to the first run, set the MLNX-OS protocol as shown below.***

Example:

```
[MLNX_OS]
protocol = https
port = 443
```

Once UFM is started, all UFM communication with MLNX-OS switches will take place via the configured protocol.

➤ ***For changing the UFM communication protocol while UFM is running, perform the following:***

1. Set the desired protocol of MLNX-OS in the conf/gv.cfg file (as shown in the example above).
2. Restart UFM.
3. Update the MLNX-OS global access credentials configuration with the relevant protocol port. Refer to [Device Access](#) for help.

For the http protocol - default port is 80.

For the https protocol - default port is 443.

4. Update the MLNX-OS access credentials with the relevant port in all managed switches that have a valid IP address.

Managing Dynamic Telemetry

The management of dynamic telemetry instances involves the facilitation of user requests for the creation of multiple telemetry instances. As part of this process, the UFM enables users to establish new UFM Telemetry instances according to their preferred counters and configurations. These instances are not initiated by the UFM but rather are monitored for their operational status through the use of the UFM Telemetry bring-up tool

For more information on the supported REST APIs, please refer to [UFM Dynamic Telemetry Instances REST API](#).

The configuration parameters can be found in the gv.cfg configuration file under the `DynamicTelemetry` section.

Name	Description	Default value
max_instances	Maximum number of simultaneous running UFM Telemetries.	5
new_instance_delay	Delay time between the start of two UFM Telemetry instances, in minutes.	5
update_discovery_delay	The time to wait before updating the discovery file of each telemetry instance if the fabric has changed, in minutes.	10
endpoint_timeout	Telemetry endpoint timeout, in seconds.	5
bringup_timeout	Telemetry bringup tool timeout, in seconds.	60
initial_exposed_port	Initial port for the available range of ports (range(initial_exposed_port, initial_exposed_port + max_instances)).	9003
instances_sessions_compatibility_interval	Every instances_sessions_compatibility_interval minutes the UFM verifies compliance between instances and sessions to avoid zombie sessions. if 0 is configured this process won't be activate	10

SM Trap Handler Configuration

The SMTrap handler is the SOAP server that handles traps coming from OpenSM.

There are two configuration values related to this service:

- `osm_traps_debounce_interval` – defines the period the service holds incoming traps
- `osm_traps_throttle_val` – once `osm_traps_debounce_interval` elapses, the service transfers `osm_traps_throttle_val` to the Model Main

Note

By default, the SM Trap Handler handles up to 1000 SM traps every 10 seconds.

Setting CPU Affinity on UFM

This feature allows setting the CPU affinity for the major processes of the UFM (such as ModelMain, SM, SHARP, Telemetry).

In order to increase the UFM's efficiency, the number of context-switches is reduced. When each major CPU is isolated, users can decrease the number of context-switches, and the performance is optimized.

The CPU affinity of these major processes is configured in the following two levels:

- Level 1- The major processes initiation.
- Level 2- Preceding initiation of the model's main subprocesses which automatically uses the configuration used in level 1 and designates a CPU for each of the subprocesses.

According to user configuration, each process is assigned with affinity.

By default, this feature is disabled. In order to activate the feature, configure `Is_cpu_affinity_enabled` with true, check how many CPUs you have on the machine, and set the desired affinity for each process.

For example:

```
[CPUAffinity]
Is_cpu_affinity_enabled=true
Model_main_cpu_affinity=1-4
Sm_cpu_affinity=5-13
SHARP_cpu_affinity=14-22
Telemetry_cpu_affinity=22-23
```

The format should be a comma-separated list of CPUs. For example: 0,3,7-11.

The ModelMain should have four cores, and up to five cores. The SM should have as many cores as you can assign. You should isolate between the ModelMain cores and the SM cores.

SHARP can be assigned with the same affinity as the SM. The telemetry should be assigned with three to four CPUs.

Quality of Service (QoS) Support

Infiniband Quality of Service (QoS) is disabled by default in the UFM SM configuration file.

To enable it and benefit from its capabilities, set the qos flag to TRUE in the `/opt/ufm/files/conf/opensm/opensm.conf` file.

Example:

```
# Enable QoS setup
qos FALSE
```

i Note

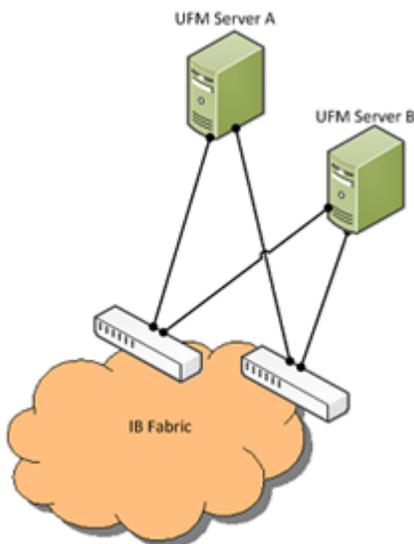
The QoS parameters settings should be carefully reviewed before enablement of the qos flag. Especially, sl2vl and VL arbitration mappings should be correctly defined.

For information on Enhanced QoS, see [Appendix – Used Ports](#).

UFM Failover to Another Port

When the UFM Server is connected by two or more InfiniBand ports to the fabric, you can configure UFM Subnet Manager failover to one of the other ports. When failure is detected on an InfiniBand port or link, failover occurs without stopping the UFM Server or other related UFM services, such as mysql, http, DRDB, and so on. This failover process prevents failure in a standalone setup, and preempts failover in a High Availability setup, thereby saving downtime and recovery.

Network Configuration for Failover to IB Port



To enable UFM failover to another port:

- Configure bonding between the InfiniBand interfaces to be used for SM failover. In an HA setup, the UFM active server and the UFM standby server can be connected

differently; but the bond name must be the same on both servers.

- Set the value of `fabric_interface` to the bond name. using the `/opt/ufm/scripts/change_fabric_config.sh` command as described in [Configuring General Settings in gv.cfg](#). If `ufma_interface` is configured for IPoIB, set it to the bond name as well. These changes will take effect only after a UFM restart. For example, if `bond0` is configured on the `ib0` and `ib1` interfaces, in `gv.cfg`, set the parameter `fabric_interface` to `bond0`.
- If IPoIB is used for UFM Agent, add `bond` to the `ufma_interfaces` list as well.

When failure is detected on an InfiniBand port or link, UFM initiates the give-up operation that is defined in the Health configuration file for OpenSM failure. By default:

- UFM discovers the other ports in the specified bond and fails over to the first interface that is up (SM failover)
- If no interface is up:
 - In an HA setup, UFM initiates UFM failover
 - In a standalone setup, UFM does nothing

If the failed link becomes active again, UFM will select this link for the SM only after SM restart.

Configuring Managed Switches Info Persistency

UFM uses a periodic system information-pulling mechanism to query managed switches inventory data. The inventory information is saved in local JSON files for persistency and tracking of managed switches' status.

Upon UFM start up, UFM loads the saved JSON files to present them to the end user via REST API or UFM WebUI.

After UFM startup is completed, UFM pulls all managed switches data and updates the JSON file and the UFM model periodically (the interval is configurable). In addition, the JSON files are part of UFM system dump.

The following parameters allow configuration of the feature via `gv.cfg` file:

```

[SrvMgmt]
# how often UFM should send json requests for sysinfo to switches
(in seconds)
systems_poll = 180
# To create UFM model in large setups might take a lot of time.
# This is an initial delay (in minutes) before starting to pull
sysinfo from switches.
systems_poll_init_timeout = 5
# to avoid sysinfo dump overloading and multiple writing to host
# switches sysinfo will be dumped to disc in json format every
set in this variable
# sysinfo request. If set to 0 - will not be dumped, if set to 1 -
will be dumped every sysinfo request
# this case (as example defined below) dump will be created every
fifth sysinfo request, so if system_poll is 180 sec (3 minutes)
sysinfo dump to the file will e performed every 15 minutes.
sysinfo_dump_interval = 5
# location of the sysinfo dump file (it is in /opt/ufm/files/logs
(it will be part of UFM dump)
sysinfo_dump_file_path = /opt/ufm/files/log/sysinfo.dump

```

Configuring Partial Switch ASIC Failure Events

UFM can identify switch ASIC failure by detecting pre-defined portion of the switch ports, reported as unhealthy. By default, this portion threshold is set to 20% of the total switch ports. Thus, the UFM will trigger the partial switch ASIC event in case the number of unhealthy switch ports exceeds 20% of the total switch ports.

You can configure UFM to control Partial Switch ASIC Failure events. To configure, you may use the `gv.cfg` file by updating the value of `switch_asic_fault_threshold` parameter under the UnhealthyPorts section. For an example, in case the switch has 32 ports, once 7 ports are detected as unhealthy ports, the UFM will trigger the partial switch ASIC event. Example:

Warning	2023-01-25 10:41:22	Unhealthy IB Port	default(2) / Switch: sw-ufm-qr	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.
Warning	2023-01-25 10:41:02	Unhealthy IB Port	default(2) / Switch: sw-ufm-qr	IBPort	Peer Port "r-ufm51 HCA-1" is considered by SM as unhealthy due to MANUAL.
Critical	2023-01-25 10:41:02	Partial Switch ASIC Failure	default / Switch: sw-ufm-qm0	Switch	Number of switch unhealthy ports has been exceeded the defined threshold which is (4) perce
Info	2023-01-25 10:40:43	MCast Group Deleted	default(2)	Site	Mcast group is deleted: ff12601bffff0000, 1ff18fe80

Enabling Network Fast Recovery

Note

To enable the Network Fast Recovery feature, ensure that all switches in the fabric use the following MLNX-OS/firmware versions:

- MLNX-OS version 3.10.6004 and up
- Quantum firmware versions:
 - Quantum FW v27.2010.6102 and up
 - Quantum2 FW v31.2010.6102 and up

Fast recovery is a switch-firmware based facility for isolation and mitigation of link-related issues. This system operates in a distributed manner, where each switch is programmed with a simple set of rule-based triggers (conditions) and corresponding action protocols. These rules permit the switch to promptly react to substandard links within its locality, responding at a very short reaction time - as little as approximately 100 milliseconds. The policy is provided and managed via the UFM and SM channel. Moreover, every autonomous action taken by a switch in the network is reported to the UFM.

The immediate reactions taken by the switch enable SHIELD and pFRN. These mechanisms collaborate to rectify routing within the proximity of the problematic link before it can disrupt transactions at the transport layer. Importantly, this process occurs rapidly, effectively limiting the spreading of congestion to a smaller segment of the network.

To use the Network Fast Recovery feature, you need to enable the designated trigger (condition) in the gv.cfg file. By doing this, you can specify which of the below four triggers the UFM will support.

As stated in the gv.cfg file, the feature is disabled by default and the below are the supported fields and options:

```
[NetworkFastRecovery]
# Fast Recovery configuration.
# Supported values:
#   0: Ignore fast recovery related MADs and configuration
#   1: Disable fast recovery
#   2: Enable fast recovery
fast_recovery_mode = 0

# This will be supported by the Network Fast Recovery.
network_fast_recovery_conditions =
SWITCH_DECISION_CREDIT_WATCHDOG, SWITCH_DECISION_RAW_BER, SWITCH_DECISION_EFFECTIVE_BER, SWITCH_DECISION_SYMBOL_BER
```

Note

To enable the Network Fast Recovery feature, the value of `fast_recovery_mode` should be set to 2. For the change to take effect, restart of UFM Enterprise is required.

Parameter	Description
SWITCH_DECISION_CREDIT_WATCHDOG	The Switch decided to close the port due to Credit watchdog
SWITCH_DECISION_RAW_BER	The Switch decided to close the port due to High raw errors
SWITCH_DECISION_EFFECTIVE_BER	The Switch decided to close the port due to High effective errors (after FEC)
SWITCH_DECISION_SYMBOL_BER	The Switch decided to close the port due to High symbol errors (after PLR)

By default, the Network Fast Recovery feature operates in monitoring mode. This means the switch does not reset ports, however, it reports issues related to them. To view these port-related issues, you must deploy the UFM PMC (Packet Monitoring Collector) plugin and use its UI to access the relevant network events.

For more details on the PMC plugin, including deployment instructions and how to view Network Fast Recovery events, please refer to [Packet Level Monitoring Collector \(PMC\) Plugin](#).

Disabling Rest Roles Access Control

By default, the Rest Roles Access Control feature is enabled. It can be disabled by setting the `roles_access_control_enabled` flag to false:

```
[RolesAccessControl]
roles_access_control_enabled = true
```

Enabling/Disabling Authentication

Kerberos Authentication

By default, [Kerberos Authentication](#) is disabled. To enable it, set the `kerberos_auth_enabled` flag to true. Additionally, provide the required configurations such as `kerberos_cred_key_path`, `kerberos_use_local_name` and `kerberos_auto_sign_up`.

```
[KerberosAuth]
# This section responsible to manage kerberos authentication
# Set to true to enable the kerberos auth feature, and set to false
to disable it. Default is false.
kerberos_auth_enabled = false
# The path of the keytab file containing credentials for GSSAPI
authentication.
```

```
kerberos_cred_key_path = /etc/kadm5.keytab
# Set to true to configure the Apache server to map authenticated
principal names (which represent different clients) to local
usernames,
# and set to false to use the principle names as usernames. Default
is true (this value will be reflected in the 'GssapiLocalName' directive
in Apache).
kerberos_use_local_name = true
# Set to true to enable auto sign up of users who do not exist in
UFM DB. Default is true.
kerberos_auto_sign_up = true
# The default role assigned to create users if they do not exist when
'kerberos_auto_sign_up' is set to true.
kerberos_default_role = System_Admin
```

kerberos_auth_enabled: By default, Kerberos authentication remains disabled. To activate it, the user must set this flag to 'true' and then restart UFM.

kerberos_cred_key_path: This specifies the path to the keytab file containing credentials for GSSAPI authentication.

kerberos_use_local_name: Set to true to configure the Apache server to map authenticated principal names (which represent different clients) to local usernames, and set to false to use the principal names as usernames. Default is true (this value will be reflected in the 'GssapiLocalName' directive in Apache).

kerberos_auto_signup: For successful authentication via Kerberos, the user must already exist within the UFM database, otherwise, the authentication will be refused by UFM. If this property is set to 'true,' UFM will create the non-existing users in the UFM DB.

kerberos_default_role: The default role is assigned to create users if they do not exist when 'kerberos_auto_sign_up' is set to true.

Finally, restart the UFM to use Kerberos authentication.

UFM Authentication Server

By default, [UFM Authentication Server](#) is enabled. To disable it, you need to set the "auth_service_enabled" parameter to 'false' and then restart the UFM service to initiate the authentication server. Additionally, you can use enable/disable flags for Basic, Session, and Token authentication:

```
[AuthService]
auth_service_enabled = true
auth_service_interface = 127.0.0.1
auth_service_port = 8087 # the serving port for the authentication
server
basic_auth_enabled = true
session_auth_enabled = true
token_auth_enabled = true
```

Azure AD Authentication

By default, [Azure AD Authentication](#) is disabled. To enable it, set the "azure_auth_enabled" flag to 'true'. Additionally, provide the required configurations from the Azure AD Application such as TENANT_ID, CLIENT_ID and CLIENT_SECRET which can be found under the "**Overview**" section of the registered application in the Azure portal. Finally, the [UFM Authentication Server](#) should be enabled to use the Azure AD Authentication.

```
[AzureAuth]
azure_auth_enabled = false
# TENANT ID of app registration
TENANT_ID =
# Application (client) ID of app registration
CLIENT_ID =
# Application's generated client secret
CLIENT_SECRET =
```

Changing Maximum SSL Request Size when Using Client Certificate

1. Activate Client Certificate Authentication. For more details, refer to the [Client Authentication REST API](#).
2. In the Server section in the `gv.cfg` file, there is a configuration option for controlling the maximum request size when using client certificates:
 - The maximum request size, specified in bytes, is set to a default value of 1,572,864 (1536 KB / 1.5 MB). If not explicitly defined, the system will default to Apache's value of 131,072 bytes (128 KB).
 - `max_ssl_request_size = 1572864`

Note

- This configuration is expressed in bytes.
- The **Setting Up SSL and CA Certificates in UFM** and **Changing Maximum SSL Request Size when Using Client Certificate** features cannot be used simultaneously. Removing, updating, or configuring will delete the certificates.

Adjusting UFM Configuration Files Based on Fabric Size

This function allows users to automate the process of updating the UFM configuration files by parsing a primary configuration file called `large_scale_subnet.cfg` file and applying the values to multiple target files or resetting to default values using the `small_scale_subnet.cfg`.

The below are instructions on how to use a Python script to parse a configuration file (`large_scale_subnet.cfg`) and update the values of specific parameters in multiple target UFM configuration files (`gv.cfg`, `reports.cfg`, `opensm.cfg`, and `sharp_am.cfg`). The script can operate in two modes:

- **Large Scale Subnet Mode:** This mode directly updates the UFM configuration files based on the parsed configuration from the `large_scale_subnet.cfg` file.

- **Small Scale Subnet (Default) Mode:** Sets the UFM configuration files to their default values by parsing the `small_scale_subnet.cfg` file.

Configuration File and Parameters

The primary configuration file contains all the parameters, and their values must be updated over the multiple UFM configuration files.

Primary Configuration Files

- `/opt/ufm/files/conf/ large_scale_subnet.cfg`
- `/opt/ufm/files/conf/ small_scale_subnet.cfg`

Target UFM Configuration Files

- `/opt/ufm/files/conf/gv.cfg`
- `/opt/ufm/files/conf/reports.cfg`
- `/opt/ufm/files/conf/opensm/opensm.conf`
- `/opt/ufm/files/conf/sharp/sharp_am.cfg`

Example structure of `large_scale_subnet.cfg` and `small_scale_subnet.cfg`:

```
[GV]
[GV.Server]
# disabled (default) | enabled (configure opensm with multiple
GUIDs) | ha_enabled (configure multiport SM with high
availability).
multi_port_sm = ha_enabled
# report_events that will determine which trap to send to ufm
all/security/none
report_events = security
```

```

[GV.FabricAnalysis]
# initial_delay (in minutes) - the initial delay for running
fabric analysis for the first time after UFM was started
initial_delay = 10

[GV.logrotate]
#max_files specifies the number of times to rotate a file before
it is deleted.
#A count of 0 (zero) means no copies are retained. A count of 10
means fifteen copies are retained (default is 10)
max_files = 10

[REPORTS]
[REPORTS.FabricHealth]
# Fabric health report timeout
timeout = 1800

[REPORTS.TopologyCompare]
# Topology compare report timeout
timeout = 1800

[REPORTS.FabricAnalysis]
# Fabric analysis report timeout
timeout = 1800

[OPENSMB]
#Amount of physical port to handle in one shot
virt_max_ports_in_process = 512
max_op_vls = 2
qos = TRUE
# Single MAD Sl2vl for all ports
use_optimized_slvl = TRUE
# Timeout for long MAD config time. might need to change 1000
long_transaction_timeout = 500
routing_engine = ar_updn

```

```

use_ucast_cache = TRUE
root_guid_file = /opt/ufm/files/conf/opensm/root_guid.conf
pgrp_policy_file = /opt/ufm/files/conf/opensm/pgrp_policy.conf

[SHARP]
ib_qpc_sl = 1
fabric_update_interval = 10
lst_file_timeout = 10
lst_file_retries = 30
max_tree_radix = 80
generate_dump_files = TRUE
dynamic_tree_allocation = TRUE
dynamic_tree_algorithm = 1
smx_keepalive_interval = 10

```

Script Usage Example in the CLI:

- **Large Scale Subnet Mode:**

```

/opt/ufm/scripts/set_ufm_scale_profile.sh --mode
large_scale_subnet --force_update

```

- **Small Scale Subnet (Default) Mode:**

```

/opt/ufm/scripts/ set_ufm_scale_profile.sh --mode
small_scale_subnet

```

The `force_update` script parameter adds any parameters found in `large_scale_subnet.cfg` and `small_scale_subnet.cfg` that are not present in the UFM configuration files. For example, if a user adds a new parameter called `test_param = 500` to the `large_scale_subnet.cfg` file under the [Server] section and this parameter does not exist in the `gv.cfg` file, running the script with the `--force_update` option will add `test_param = 500` to the [Server] section of the `gv.cfg` file.

Expected Output

1. **Large Scale Subnet Mode:**

- The script reads `large_scale_subnet.cfg`.

- It updates the parameters in the target UFM configuration files based on the parsed data.
- It logs messages for any skipped parameters.

1. **Small Scale Subnet - Default Mode:**

- The script reads `small_scale_subnet.cfg`.
- It updates the parameters in the target UFM configuration files based on the parsed data.
- It logs messages for any skipped parameters or adds the parameter to the configuration file if the `force_update` was True.

Note

Note: In case of the script running failure, the script will reset the UFM configuration files to their default values.

Setting Up SSL and CA Certificates in UFM

This feature allows you to set up SSL and CA certificates, issued and signed by a publicly trusted certificate authority (CA) in UFM .

To utilize this feature, please ensure you have the following prerequisites:

- UFM Docker image
- Certificate files:
 - A certificate file named `server.crt`
 - A key file named `server.key`

- An optional chain of authority file named `ca-intermediate.crt`

All of these files must be located in the directory `/opt/ufm/files/conf/webclient`.

Once these prerequisites are met, UFM will utilize the provided certificates.

Note

The **Setting Up SSL and CA Certificates in UFM** and **Changing Maximum SSL Request Size when Using Client Certificate** features cannot be used simultaneously. Removing, updating, or configuring will delete the certificates.

Setting up Telemetry in UFM

Setting up telemetry deploys UFM Telemetry as bare metal on the same machine. Historical data is sent to SQLite database on the server and live data becomes available via UFM UI or REST API.

Enabling UFM Telemetry

The UFM Telemetry feature is enabled by default and the provider is the UFM Telemetry. The user may change the provider via flag in `conf/gv.cfg`

The user may also disable the History Telemetry feature in the same section.

```
[Telemetry]
history_enabled=True
```

Enabling UFM Telemetry Manager Plugin

UFM Telemetry can be managed via the [UFM Telemetry Manager \(UTM\) Plugin](#). To enable UTM mode, deploy the plugin, set one or all of the following flags in `/opt/ufm/files/conf/gv.cfg` under the [Telemetry] section to `false` and restart UFM:

```
[Telemetry]
primary_telemetry_legacy_mode = true
secondary_telemetry_legacy_mode = true
dynamic_telemetry_legacy_mode = true
```

To edit UFM Telemetry configuration, edit

`/opt/ufm/files/conf/telemetry_defaults/primary_env.cfg` for primary,
`/opt/ufm/files/conf/secondary_telemetry_defaults/secondary_env.cfg` for secondary,
`/opt/ufm/files/conf/dynamic_telemetry_defaults/dynamic_env.cfg` for dynamic.

Here is a list of available UTM Plugin APIs:

Command	Method	Description
<code>/status</code>	GET	Return status of managed telemetry setup
<code>/status.html</code>	GET	Return status in HTML format
<code>/switches</code>	GET	Return all switches
<code>/hcas</code>	GET	Return all HCAs
<code>/guids</code>	GET	Return all GUIDS PORTS pairs
<code>/add_server</code>	GET	Add a <i>new</i> telemetry instance at 'url' added to 'group'.
		Query parameters: url=[target ip, required], group='default'

```

/remove_server          GET          Remove paused or running
telemetry instance at URL (required query parameter url=URL)
/pause_server          GET          Pause an existing telemetry
instance at URL (required query parameter url=URL)
/start_server          GET          Start a paused telemetry
instance at URL (required query parameter url=URL)
/restart_server        GET          Restart paused or running
telemetry instance at URL (required query parameter url=URL)
                                Apply new

```

configuration if query parameters are set:

```

                                xcset_name=
regenerate new config ini file for IB Telemetry
                                http_port=
replace http port
                                sample_rate=

```

update sample rate

```

/get_server_xcsets      GET          Get list of available xcsets
available on server at URL (required query parameter url=URL)
/deploy_switch_agents  GET          Deploy agent image to
switches to run telemetry within it later

```

```

                                ip_list=[required]    csv
list of target switches IPs or 'all' to deploy to all switches

```

Examples:

1. deploy to all the managed switches:

```

                                curl -X GET
127.0.0.1:8888/deploy_switch_agents?ip_list=all

```

2. deploy to switches with IPs 127.0.1.1 and 127.0.1.2:

```

                                curl -X GET
127.0.0.1:8888/deploy_switch_agents?ip_list=127.0.1.1,127.0.1.2

```

```

/remove_switch_agents  GET          Remove deployed switch agents
and switch telemetry

```

```

                                ip_list=[required]    csv
list of target switches IPs or 'all' to remove from all deployed

```

switches

/switch_mon_list GET Set IPs of managed switches that will be periodically monitored.

ip_list=[required] csv
list of target switches IPs or 'all' to deploy to all switches

Examples:

1. deploy to all the

managed switches:

curl -X GET

127.0.0.1:8888/switch_mon_list?ip_list=all

2. deploy to switches

with IPs 127.0.1.1 and 127.0.1.2:

curl -X GET

127.0.0.1:8888/switch_mon_list?ip_list=127.0.1.1,127.0.1.2

/managed_switches_status GET Get info in JSON-format about managed switches in Distributed Telemetry.

Query parameters:

monitored_only=

[1|0] show only monitored switches (the switches that were set via /switch_mon_list endpoint). Default 0.

/start_switch_telemetry GET (Re)configure and (re)start switch telemetry. Query parameters:

ip=[target ip], set

switch IP to (re)start a single switch telemetry,

otherwise:

all the managed switches with installed

switch

agents will (re)start telemetry

sample_rate,

restart_every,

counter_set,

http_port,

dt_udp_handshake,

dt_udp_data_ack,

gnmi

```

/stop_switch_telemetry    GET          Stop all running switch
telemetry instance
                                ip=[target ip],      set
switch IP to stop a single switch telemetry,
                                otherw:
all the running switch telemetries will be stopped
/set_switch_creds        POST          Set switch credentials.
                                Required query parameters:
                                    ip=
                                    user=
                                    pass=
/xcset/all                GET          Get cached name-hash xcset
pairs
/xcset                    GET          Get xcset content by name
/xcset                    DELETE       Delete xcset from cache
/xcset                    POST         Add/overwrite cached xcset
                                Example:
                                    curl -X POST
0.0.0.0:8888/xcset?name=test --data-binary @path/to/file.xcset
/filter                    POST          Post [x|f]set name to the
host telemetry instance. This data will be accessible via
/[xc,c,f]set/name info endpoint.
                                Required args:
                                    name=[required]
set name
                                ext=[required]
set extension (fset, cset, xcset)
                                session_id=[required]
session ID of the host telemetry instance
                                Examples:
                                    curl -X POST
0.0.0.0:8888/filter?name=test&ext=fset&session_id --data-binary
@path/to/file.fset
                                curl -X POST
0.0.0.0:8888/filter?name=test&ext=cset&session_id --data-binary
@path/to/file.cset

```

```
curl -X POST
0.0.0.0:8888/filter?name=test&ext=xcset&session_id --data-binary
@path/to/file.xcset
/host/create_telemetry POST Deploy and start internal
host telemetry.
```

Note: works only when
telemetry bringup is installed to UTM image

Required query parameters:

```
hca=
http_port=
sample_rate=
```

Optional query parameters:

```
xcset_name=
```

regenerate [new](#) config ini file [for](#) IB Telemetry

```
env_params= csv line
of env parameters
```

```
ibdiag_opts= csv line
of ibdiag options
```

```
group= set
telemetry group name
```

Optional POST parameters:

```
env_file path to
```

env file. Format is key=value per line.

Usage:

```
curl
```

```
... --data-binary @path/to/file
```

```
/host/remove_telemetry GET Stop and remove host
telemetry.
```

Note: works only when
telemetry bringup is installed to UTM image

One of the following query
params is required:

by session ID		session_id=	to stop
		group=	to stop
all instances from the group			
/host/get_sessions	GET	Get session id to telemetry	
instance mapping			
/help.html	GET	Print help information in	
HTML format			
/help	GET	Print help information	

For example, to update an existing `cset` in UTM mode, get the `session_id` using `/host/get/sessions` API and update the cset with a post API:

```
curl -k -u admin:123456 -X POST "https://localhost/ufmRest/plugin/utm/filter?
name=minimal&ext=cset&session_id=92" --data-binary
@/opt/ufm/conf/telemetry/prometheus_configs/cset/minimal.cset
```

Changing Telemetry Bind Address

By default, UFM Telemetry will bind to 127.0.0.1. Users can modify this setting for both primary and secondary telemetry instances using the appropriate flags in `conf/gv.cfg`.

```
[Telemetry]
primary_ip_bind_addr=0.0.0.0
secondary_ip_bind_addr=0.0.0.0
```

Changing Telemetry Endpoint Protocol

The default protocol for the Telemetry endpoint is HTTP. However, this can be switched to HTTPS by meeting two conditions:

1. Ensure that the certificate files, named `server.key` and `server.crt`, are present in the following directories:

- For bare-metal UFM users: `/var/opt/ufm/webclient`
- For Docker/Appliance UFM users: `/opt/ufm/files/conf/webclient`

2. Modify the protocol setting in the configuration file `conf/gv.cfg` under the `[Telemetry]` section:

```
[Telemetry]
prometheus_protocol = https
```

Changing UFM Telemetry Default Configuration

There is an option to configure parameters on a telemetry configuration file which takes effect after restarting the UFM or failover in HA mode.

The `launch_ibdiagnet_config.ini` default file is located under `/opt/ufm/conf/telemetry_defaults` and is copied to the telemetry configuration location (`/opt/ufm/conf/telemetry`) upon startup UFM.

All values taken from the default file take effect at the deployed configuration file except for the following:

Note that normally the user does not have to do anything and they get two pre-configured instances – one for low frequency and one for higher-frequency sampling of the network.

Value	Description
<code>hca</code>	-
<code>scope_file</code>	-
<code>plugin_env_PROMETHEUS_ENDPOINT</code>	The port on which HTTP endpoint is configured

Value	Description
<code>plugin_env_PROMETHEUS_INDEXES</code>	Configures how data is indexed and stored in memory
<code>config_watch_enabled=true</code>	Configures network watcher to inform ibdiagnet that network topology has changed (as ibdiagnet lacks the ability to re-discover network changes)
<code>plugin_env_PROMETHEUS_CSET_DIR</code>	Specifies where the counterset files, which define the data to be retrieved and the corresponding counter names.
<code>num_iterations</code>	The number of iterations to run before 'restarting', i.e. rediscovering fabric.
<code>plugin_env_CLX_RESTART_FILE</code>	A file that is 'touched' to indicate that an ibdiagnet restart is necessary

The following attributes are configurable via the gv.cfg:

- `sample_rate` (gv.cfg → `dashboard_interval`) – only if `manual_config` is set to false
- `prometheus_port`

Supporting Generic Counters Parsing and Display

As of UFM v6.11.0, UFM can support any numeric counters from the HTTP endpoint. The list of supported counters are fetched upon starting the UFM from all the endpoints that are configured.

Some of the implemented changes are as follows:

1. Counter naming – all counters naming convention is extracted from the HTTP endpoint. The default `cset` file is configured as follows:

“

```
Infiniband_LinkIntegrityErrors=^LocalLinkIntegrityErrorsExtended$
```

” to get this name to the UFM.

Counters received as floats should contain an "_f" suffix such as:

```
Infiniband_CBW_f=^infiniband_CBW$
```

2. Attribute units – To see units of a specific counter on the UI graphs, configure the `cset` file to have the counter returned as “`counter_name_u_unit`”.

3. Telemetry History:

The SQLite history table

`(/opt/ufm/files/sqlite/ufm_telemetry.db – telemetry_calculated)`, contains the new naming convention of the telemetry counters.

In the case of an upgrade, all previous columns that were configured are renamed following the new naming convention, and then, the data is saved. If a new counter that is not in the table needs to be supported, the table is altered upon UFM start.

4. New counter/`cset` to fetch – if there is a new `cset` /counter that needs to be supported AFTER the UFM already started, perform system restart.

5. Created New API/UfmRestV2/telemetry/counters for the UI visualization. This API returns a dictionary containing the counters that the UFM supports, based on the fetched URLs and their units (if known).

Supporting Multiple Telemetry Instances Fetch

This functionality allows users to establish distinct Telemetry endpoints that are defined to their preferences.

Users have the flexibility to set the following aspects:

- Specify a list of counters they wish to pull. This can be achieved by selecting from an existing, predefined counters set (`cset file`) or by defining a new one.
- Set the interval at which the data should be pulled.

Upon initiating the Telemetry endpoint, users can access the designated URL to fetch the desired counter data.

To enable this feature, under the [Telemetry] section in `gv.cfg`, the flag named “`additional_cset_urls`” holds the list of additional URLs to be fetched.

the URLs should be separated by “ ” (with a space) and should follow the following format: `http://:/csv/`. For example <http://10.10.10:9001/csv/minimal>

<http://10.10.10.10:9002/csv/test>.

Note

Only csv extensions are supported.

Each UFM Telemetry instance run by UFM can support multiple cset (counters set) in parallel. If the user would like to have a second cset file fetched by UFM and exposed by the same UFM Telemetry instance, the new cset file should be placed under `/opt/ufm/files/conf/telemetry/prometheus_configs/cset/` and configured in `gv.cfg` to fetch its data as described above.

Low-Frequency (Secondary) Telemetry

As a default configuration, a second UFM Telemetry instance runs, granting access to an extended set of counters that are not available in the default telemetry session. The default telemetry session is used for the UFM Web UI dashboard and user-defined telemetry views. These additional counters can be accessed via the following API endpoint: **`http://<UFM_IP>:9002/csv/xcset/low_freq_debug`**.

It is important to note that these exposed counters are not accessible through UFM's REST APIs. All the configurations for the second telemetry can be found under `/opt/ufm/files/conf/secondary_telemetry/`, where the defaults are located under `/opt/ufm/files/conf/secondary_telemetry_defaults/`. The second telemetry instance also allows telemetry data to be exposed on disabled ports, although this feature can be disabled if desired.

The relevant flags in the `gv.cfg` file are as follows:

- `secondary_telemetry` = true (To enable or disable the entire feature)
- `secondary_endpoint_port` = 9002 (The endpoint's exposed port)
- `secondary_disabled_ports` = true (If set to true, secondary telemetry will expose data on disabled ports)

- `secondary_slvl_support` = false (if set to true, low-frequency (secondary) Telemetry will collect counters per slvl, the corresponding supported xcset can be found under `/opt/ufm/files/conf/secondary_telemetry/prometheus_configs/cset/low_f`)

The counters that are supported by default, collected, and exposed can be located in the directory

```
/opt/ufm/files/conf/secondary_telemetry/prometheus_configs/cset/low_f
```

For the list of low-frequency (secondary) telemetry fields and available counters, please refer to [Low-Frequency \(Secondary\) Telemetry Fields](#).

Low-Frequency (Secondary) Telemetry - Exposing IPv6 Counters

To allow the low-frequency (secondary) telemetry instance to expose counters on its IPv6 interfaces, perform the following:

1. Change the following flag in the gv.cfg:

```
secondary_ip_bind_addr =0:0:0:0:0:0:0:0
```

2. Restart UFM telemetry or restart UFM.

Stopping Telemetry Endpoint Using CLI Command

To stop low-frequency (secondary) telemetry endpoint only using the CLI you may run the following command:

```
/etc/init.d/ufmd ufm_telemetry_secondary_stop
```

Exposing Switch Aggregation Nodes Telemetry

To expose switches SHARP aggregation nodes telemetry, follow the below steps:

- Configure the low-frequency (secondary) telemetry instance. Run:

```
vi
/opt/ufm/files/conf/secondary_telemetry_defaults/launch_ibdiag
```

- Set the following:

- `arg_16=--sharp --sharp_opt dsc`
- `plugin_env_CLX_EXPORT_API_SKIP_SHARP_PM_COUNTERS=0`

- Add the wanted attributes to the default `xcset` or to a new one:

- New `xcset` –

```
vi
/opt/ufm/files/conf/secondary_telemetry/prometheus_conf
for your choice>.xcset
```

- After restarting, query curl

```
http://<UFM_IP>:9002/csv/xcset/<chosen_name>
```

- Existing `xcset` –

```
vi
/opt/ufm/files/conf/secondary_telemetry/prometheus
```

- -

- Add the following attributes:

- `packet_sent`

- `ack_packet_sent`
 - `retry_packet_sent`
 - `rn timer_event`
 - `timeout_event`
 - `oos_nack_rcv`
 - `rn timer_nack_rcv`
 - `packet_discard_transport`
 - `packet_discard_sharp`
 - `aeth_syndrome_ack_packet`
 - `hba_sharp_lookup`
 - `hba_received_pkts`
 - `hba_received_bytes`
 - `hba_sent_ack_packets`
 - `rcds_sent_packets`
 - `hba_sent_ack_bytes`
 - `rcds_send_bytes`
 - `hba_multi_packet_message_dropped_pkts`
 - `hba_multi_packet_message_dropped_bytes`
- Restart telemetry:

```
/etc/init.d/ufmd ufm_telemetry_stop
```

```
/etc/init.d/ufmd ufm_telemetry_start
```

Exposing Performance Histogram Counters for Egress Queue Depth Indications (Secondary) Telemetry

To enable the secondary telemetry instance to expose performance histogram counters for all VLs, perform the following:

1. Change the following flag in the `gv.cfg` file:

```
queue_depth_indications_all_vls = true
```

If this flag remains set to `false`, the secondary telemetry instance will only collect counters for VLs 0 and 1.

2. Restart UFM telemetry or restart UFM.

After the secondary telemetry instance restarts, you can find the collected counters at:

```
/opt/ufm/conf/secondary_telemetry/prometheus_configs/cset/low_freq.
```

Running UFM Server Software

Before running UFM:

- Perform [Initial Configuration](#)
- Ensure that all ports used by the UFM server for internal and external communication are open and available. For the list of ports, see [Used Ports](#).

You can run the UFM server software in the following modes:

- - [Running UFM Server Software in Management Mode](#)
 - [Running UFM Software in High Availability Mode](#)
 - Running UFM in High Availability with failover to an external SM

Note

In Management or High Availability mode, ensure that all Subnet Managers in the fabric are disabled *before* running UFM. Any remaining active Subnet Managers will prevent UFM from running.

Running UFM Server Software in Management Mode

After installing, run the UFM Server by invoking:

```
systemctl start ufm-enterprise.service
```

Note

`/etc/init.d/ufmd` - Available for backward compatibility.

Log files are located under `/opt/ufm/files/log` (the links to log files are in `/opt/ufm/log`).

Running UFM Software in High Availability Mode

On the Master server, run the UFM Server by invoking:

```
ufm_ha_cluster start
```

You can specify additional command options for the `ufmha` service.

ufm_ha_cluster Command Options

Command	Description
start	Starts UFM HA cluster.
stop	Stops UFM HA cluster.
failover	Initiates failover (change mastership from local server to remote server).
takeover	Initiates takeover (change mastership from remote server to local server).
status	Shows current HA cluster status.
cleanup	Cleans the HA configurations on this node.
help	Displays help text.

HTTP/HTTPS Configuration

By default, UFM is configured to work with the secured HTTPS protocol.

After installation, the user can change the the Web Server configuration to communicate in secure (HTTPS) or non-secure (HTTP) protocol.

For changing the communication protocol, use the following parameter under the [Server] section in the `gv.cfg` file:

- `ws_protocol = https`

Changes will take effect after restarting UFM.

UFM Internal Web Server Configuration

UFM uses Apache as the main Web Server for client external access. The UFM uses an internal web server process to where the Apache forwards the incoming requests.

By default, the internal web server listens to the local host interface (127.0.0.1) on port 8000.

For changing the listening local interface or port, use the following parameters under the [Server] section in the `gv.cfg` file:

- `rest_interface = 127.0.0.1`
- `rest_port = 8000`

Changes will take effect after restarting UFM.

User Authentication

UFM User Authentication is based on standard Apache User Authentication. Each Web Service client application must authenticate against the UFM server to gain access to the system.

The UFM software comes with one predefined user:

- Username: admin
- Password: 123456

You can add, delete, or update users via [User Management Tab](#).

UFM Authentication Server

The UFM Authentication Server, a centralized HTTP server, is responsible for managing various authentication methods supported by UFM.

Configurations of the UFM Authentication Server

The UFM Authentication Server is designed to be configurable and is initially turned off by default. This means that existing authentication methods are managed either by the native Apache functionality (such as Basic, Session, and Client Certificate authentication) or at the UFM level (including Token-Based authentication and Proxy Authentication).

Enabling the UFM Authentication Server provides a centralized service that oversees all supported authentication methods within a single service, consolidating them under a unified authentication API.

Apache utilizes the authentication server's APIs to determine a user's authentication status.

To enable the UFM Authentication Server, refer to [Enabling UFM Authentication Server](#).

All activities of the UFM Authentication Server are logged in the `authentication_service.log` file, located at `/opt/ufm/files/log`.

Azure AD Authentication

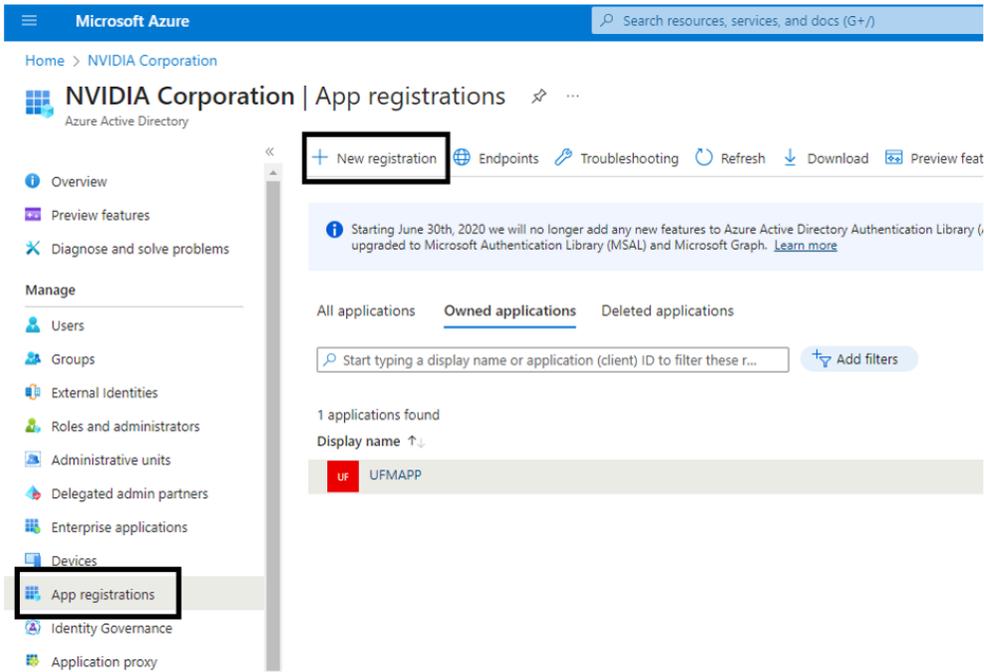
Microsoft Azure Authentication is a service provided by Microsoft Azure, the cloud computing platform of Microsoft. It is designed to provide secure access control and authentication for applications and services hosted on Azure.

UFM supports Authentication using Azure Active Directory, and to do so, you need to follow the following steps:

Register UFM in Azure AD Portal

To log in via Azure, UFM must be registered in the Azure portal using the following steps:

1. Log in to [Azure Portal](#), then click "**Azure Active Directory**" in the side menu.
2. If you have access to more than one tenant, select your account in the upper right. Set your session to the Azure AD tenant you wish to use.
3. Under "**Manage**" in the side menu, click App Registrations > New Registration.



4. Provide the application details:

1. **Name:** Enter a descriptive name.
2. **Supported account types:** Account types that are allowed to login and use the registered application.
3. **Redirect URL:** select the app type **Web**, and Add the following redirect URL `https:///auth/login`

Register an application ...

* Name

The user-facing display name for this application (this can be changed later).

UFM_APP ✓

Supported account types

Who can use this application or access this API?

- Accounts in this organizational directory only (NVIDIA Corporation only - Single tenant)
- Accounts in any organizational directory (Any Azure AD directory - Multitenant)
- Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)
- Personal Microsoft accounts only

[Help me choose...](#)

Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web ✓

Register an app you're working on here. Integrate gallery apps and other apps from outside your organization by adding from [Enterprise applications](#).

By proceeding, you agree to the [Microsoft Platform Policies](#)

[Register](#)

Then, click **Register**. The app's **Overview** page opens.

5. Under **Manage** in the side menu, click **Certificates & Secrets** > New client secret.

Add a client secret



Description

UFM_APP_sec

Expires

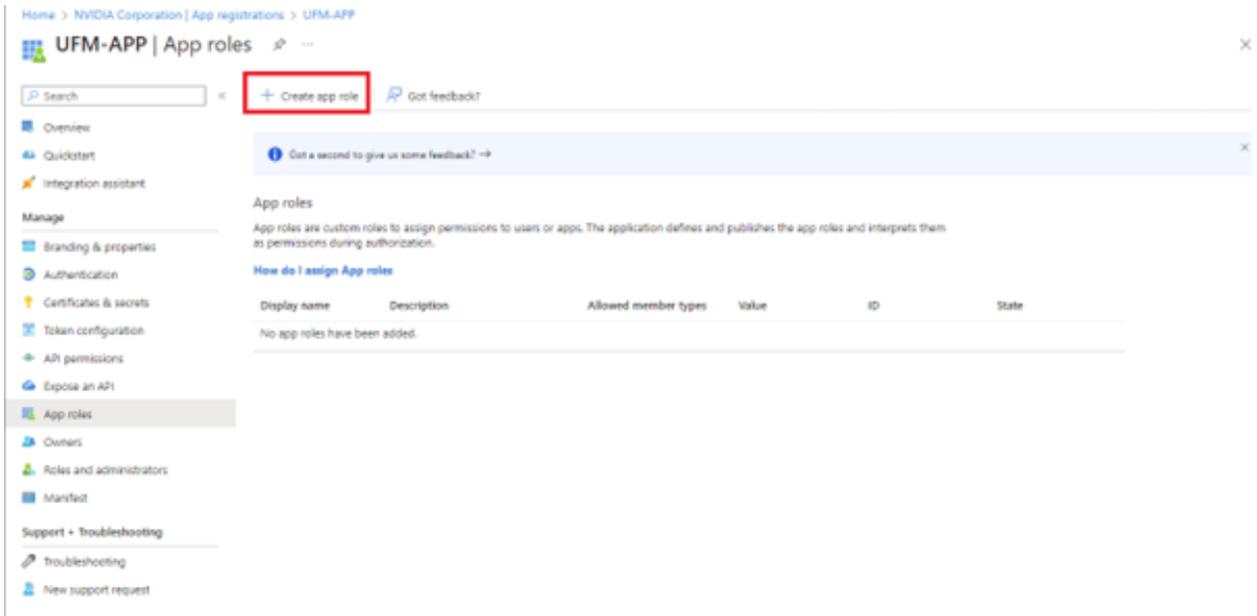
Recommended: 180 days (6 months)



Provide a description for the client secret and set an expiration time, then click **"Add."**

6. Copy the client secret key value which will be needed to configure the UFM with Azure AD (Please note that the value of the generated secret will be hidden and will not be able to be copied/read after you leave the page.

Under **"Manage"** in the side menu, click App roles > Create app role.



7. Provide the role details. Please note that the role value must be a valid UFM role; otherwise, the login will fail.

Create app role ✕

Display name * ⓘ

System_Admin ✓

Allowed member types * ⓘ

Users/Groups
 Applications
 Both (Users/Groups + Applications)

Value * ⓘ

System_Admin ✓

Description * ⓘ

System_Admin

Do you want to enable this app role? ⓘ

8. Assign the created role to the user. Follow the below steps:

✦ ...

+ Create app role | 🗨️ Got feedback?

📘 Got a second to give us some feedback? →

App roles

App roles are custom roles to assign permissions to users or apps. The application determines permissions during authorization.

How do I assign App roles 1

Display name	Description	Allowed member ty...	Value
System_Admin	System_Admin	Users/Groups,Applicat...	Syste

Assigning app roles ✕

App roles for Users/Groups

Assign app roles with 'User' allowed member types in **Enterprise** applications or in Microsoft Graph APIs.

[Learn more about how to assign App roles for Users/Groups](#)

App roles for applications

Assign app roles with 'Applications' allowed member types in API permissions blade.

Properties

UF Name ⓘ Copy to clipboard
UFM-APP

Application ID ⓘ
0d5e6cda-9144-47a2-b685-...

Object ID ⓘ
dd2a68d5-a3e0-45e3-9c1c-...

Getting Started

3

 **1. Assign users and groups**
Provide specific users and groups access to the applications
[Assign users and groups](#)

 **2. Provision User Accounts**
You'll need to create user accounts in the application
[Learn more](#)

 **3. Self service**
Enable users to request access to the application using their Azure AD credentials
[Get started](#)

+ Add user/group 4 Edit assignment Remove Update credentials | Columns | Got feedback?

i The application will not appear for assigned users within My Apps. Set 'visible to users?' to yes in properties to enable this. →

Assign users and groups to app-roles for your application here. To create new app-roles for this application, use the [application registration](#).

First 200 shown, to search all users & gro...

Display Name	Object Type	Role assigned
No application assignments found		

Add Assignment ...

NVIDIA Corporation

Users and groups

1 user selected.

Select a role *

System_Admin

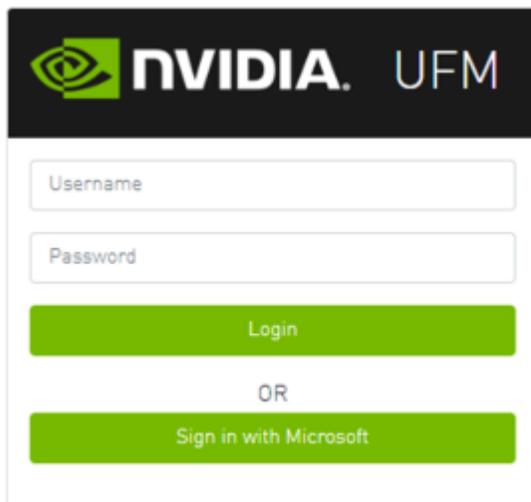
9. Click on "**Overview**" in the side menu to view the application information, such as tenant ID, client ID, and other details.

Enable Azure Authentication From UFM

Azure authentication is disabled by default. To enable it, please refer to [Enabling Azure AD Authentication](#).

Azure Authentication Login Page

After enabling and configuring Azure AD authentication, an additional button will appear on the primary UFM login page labeled 'Sign In with Microsoft,' which will lead to the main Microsoft sign-in page:



The screenshot shows the NVIDIA UFM login interface. At the top, there is a black header with the NVIDIA logo and the text 'NVIDIA. UFM'. Below the header, there are two input fields: 'Username' and 'Password'. A green 'Login' button is positioned below the password field. Below the 'Login' button, the word 'OR' is centered. At the bottom, there is a green button labeled 'Sign in with Microsoft'.

Kerberos Authentication

Kerberos is a network authentication protocol designed to provide strong authentication for client-server applications by using secret-key cryptography.

The Kerberos protocol works on the basis of tickets, it helps ensure that communication between various entities in a network is secure. It uses symmetric-key cryptography, which means both the client and servers share secret keys for encrypting and decrypting communication.

To enable Kerberos Authentication, refer to [Enabling Kerberos Authentication](#).

Setting Up Kerberos Server Machine

To set up a system as a Kerberos server, perform the following:

1. Install the required packages:

```
#Redhat
sudo yum install krb5-libs krb5-server
# Ubuntu
sudo apt-get install krb5-kdc krb5-admin-server
```

2. Edit the Kerberos configuration file `/etc/krb5.conf` to reflect your realm, domain and other settings:

```
[libdefaults]
    default_realm = YOUR-REALM

[realms]
    YOUR-REALM = {
        kdc = your-kdc-server
        admin_server = your-admin-server
    }
```

```
[domain_realm]
    your-domain = YOUR-REALM
    your-domain = YOUR-REALM
```

3. Use the `kdb5_util` command to create the Kerberos database:

```
kdb5_util create -r YOUR-REALM -s
```

4. Add administrative principals:

```
Kadmin.local addprinc -randkey HTTP/YOUR-HOST-NAME@YOUR-
REALM
```

5. Start KDC and Kadmin services:

```
sudo systemctl start krb5kdc kadmin
sudo systemctl enable krb5kdc kadmin
```

6. Generate a keytab file. The keytab file contains the secret key for a principal and is used to authenticate the service.

```
kadmin.local ktadd -k /path/to/your-keytab-file HTTP/YOUR-
HOST-NAME@YOUR-REALM
```

Replace `/path/to/your-keytab-file` with the actual path where you want to store the keytab file.

Setting Up Kerberos Client Machine

Follow the below steps to set up a system as a Kerberos client.

1. Install the required packages. When installing the UFM, the following packages will be installed as dependencies:

```
#Redhat
krb5-libs krb5-workstation mod_auth_gssapi
# Ubuntu
krb5-config krb5-user libapache2-mod-auth-gssapi
```

2. Configure the `/etc/krb5.conf` file to reflect your realm, domain, local names map and other settings:

```
[libdefaults]
    default_realm = YOUR-REALM

[realms]
    YOUR-REALM = {
        kdc = your-kdc-server
        admin_server = your-admin-server
        auth_to_local_names = {
            your-principle-name = your-local-user
        }
    }

[domain_realm]
    your-domain = YOUR-REALM
    your-domain = YOUR-REALM
```

3. Copy the keytab file from the Kerberos server to the machine where your service runs (the client). It is important to ensure that it is kept confidential.

Please ensure that the keytab file exists and that Apache has the necessary read permissions to access the keytab file; otherwise, Kerberos authentication will not function properly.

4. Obtain a Kerberos ticket-granting ticket (TGT):

```
kinit -k -t /path/to/your-keytab-file HTTP/YOUR-HOST-NAME@YOUR-REALM
```

5. Enable Kerberos Authentication from UFM. Kerberos authentication is disabled by default. To enable it, please refer to [Enabling Kerberos Authentication](#).

6. Test the Kerberos Authentication. You can use curl to test whether the user can authenticate to UFM REST APIs using Kerberos.

```
curl --negotiate -i -u : -k 'https://ufmc-eos01/ufmRestKrb/app/tokens'
```

Licensing

UFM license is subscription-based featuring the following subscription options:

- 1-year subscription
- 3-year subscription
- 5-year subscription
- Evaluation 30-day trial license

Note

UFM will continue to support old license types, but they are no longer available to obtain.

2 months before the expiration of your subscription license, UFM will warn you that your license will expire soon. After the subscription expires, UFM will continue to work with the expired license for two months beyond its expiration.

During this extra two-month period, UFM will generate a critical alarm indicating that the UFM license has expired and that you need to renew your subscription. Failing to do so within that 2-month period activates UFM Limited Mode. Limited mode blocks all REST APIs and access to the UFM web UI.

UFM enables functionality based on the license that was purchased and installed. This license determines the functionality and the maximum allowed number of nodes in the fabric.

To renew your UFM subscription, purchase a new license and install the new license file by downloading the license file to a temp directory on the UFM master server and then copying the license file to `/opt/ufm/files/licenses/` directory.

Note

UFM may not detect new license files if downloaded directly to `/opt/ufm/files/licenses`. If UFM does not detect the new license file, a UFM restart may be required.

If several licenses are installed on the server (more than one license file exists under `/opt/ufm/files/licenses/`), UFM uses only the strongest license and takes into consideration the expiration date, and the managed device limits on it, regardless of any other licenses that may exist on the server.

Showing UFM Processes Status

This functionality allows users to view the current status of main processes handled by the UFM.

- To view the main UFM processes, run the script `show_ufm_status.sh` under the `/opt/ufm/scripts` . Example: `/opt/ufm/scripts/show_ufm_status.sh`
- To view the UFM main and child processes, run the script `show_ufm_status.sh` with `-e` (extended_processes).

Example: `/opt/ufm/scripts/show_ufm_status.sh -e`

```
[root@r-ufm77 gvvm_github]# /opt/ufm/scripts/show_ufm_status.sh
=====
                        UFM Main Processes
=====
ModelMain      Process is : [ Running ]
Opensm         Process is : [ Running ]
SHARP          Process is : [ Running ]
Unhealthy Ports Process is : [ Running ]
Daily Report   Process is : [ Running ]
UFM Health     Process is : [ Running ]
UFM Telemetry  Process is : [ Running ]

-----

[root@r-ufm77 gvvm_github]# /opt/ufm/scripts/show_ufm_status.sh -e
=====
                        UFM Main Processes
=====
ModelMain      Process is : [ Running ]
Opensm         Process is : [ Running ]
SHARP          Process is : [ Running ]
Unhealthy Ports Process is : [ Running ]
Daily Report   Process is : [ Running ]
UFM Health     Process is : [ Running ]
UFM Telemetry  Process is : [ Running ]

-----

                        UFM ModelMain Child Processes
=====
SMClientConsumer Process is : [ Running ]
SMTrapHandler    Process is : [ Running ]
SysinfoJsonAgent Process is : [ Running ]
Telemetry Agent  Process is : [ Running ]
Telemetry History Process is : [ Running ]
```

Upgrading UFM Software

After UFM installation, UFM detects existing UFM versions previously installed on the machine and prompts you to run a clean install of the new version or to upgrade. We recommend backing up the UFM configuration before upgrading the UFM as specified in the section UFM Database and Configuration File Backup.

Info

Upgrading the UFM Enterprise software version is supported up to two previous GA software versions (GA -1 or GA -2).

For example, if you wish to upgrade to UFM Enterprise v6.11.0, it is possible to do so only from UFM Enterprise v6.9.0 or v6.10.0.

- [Upgrading UFM on Bare Metal Server](#)
- [Upgrading UFM on Docker Container](#)

Upgrading UFM on Bare Metal Server

Upgrading UFM on Bare Metal - Standalone Server Upgrade

You can upgrade the UFM standalone server software for InfiniBand from the previous UFM version.

To upgrade the UFM server software:

1. Create a temporary directory (for example */tmp/ufm*).
2. Open the UFM software zip file that you downloaded. The zip file contains the following installation files for:
 - RedHat 7/CentOS 7/OEL 7: `ufm-X.X -XXX.el7.x86_64.tgz`
 - RedHat 8/CentOS 8/OEL 8: `ufm-X.X -XXX.el8.x86_64.tgz`
 - Ubuntu 18.04: `ufm-X.X -XXX.ubuntu18.x86_64.tgz`
 - Ubuntu 20.04: `ufm-X.X -XXX.ubuntu20.x86_64.tgz`
 - Ubuntu 22.04: `ufm-X.X-XXX.ubuntu22.x86_64.tgz`
3. Extract the installation file for your system's OS to the temporary directory that you created.
4. Stop the UFM server. Run:

```
systemctl stop ufm-enterprise
```

5. From within the temporary directory, run the following command as root:

```
./upgrade.sh
```

(i) Note

A configuration backup ZIP file will be created in the running directory (e.g. /tmp/ufm). The backup file name is ufm_X.X.X_bkp.zip (X.X.X is the previous version).

1. Upgrade from the previous version: the existing UFM data and configuration are preserved.
2. In case upgrade.sh script stops before completion (e.g. missing prerequisite), the upgrade procedure can be resumed by fixing the issue (e.g. installing missing prerequisite) and rerunning ./upgrade.sh again.

6. Restart the UFM server. Run:

```
systemctl start ufm-enterprise.service
```

(i) Note

/etc/init.d/ufmd start - Available for backward compatibility.

7. After the upgrade, remove the temporary directory

Upgrading UFM on Bare Metal - High Availability Upgrade

i Note

As of UFM version 6.14.0, UFM upgrade on HA supports in-service upgrade, meaning UFM can continue running during the steps of the upgrade, and there is no need to stop UFM before the upgrade (although this is also supported).

You can upgrade the UFM server HA software for InfiniBand from the previous release. The upgrade is performed on both servers.

To upgrade the UFM server software:

Upgrading the UFM Enterprise Package

1. On the standby server, extract the new UFM Enterprise package to the /tmp folder:

```
tar -xzf ufm-X.X.X-XXXXX.tgz -C /tmp
```

2. On the standby server, enter to the installation folder and upgrade script:

```
standby# cd /tmp/ ufm-X.X.X-X.<OS_NAME>.x86_64.mofed5/
```

3. Run the UFM upgrade script on the standby server:

```
./upgrade.sh
```

4. After the completion of the upgrade script, the UFM code will undergo an upgrade, while the UFM data will remain unchanged. The automatic upgrade of UFM data will take place during the next startup of UFM. To initiate this process, execute a failover from the Master node (or perform a takeover from the Standby node).

```
master# ufm_ha_cluster failover
```

Note

UFM will log the data upgrade to the syslog of the server, in case of issue a backup of the UFM data is saved prior to the upgrade in /opt/ufm/BACKUP directory and can be restored. For more information, refer to [Appendix – Restoring UFM Data](#).

5. Once UFM is operational on the upgraded node (formerly the standby node), proceed to replicate steps 1 to 3 on the non-upgraded node (previously the master node).

Upgrading the UFM HA Package

1. On **both servers**, download latest UFM-HA package:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.tgz
```

For sha256:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.sha256
```

2. On **both servers**, extract the HA package under `/tmp/` and enter the new directory
3. On the UFM **Standby server**, run the upgrade command from within the extracted HA package located in `/tmp/`:

```
./install.sh --upgrade
```

4. On the UFM **Master server**, run the upgrade command from within the extracted HA package located in `/tmp`:

```
./install.sh --upgrade
```

5. Run the following command to verify that the UFM HA cluster is up and running:

```
ufm_ha_cluster status
```

Upgrading UFM on Docker Container

Note

Upgrade the UFM container based on the existing UFM configuration files that are mounted on the server. It is important to use that same directory as a volume for the UFM installation command.

In the below example `/opt/ufm_files` is used.

Upgrading UFM on Docker Container in Standalone Mode

1. Stop the UFM Enterprise service. Run:

```
systemctl stop ufm-enterprise
```

2. Remove the existing docker image. Run:

```
docker rmi mellanox/ufm-enterprise:latest
```

3. Load the new UFM Enterprise docker image. Run:

```
docker pull mellanox/ufm-enterprise:latest
```

4. Run the docker upgrade command:

```
docker run -it --name=ufm_installer --rm \  
-v /var/run/docker.sock:/var/run/docker.sock \  
-v /etc/systemd/system:/etc/systemd_files/ \  
-v /opt/ufm/files:/opt/ufm/shared_config_files/ \  
mellanox/ufm-enterprise:latest --upgrade
```

5. Reload system manager configuration:

```
systemctl daemon-reload
```

6. Start UFM Enterprise service:

```
systemctl start ufm-enterprise
```

Upgrading UFM Container in High Availability Mode

Note

As of UFM version 6.14.0, UFM upgrade on HA supports in-service upgrade, meaning UFM can continue running during the steps of the upgrade, and there is no need to stop UFM before the upgrade (although this is also supported).

Upgrading the UFM Enterprise Package

1. Remove the old docker image from the **Standby** server. Run:

```
Stand-by# docker rmi mellanox/ufm-enterprise:latest
```

2. Pull the new UFM Enterprise docker image on the **Standby** server. Run:

```
docker pull mellanox/ufm-enterprise:latest
```

Note

At this stage, the UFM container has been updated with the latest code. The UFM data, however, will be updated during the next UFM run.

3. Perform a failover to start UFM on the upgraded node. On the **Master** node, run:

```
ufm_ha_cluster failover
```

Note

When UFM starts, it will automatically update the UFM configuration.

4. Repeat steps 1-2 on the un-upgraded node (previous **Master** node).

Upgrading the UFM HA Package

1. On **both servers**, download and extract the latest UFM HA package. Run:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.tgz
```

For sha256:

```
wget https://www.mellanox.com/downloads/ufm/ufm_ha/5.8.0/ufm_ha_5.8.0-4.sha256
```

2. On both the **Master** and **Standby** servers, execute the upgrade command from within the extracted HA package. Ensure you run it first on the **Standby** server, then on the **Master** server:

```
./install.sh --upgrade
```

3. Run the following command to verify that the UFM HA cluster is up and running:

```
ufm_ha_cluster status
```

Uninstalling UFM

The UFM Server can be uninstalled by running an uninstall script in the different server modes:

- [Uninstalling UFM in Standalone Mode](#)
- [Uninstalling UFM in High Availability](#)
- [Uninstalling UFM in Docker Deployment](#)

Uninstalling UFM in Standalone Mode

To uninstall the UFM Server:

1. Go to `/opt/ufm`.
2. Run `./uninstall.sh`.

Note

Child interfaces are not deleted.

3. To delete primary interfaces, restart `/etc/init.d/openibd`.

Uninstalling UFM in High Availability

To uninstall the UFM Server in high availability mode:

1. Run the following on the master and slave to clean up the UFM HA configuration:

```
ufm_ha_cluser cleanup
```

2. To uninstall the UFM HA configuration, run:

```
/opt/ufm/ufm_ha/uninstall_ha.sh
```

3. To uninstall UFM Enterprise software, run the following on the master and slave:

```
/opt/ufm/uninstall.sh
```

Uninstalling UFM in Docker Deployment

To uninstall the UFM Server in high availability mode:

1. Run the following on the master and slave:

```
ufm_ha_cluser cleanup
```

2. Run:

```
/opt/ufm/ufm_ha/uninstall_ha.sh
```

3. Run the following on the master and slave:

```
/opt/ufm/files/uninstall.sh
```

UFM Configuration Backup and Restore

Overview

UFM migration enables backup and restores UFM configuration files.

Backup UFM configuration

By default, the following folders (placed in `/opt/ufm/files`) are being backed up:

- conf
- dashboardViews
- licenses
- networkViews
- scripts
- sqlite
- templates/user-defined
- ufmhealth/scripts
- userdata
- users_preferences

Note

The user may also backup the UFM historical telemetry data ("-t" argument).

UFM (Bare Metal)

```
/opt/ufm/scripts/ufm_backup.sh --help
usage: ufm_backup.pyc [-h] [-f BACKUP_FILE] [-t]
```

Optional Arguments

-h	--help	show this help message and exit
-f	--backup-file BACKUP_FILE	full path of zip file to be generated

```
-t
```

```
--telemetry
```

```
backup UFM historical telemetry
```

UFM Docker Container

1. Backup UFM configuration. Run:

```
docker exec ufm /opt/ufm/scripts/ufm_backup.sh
```

2. Copy the backup file from UFM docker container to the host. Run:

```
docker cp ufm:/root/<backup file> <path on host>
```

UFM Appliance

1. Backup UFM configuration. Run:

```
ufm data backup [with-telemetry]
```

2. Upload the backup file to a remote host. Run:

```
ufm data upload <backup file> <upload URL>
```

Note

More details can be found in the log file `/tmp/ufm_backup.log`.

Restore UFM Configuration

Note

All folders which are a part of the UFM backup are restored (filter is done during the backup stage).

UFM Bare Metal

```
/opt/ufm/scripts/ufm_restore.sh --help  
usage: ufm_restore.pyc [-h] -f BACKUP_FILE [-u] [-v]
```

Optional Arguments

-h	--help	show this help message and exit
-f BACKUP_FILE	--backup-file BACKUP_FILE	full path of zip file generated by backup script
-u	--upgrade	upgrades the restored UFM files
-v	--verbose	makes the operation more talkative

UFM Docker Container

1. Stop UFM. Run:

```
docker exec ufm /etc/init.d/ufmd stop
```

2. Copy the backup file from the host into UFM docker container. Run:

```
docker cp <backup file> ufm:/tmp/<backup file>
```

3. Restore UFM configuration. Run:

```
docker exec ufm /opt/ufm/scripts/ufm_restore.sh -f  
/tmp/<backup file> [--upgrade]
```

4. Start UFM. Run:

```
docker exec ufm /etc/init.d/ufmd start
```

UFM Appliance

1. Stop UFM. Run:

```
no ufm start
```

2. Copy the backup file from a remote host into UFM appliance. Run:

```
ufm data fetch <download URL>
```

3. Restore UFM configuration. Run:

```
ufm data restore <backup file>
```

4. Start UFM. Run:

```
ufm start
```

Note

When restoring the UFM configuration from host to a container, the following parameters in `/opt/ufm/files/conf/gv.cfg` may be reset the following:

- fabric_interface
- ufma_interfaces
- mgmt_interface

Note

UFM configuration upgrade during restore is not supported in UFM Appliance GEN2/GEN2.5

More details can be found in the log files `/tmp/ufm_restore.log` and `/tmp/ufm_restore_upgrade.log`

UFM Factory Reset

This section provides a comprehensive guide on resetting UFM to its original factory settings.

Note

WARNING!!! this operation will remove all user data and configuration and will restore UFM to its factory defaults.

Note

The UFM Factory-Reset will exclusively revert UFM to its original factory settings, leaving HA configurations unaffected. To remove HA, it is essential to execute `ufm_ha_cluster cleanup` before initiating the factory reset.

UFM Docker Container Factory Reset

To reset UFM to its factory defaults when using UFM on a Docker container, follow these steps.

1. Ensure that UFM is not up and running. If UFM is running, stop it.

For Stand-alone (SA) installations:

```
systemctl stop ufm-enterprise
# validate that ufm is not running
systemctl status ufm-enterprise
```

For High-Availability setups (perform the following on the master node only):

```
ufm_ha_cluster stop
# validate that ufm is not running
ufm_ha_cluster status
```

2. Run `mellanox/ufm-enterprise` Docker Container with the following flags:

Note

WARNING: This operation will erase all user data and configurations, resetting UFM to its factory defaults.

CAUTION: This step does not require user confirmation, meaning UFM will be restored to factory defaults immediately once initiated.

```
docker run -it --name=ufm_installer --rm \
    -v /var/run/docker.sock:/var/run/docker.sock \
    -v /tmp:/tmp \
    -v /opt/ufm/files:/opt/ufm/shared_config_files/ \
    mellanox/ufm-enterprise:latest \
    --factory-reset
```

Flag	Type	Description
<code>--name=ufm_installer</code>	Mandatory	The container name must be called <code>ufm_installer</code> .

Flag	Type	Description
<code>-v /var/run/docker.sock:/var/run/docker.sock</code>	Mandatory	The docker socket must be mounted on the docker container.
<code>-v /tmp:/tmp</code>	Optional	Logs of the operation can be viewed in <code>/tmp</code> on the host in case it is mounted.
<code>-v /opt/ufm/files:/opt/ufm/shared_config_ufm/</code>	Mandatory	For the factory reset to persist, it is essential to have the <code>/opt/ufm/files</code> directory mounted from the host.
<code>mellanox/ufm-enterprise:latest</code>	Mandatory	The docker image name.
<code>--factory-reset</code>	Mandatory	This action will signal the UFM container to initiate the factory reset process.

UFM Enterprise Factory Reset

To restore UFM Enterprise to factory defaults:

1. Ensure that UFM is not up and running. If UFM is running, stop it.

For Stand-alone (SA) installations:

```
systemctl stop ufm-enterprise
# validate that ufm is not running
systemctl status ufm-enterprise
```

For High-Availability setups (perform the following on the master node only):

```
ufm_ha_cluster stop
# validate that ufm is not running
ufm_ha_cluster status
```

2. Run the `ufm_factory_reset.sh` script:

Note

WARNING: This operation will erase all user data and configurations, resetting UFM to its factory defaults.

```
/opt/ufm/scripts/ufm_factory_reset.sh [-y]
```

Flag:

Flag	Type	Description
<code>-y</code>	Optional	Does not require user confirmation.

Manage Users

Accounts and Roles

Each UFM user can be assigned to one of the following four roles:

- **System Admin** – users can perform all operations including managing other users accounts.
- **Fabric Admin** – users can perform fabric administrator actions such as update SM configuration, update global credentials, manage reports, managing unhealthy ports, and manage PKeys, etc.
- **Fabric Operator** – users can perform fabric operator actions such as device management actions (enable/disable port, add/remove devices to/from groups, reboot device, upgrade software, etc.)
- **Monitoring Only** – users can perform monitoring actions such as view the fabric configuration, open monitoring sessions, define monitoring templates, and export monitoring data to CSV files, etc.

User Account Management

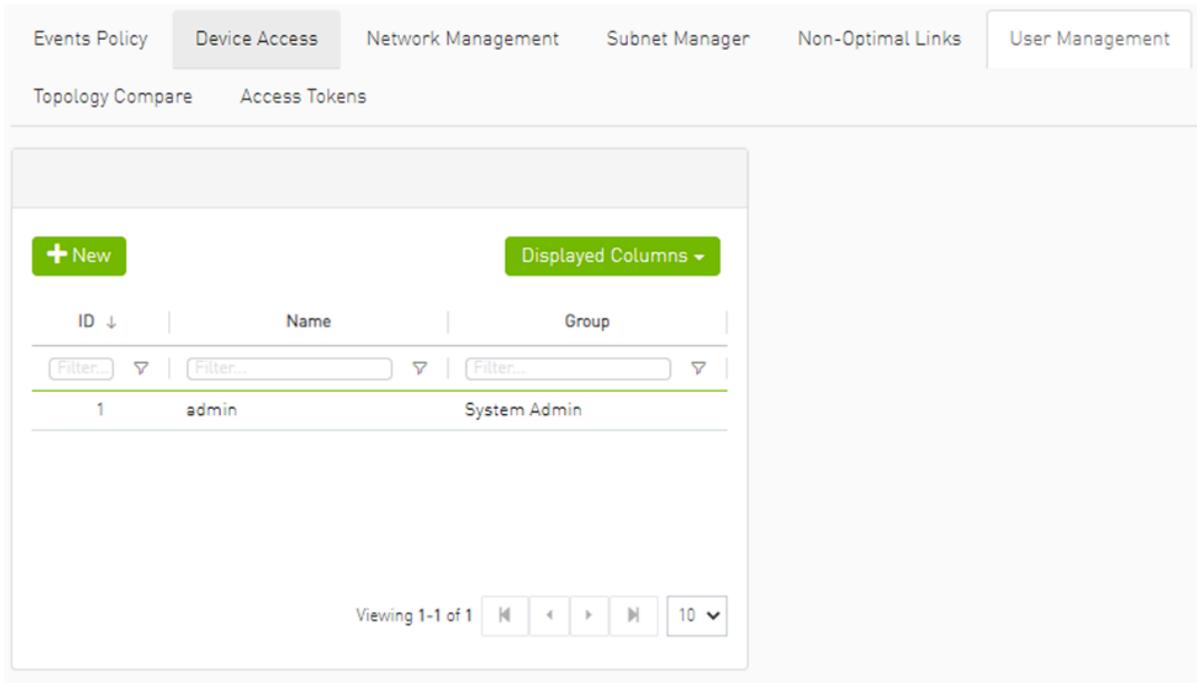
By default and upon every UFM deployment, the **admin** user (System Admin) is generated to allow initial access to the UFM.

A user with system Administration rights can manage other users' accounts, including the creation, deletion, and modification of accounts.

To edit existing user accounts, right-click the account from the list of user accounts and perform the desired action (Change Password/Remove).

Add New User

1. Click the “New” button.



2. Fill in the required fields in the dialog box.

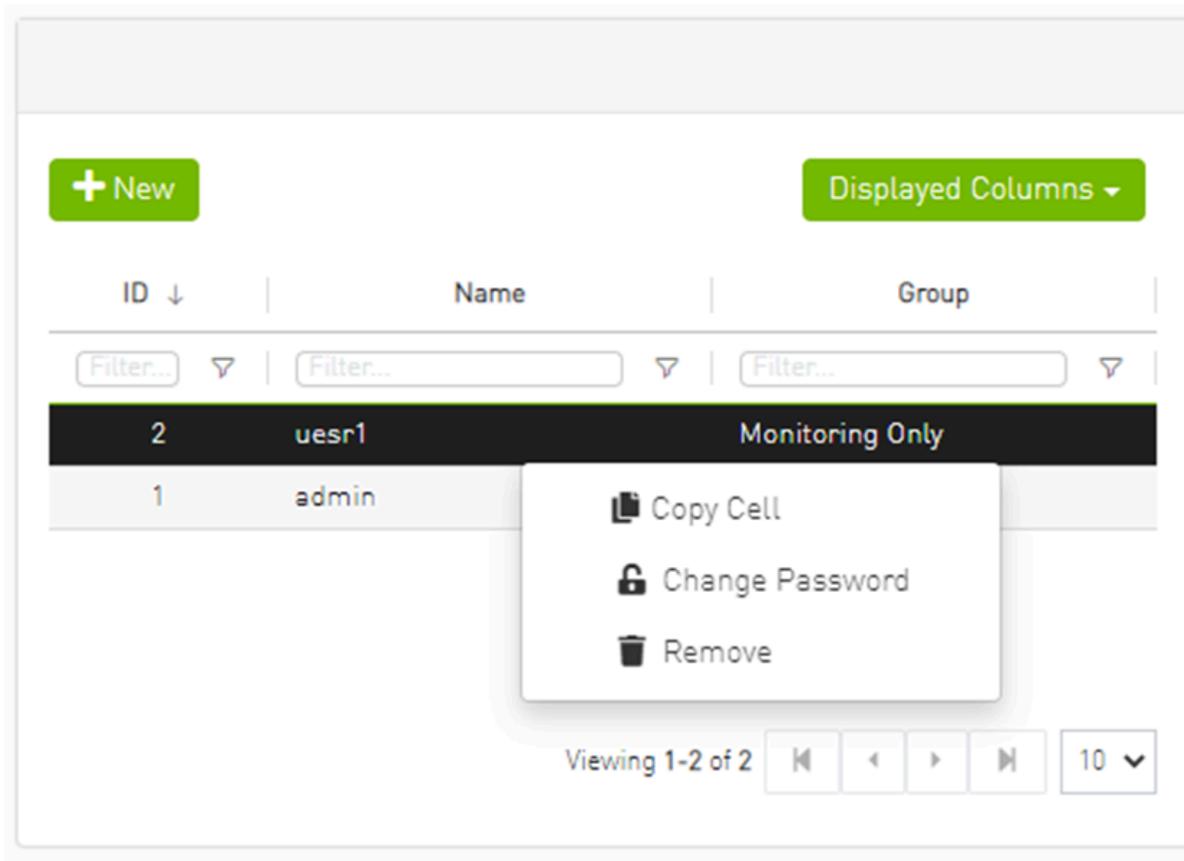
The 'Create A User' dialog box contains the following fields:

- User Name:
- Group:
- Password:
- Confirm Password:

A green 'Create' button is located at the bottom right of the dialog.

Edit/Remove Existing User

Right-click the account from the list of user accounts and perform the desired action (Change Password/Remove).



Authentication Methods

UFM User Authentication is based on standard Apache User Authentication or Internal UFM Authentication Server.

Each Web Service client application must authenticate against the UFM server to gain access to the system.

The available authentication methods supported by UFM are as follows:

Authentication Method	Description	UFM Related Prefix	REST API Reference
Basic Authentication	Based on user and password, provided by the client. This method is enabled by default.	/ufmRest	Basic Authentication

Authentication Method	Description	UFM Related Prefix	REST API Reference
Session-Based Authentication	A stateful authentication technique where sessions are used to keep track of the authenticated user. This method is enabled by default and is used by the UFM WebUI.	/ufmRestV2	Session-Based Authentication
Client-Based Authentication	Refers to an end user's device proving its own identity by providing a digital certificate that can be verified by a server in order to gain access to UFM resources	/ufmRest	Client-Based Authentication
Token-Based Authentication	Token-based authentication is a protocol which allows users to verify their identity, and in return receive a unique access token. To use UFM, the user should create a token using UFM Web UI or UFM REST API	/ufmRestV3	Token-Based Authentication
Proxy Authentication	Proxy authentication delegates the user authentication to a remote Proxy server.	/ufmRestV2 or /ufmRestV3	N/A

Authentication Method	Description	UFM Related Prefix	REST API Reference
<u>Azure AD Authentication</u>	Microsoft Azure Authentication is a service provided by Microsoft Azure, the cloud computing platform of Microsoft. It is designed to provide secure access control and authentication for applications and services hosted on Azure.	/ufmRestV2	N/A
<u>Kerberos Authentication</u>	Kerberos is a protocol designed to authenticate service requests between trusted hosts over an untrusted network	/ufmRestKrb	N/A

There are two optional services which can provide authentication handling of UFM.

1. Apache Web Server (used by default) - Standard Apache web server and supports the above-mentioned authentication methods.
2. UFM Authentication Server - a centralized HTTP server, is responsible for managing various authentication methods supported by UFM.

Client Based Authentication

The management port of the UFM is connected to a secure zone within the customer data center. All communications between any user or service and the UFM must remain encrypted, authenticated, and authorized according to user's security standards.

This option allows the user to set/configure required certificates within UFM server for supporting client-based authentication.

Associating Client Certificate Common Name (CN) with UFM User

It is necessary to associate the Common Name (CN) of a client certificate with a specific UFM user. UFM will internally store the CN and link it to the corresponding user.

Once Apache validates the client certificate's chain, UFM will extract the CN from the certificate and compare it against the stored value. If the CN does not match, the request will be denied. If the CN matches, the request will be authorized, and the system will treat it as though the associated user had logged in directly.

Integrating User Identity into UFM

The user component, also referred to as the "Agent," operates locally on both the UFM master and standby nodes. The Agent's role is to transfer valid certificates into a local folder on the host (which is mapped to the UFM container) and to trigger a local UFM script to restart Apache once the certificates have been updated.

Configuration

To configure UFM with client certificate authentication using locally refreshed certificates, follow these steps:

1. **Install the UFM container with the `--local-certs-dir` flag, which maps a local host directory to the UFM container.**

TBD: add an example of the Docker install

Note

Steps 2-6 should be performed once UFM container is running.

2. **Run the UFM service. Run:**

```
systemctl start ufm-enterprise
```

3. **Enter the UFM container.** Run:

```
docker exec -it ufm /bin/bash
```

4. **Enable client certificate authentication.** Run:

```
/opt/ufm/scripts/manage_client_authentication.sh enable-client-cert-authen
```

5. **Set the client certificate subject identifier to CN.** Run:

```
/opt/ufm/scripts/manage_client_authentication.sh set-subject-identifier --identifier CN
```

6. **Associate a client certificate CN with a UFM user.** Run:

```
/opt/ufm/scripts/manage_client_authentication.sh associate-user --cn <CN> --username <UFM user>
```

7. **Set the SSL server certificate hostname.** Run:

```
/opt/ufm/scripts/manage_client_authentication.sh set-ssl-cert-hostname --hostname <hostname>
```

8. Restart Apache once the certificates have been refreshed.

Note

Note: This command should be embedded in the "Agent" and can be invoked after the certificates have been refreshed and UFM container is running. Run:

```
docker exec ufm
/opt/ufm/scripts/manage_client_authentication.sh
restart_ufm_websrv
```

UFM Authentication Server

Configurations of the UFM Authentication Server

The UFM Authentication Server is designed to be configurable and is initially turned on by default.

Enabling the UFM Authentication Server provides a centralized service that oversees all supported authentication methods within a single service, consolidating them under a unified authentication API.

Apache utilizes the authentication server's APIs to determine a user's authentication status.

All activities of the UFM Authentication Server are logged in the `authentication_service.log` file, located at `/opt/ufm/files/log`.

To enable/disable the UFM Authentication Server, refer to .

Token-Based Authentication

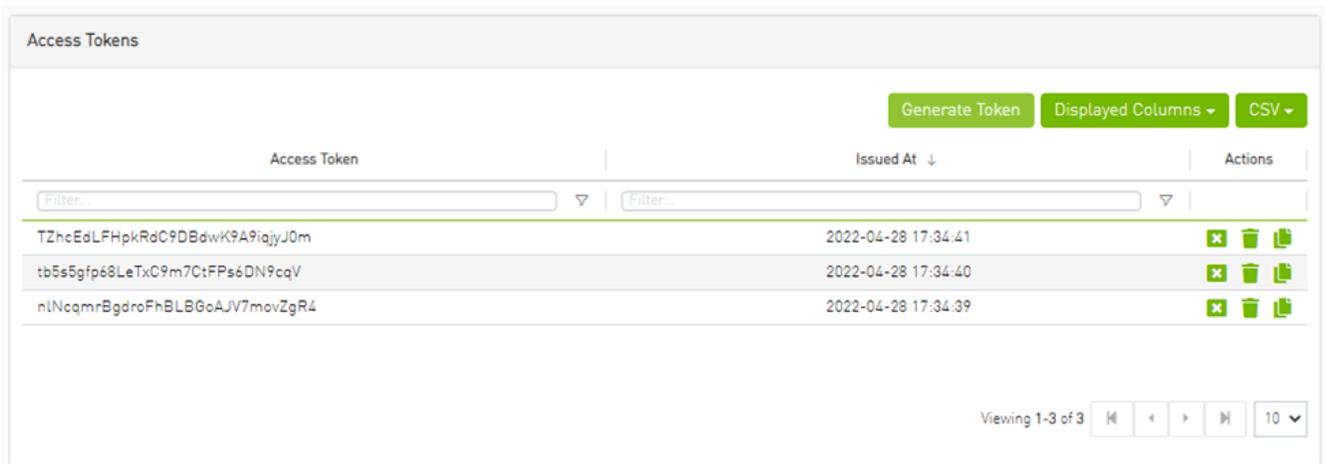
Token-based authentication is a protocol which allows users to verify their identity, and in return receive a unique access token. During the life of the token, users then access the

UFM APIs that the token has been issued for, rather than having to re-enter credentials each time they need to use any UFM API.

Note

Under the Settings section there is a tab titled called “Access Tokens”.

The functionality of the added tab is to give the user the ability to create new tokens & manage the existing ones (list, copy, revoke, delete):



Actions:

Name	Icon	Description
Revoke		<p>Revoke a specific token.</p> <p>Note The revoked token will no longer be valid.</p>
Delete		Delete a specific token.

Name	Icon	Description
Copy		Copy specific token into the clipboard.

Note

Each user is able to list and manage only the tokens that have been created by themselves. Only the users with `system_admin` role will be able to create tokens.

Proxy Authentication

Delegating Authentication to a Proxy

To allow a custom user authentication, you can configure UFM to delegate the user authentication to a remote Proxy server. The remote Proxy server is written by the user, thus, allowing flexibility on deciding how the authentication is performed.

By default, the feature is disabled. To activate the feature, configure `auth_proxy_enabled` with `true`.

In case server authentication is enabled, use `/ufmRestV2`, otherwise, use `/ufmRestV3` to send requests to UFM.

The request header should contain a username and role. The available roles are `System_Admin`, `Fabric_Admin`, `Fabric_Operator`, and `Monitoring_Only`. If the request header is sent without a username or a role, it is rejected by the UFM.

For example:

```
[AuthProxy]
# Defaults to false, but set to true to enable this feature
auth_proxy_enabled = true
```

```

# HTTP Header name that will contain the username
auth_proxy_header_name = X_WEBAUTH_USER
# HTTP Header name that will contain the user roles. The
available roles are as follows: System_Admin, Fabric_Admin,
Fabric_Operator, and Monitoring_Only
auth_proxy_header_role = X_WEBAUTH_ROLE

# Set to `true` to enable auto sign up of users who do not exist in
UFM DB. Defaults to `true`.
auth_proxy_auto_sign_up = true
# Limit where auth proxy requests come from by configuring a list
of IP addresses.
# This can be used to prevent users spoofing the X_WEBAUTH_USER
header.
# This option is required
# Example `whitelist = 192.168.1.1, 192.168.1.0/24, 2001::23, 2001::0/120`
auth_proxy_whitelist =
# Define a list of allowed Common Names (CNs) for mTLS on
authentication proxy requests.
# Only clients with certificates that contain CN values from this
list are allowed to act as an authentication proxy.
# Example: `auth_proxy_cn_whitelist = user1, service1, client-
cert`.
auth_proxy_cn_whitelist =

```

Parameter	Default	Description
auth_proxy_enabled	false	Enables authentication by proxy
auth_proxy_header_name	X_WEBAUTH_USER	The HTTP header that contains the UFM username, to be supplied by the proxy.
auth_proxy_header_role	X_WEBAUTH_ROLE	The HTTP header that will include the UFM role. The available predefined roles are:

Parameter	Default	Description
		<ul style="list-style-type: none"> System_Admin Fabric_Admin Fabric_Operator Monitoring_Only
auth_proxy_auto_signup	True	Allows automatic signup of users who are not yet present in UFM.
auth_proxy_whitelist	N/A	<p>Restricts the source of authentication proxy requests by setting up a list of allowed IP addresses.</p> <p>This field is mandatory when the client certificate is disabled and optional when the client certificate is enabled.</p> <p>Example:</p> <pre>whitelist = 192.168.1.1, 192.168.1.0/24, 2001::23, 2001::0/120</pre>
auth_proxy_cn_whitelist	N/A	<p>Specifies a list of permitted Common Names (CNs) for mTLS in authentication proxy requests. Only clients with certificates containing CN values from this list are authorized to act as an authentication proxy.</p> <p>Example:</p> <pre>auth_proxy_cn_whitelist = user1, service1, client-cert</pre> <p>This field is mandatory when the client certificate is enabled, and the subject identifier of the client certificate is the Common Name (CN). For additional details, see Client-Based Authentication. To use this feature, the Authentication Server must be enabled. For more information, refer to Enabling UFM Authentication Server</p>

Azure AD Authentication

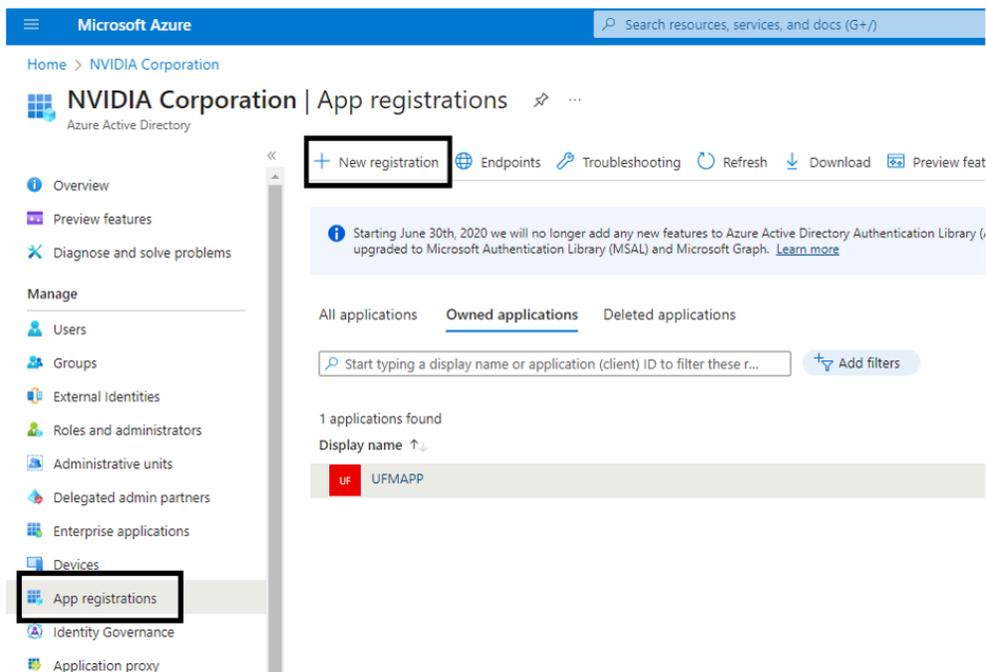
Microsoft Azure Authentication is a service provided by Microsoft Azure, the cloud computing platform of Microsoft. It is designed to provide secure access control and authentication for applications and services hosted on Azure.

UFM supports Authentication using Azure Active Directory, and to do so, you need to follow the following steps:

Register UFM in Azure AD Portal

To log in via Azure, UFM must be registered in the Azure portal using the following steps:

1. Log in to [Azure Portal](#), then click "**Azure Active Directory**" in the side menu.
2. If you have access to more than one tenant, select your account in the upper right. Set your session to the Azure AD tenant you wish to use.
3. Under "**Manage**" in the side menu, click App Registrations > New Registration.



4. Provide the application details:

1. **Name:** Enter a descriptive name.
2. **Supported account types:** Account types that are allowed to login and use the registered application.
3. **Redirect URL:** select the app type **Web**, and Add the following redirect URL <https://auth/login>

Register an application ...

* Name

The user-facing display name for this application (this can be changed later).

UFM_APP ✓

Supported account types

Who can use this application or access this API?

- Accounts in this organizational directory only (NVIDIA Corporation only - Single tenant)
- Accounts in any organizational directory (Any Azure AD directory - Multitenant)
- Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)
- Personal Microsoft accounts only

[Help me choose...](#)

Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web ✓ ✓

Register an app you're working on here. Integrate gallery apps and other apps from outside your organization by adding from [Enterprise applications](#).

By proceeding, you agree to the [Microsoft Platform Policies](#)

[Register](#)

Then, click **Register**. The app's **Overview** page opens.

5. Under **Manage** in the side menu, click **Certificates & Secrets** > New client secret.

Add a client secret



Description

UFM_APP_sec

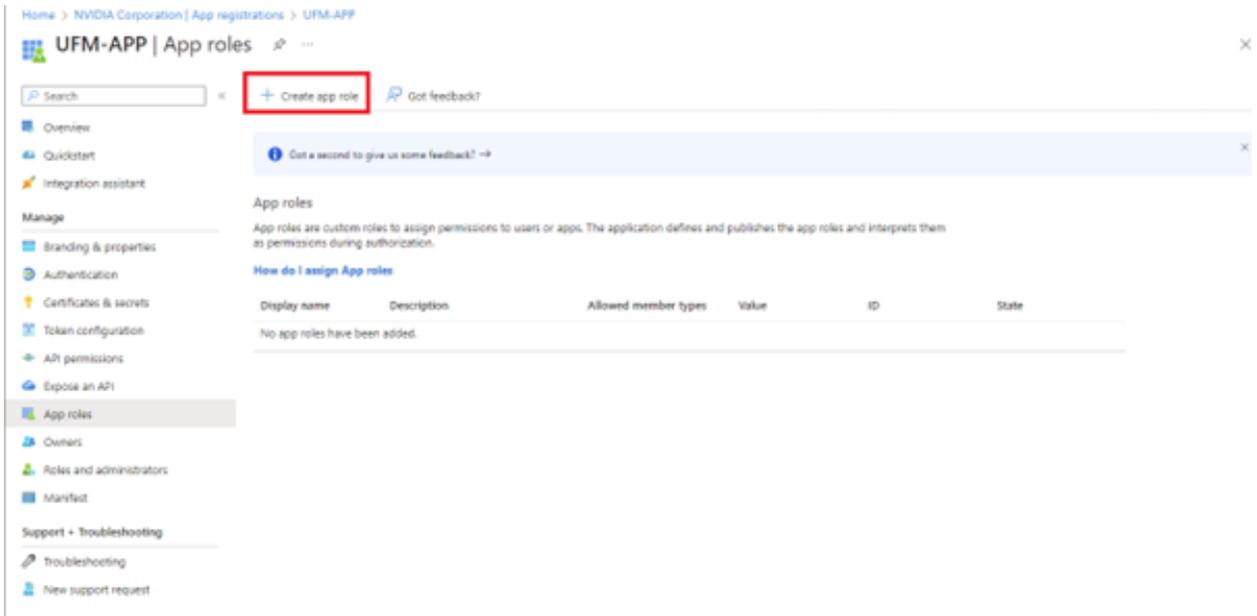
Expires

Recommended: 180 days (6 months) ✓

Provide a description for the client secret and set an expiration time, then click **"Add."**

6. Copy the client secret key value which will be needed to configure the UFM with Azure AD (Please note that the value of the generated secret will be hidden and will not be able to be copied/read after you leave the page.

Under **"Manage"** in the side menu, click App roles > Create app role.



7. Provide the role details. Please note that the role value must be a valid UFM role; otherwise, the login will fail.

Create app role ✕

Display name * ⓘ

System_Admin ✓

Allowed member types * ⓘ

Users/Groups
 Applications
 Both (Users/Groups + Applications)

Value * ⓘ

System_Admin ✓

Description * ⓘ

System_Admin

Do you want to enable this app role? ⓘ

8. Assign the created role to the user. Follow the below steps:

✦ ...

+ Create app role | 🗨️ Got feedback?

📘 Got a second to give us some feedback? →

App roles

App roles are custom roles to assign permissions to users or apps. The application determines the permissions during authorization.

How do I assign App roles 1

Display name	Description	Allowed member ty...	Value
System_Admin	System_Admin	Users/Groups,Applicat...	Syste

Assigning app roles ✕

App roles for Users/Groups

Assign app roles with 'User' allowed member types in **Enterprise** applications or in Microsoft Graph APIs. 2

[Learn more about how to assign App roles for Users/Groups](#)

App roles for applications

Assign app roles with 'Applications' allowed member types in API permissions blade.

Properties

UF Name ⓘ Copy to clipboard
UFM-APP

Application ID ⓘ
0d5e6cda-9144-47a2-b685-...

Object ID ⓘ
dd2a68d5-a3e0-45e3-9c1c-...

Getting Started

3

**1. Assign users and groups**
Provide specific users and groups access to the applications
[Assign users and groups](#)

**2. Provision User Accounts**
You'll need to create user accounts in the application
[Learn more](#)

**3. Self service**
Enable users to request access to the application using their Azure AD credentials
[Get started](#)

+ Add user/group 4 Edit assignment Remove Update credentials | Columns | Got feedback?

i The application will not appear for assigned users within My Apps. Set 'visible to users?' to yes in properties to enable this. →

Assign users and groups to app-roles for your application here. To create new app-roles for this application, use the [application registration](#).

First 200 shown, to search all users & gro...

Display Name	Object Type	Role assigned
No application assignments found		

Add Assignment

NVIDIA Corporation

Users and groups

1 user selected.

Select a role *

System_Admin

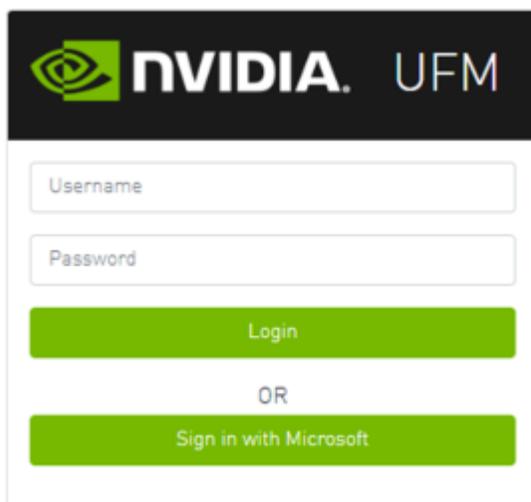
9. Click on "**Overview**" in the side menu to view the application information, such as tenant ID, client ID, and other details.

Enable Azure Authentication from UFM

Azure authentication is disabled by default. To enable it, please refer to [Enabling Azure AD Authentication](#).

Azure Authentication Login Page

After enabling and configuring Azure AD authentication, an additional button will appear on the primary UFM login page labeled 'Sign In with Microsoft,' which will lead to the main Microsoft sign-in page:



The screenshot shows the NVIDIA UFM login interface. At the top, there is a black header with the NVIDIA logo and the text 'NVIDIA. UFM'. Below the header, there are two input fields: 'Username' and 'Password'. A green 'Login' button is positioned below the password field. Below the 'Login' button, the word 'OR' is centered. At the bottom, there is a green button labeled 'Sign in with Microsoft'.

Kerberos Authentication

Kerberos is a network authentication protocol designed to provide strong authentication for client-server applications by using secret-key cryptography.

The Kerberos protocol works on the basis of tickets, it helps ensure that communication between various entities in a network is secure. It uses symmetric-key cryptography, which means both the client and servers share secret keys for encrypting and decrypting communication.

To enable Kerberos Authentication, refer to [Enabling Kerberos Authentication](#).

Setting Up Kerberos Server Machine

To set up a system as a Kerberos server, perform the following:

1. Install the required packages:

```
#Redhat
sudo yum install krb5-libs krb5-server
# Ubuntu
sudo apt-get install krb5-kdc krb5-admin-server
```

2. Edit the Kerberos configuration file `/etc/krb5.conf` to reflect your realm, domain and other settings:

```
[libdefaults]
    default_realm = YOUR-REALM

[realms]
    YOUR-REALM = {
        kdc = your-kdc-server
        admin_server = your-admin-server
    }
```

```
[domain_realm]
your-domain = YOUR-REALM
your-domain = YOUR-REALM
```

3. Use the `kdb5_util` command to create the Kerberos database:

```
kdb5_util create -r YOUR-REALM -s
```

4. Add administrative principals:

```
Kadmin.local addprinc -randkey HTTP/YOUR-HOST-NAME@YOUR-
REALM
```

5. Start KDC and Kadmin services:

```
sudo systemctl start krb5kdc kadmin
sudo systemctl enable krb5kdc kadmin
```

6. Generate a keytab file. The keytab file contains the secret key for a principal and is used to authenticate the service.

```
kadmin.local ktadd -k /path/to/your-keytab-file HTTP/YOUR-
HOST-NAME@YOUR-REALM
```

Replace `/path/to/your-keytab-file` with the actual path where you want to store the keytab file.

Setting Up Kerberos Client Machine

Follow the below steps to set up a system as a Kerberos client.

1. Install the required packages. When installing the UFM, the following packages will be installed as dependencies:

```
#Redhat
krb5-libs krb5-workstation mod_auth_gssapi
# Ubuntu
krb5-config krb5-user libapache2-mod-auth-gssapi
```

2. Configure the `/etc/krb5.conf` file to reflect your realm, domain, local names map and other settings:

```
kinit -k -t /path/to/your-keytab-file HTTP/YOUR-HOST-
NAME@YOUR-REALM
```

```
[libdefaults]
    default_realm = YOUR-REALM

[realms]
    YOUR-REALM = {
        kdc = your-kdc-server
        admin_server = your-admin-server
        auth_to_local_names = {
            your-principle-name = your-local-user
        }
    }

[domain_realm]
    your-domain = YOUR-REALM
```

```
your-domain = YOUR-REALM
```

3. Copy the keytab file from the Kerberos server to the machine where your service runs (the client). It is important to ensure that it is kept confidential.

Please ensure that the keytab file exists and that Apache has the necessary read permissions to access the keytab file; otherwise, Kerberos authentication will not function properly.

4. Obtain a Kerberos ticket-granting ticket (TGT):
5. Enable Kerberos Authentication from UFM. Kerberos authentication is disabled by default. To enable it, please refer to [Enabling Kerberos Authentication](#).
6. Test the Kerberos Authentication. You can use curl to test whether the user can authenticate to UFM REST APIs using Kerberos.

```
curl --negotiate -i -u : -k 'https://ufmc-eos01/ufmRestKrb/app/tokens'
```

UFM Server Health Monitoring

The UFM Server Health Monitoring module is a standalone module that monitors UFM resources and processes according to the settings in the `/opt/ufm/files/conf/UFMHealthConfiguration.xml` file.

For example:

- Each monitored resource or process has its own failure condition (number of retries and/or timeout), which you can configure.
- If a test fails, UFM will perform a *corrective operation*, if defined for the process, for example, to restart the process. You can change the configured corrective operation. If the corrective operation is set to "None", after the defined number of failures, the *give-up* operation is performed.
- If a test reaches the configured threshold for the number of retries, the health monitoring initiates the *give-up* operation defined for the process, for example, UFM failover or stop.
- By default, events and alarms are sent when a process fails, and they are also recorded in the internal log file.

Each process runs according to its own defined schedule, which you can change in the configuration file.

Changes to the configuration file take effect only after a UFM Server restart. (It is possible to kill and run in background the process `nohup python /opt/ufm/ufmhealth/UfmHealthRunner.pyo &.`)

You can also use the configuration file to improve disk space management by configuring:

- How often to purge MySQL binary log files.
- When to delete compressed UFM log files (according to free disk space).

The settings in the `/opt/ufm/files/conf/UFMHealthConfiguration.xml` file are also used to generate the UFM Health Report.

The following section describes the configuration file options for UFM server monitoring.

UFM Health Configuration

The UFM health configuration file contains three sections:

- Supported Operations—This section describes all the operations that can be used in tests, and their parameters.
- Supported Tests—This section describes all the tests. Each test includes:
 - The main test operation.
 - A corrective operation, if the main operation fails.
 - A give-up operation, if the main operation continues to fail after the corrective operation and defined number of retries.

The number of retries and timeout is also configured for each test operation.

- Test Schedule - This section lists the tests in the order in which they are performed and their configured frequency.

The following table describes the default settings in the */opt/ufm/files/conf/UFMHealthConfiguration.xml* file for each test. The tests are listed in the order in which they are performed in the default configuration file.

You might need to modify the default values depending on the size of your fabric.

For example, in a large fabric, the SM might not be responsive for *sminfo* for a long time; therefore, it is recommended to increase the values for timeout and number of retries for **SMResponseTest**.

Recommended configurations for *SMResponseTest* are:

- For a fabric with 5000 nodes:
 - Number of retries = 12
 - Frequency = 10
- For a fabric with 10000 nodes:
 - Number of retries = 12

- o Frequency = 20

Test Name / Description	Test Operation	Corrective Operation (if Test Operation fails)	No. Retries / Give-up Operation	Test Frequency
CpuUsageTest Checks total CPU utilization.	CPUTest Tests that overall CPU usage does not exceed 80% (this percentage is configurable).	None If UFM Event Burst Management is enabled, it is automatically initiated when the test operation fails	1 Retry None	c
AvailableDiskSpaceTest Checks available disk space.	FreeDiskTest Tests that disk space usage for <i>/opt/ufm</i> does not exceed 90% (this percentage is configurable).	CleanDisk Delete compressed UFM log files under <i>/opt/ufm</i>	3 Retries None	1 hour
CheckIBFabricInterface Checks state of active fabric interface.	IBInterfaceTest Tests that active fabric interface is up.	BringUpIBFabricInterface Bring up the fabric interface	3 Retries SMOrUFMFailoverOrDoNothing	35 seconds
CheckIBFabricInterfaceStandby (HA only) Checks state of fabric interface on standby.	IBInterfaceTestOnStandby Tests that fabric interface on standby is up.	None	1 Retry None	1 minute
MemoryTest Checks total memory usage.	MemoryUsageTest Tests that memory usage does not exceed 90% (this percentage is configurable).	None	1 Retry None	1 minute

Test Name / Description	Test Operation	Corrective Operation (if Test Operation fails)	No. Retries / Give-up Operation	Test Frequency
SMProcessTest Checks status of the OpenSM service.	SMRunningTest Tests that the SM process is running.	RestartProcess Restart the SM process	1 Retry UFMFailoverOrDoNothing	10 seconds
SMResponseTest Checks responsiveness of SM (when SM process is running).	SMTTest Tests SM responsiveness by sending the sminfo query to SM.	None	9 Retries UFMFailoverOrDoNothing	10 seconds
IbpmTest Checks status of the IBPM (Performance Manager) service.	ProcessIsRunningTest Tests that the IBPM service is running.	RestartProcess Restart the IBPM service	3 Retries None	1 minute
ModelMainTest Checks status of the main UFM service	ProcessIsRunningTest Tests that the UFM service is running.	RestartProcess Restart the UFM service	3 Retries UFMFailoverOrDoNothing	20 seconds
HttpdTest Checks status of the httpd service.	ProcessIsRunningTest Tests that the httpd service is running.	RestartProcess Restart the httpd service	3 Retries None	20 seconds
PluginsRunningTest Checks status of the UFM plugin. Checking if UFM plugins are running.	Is[plugin name]PluginRunningTest Test for deployed plugins if they are up and running and operational.	RestartPlugin Start plugin if not running or restart plugin if not operational.	3 Retries None	1 minute

Test Name / Description	Test Operation	Corrective Operation (if Test Operation fails)	No. Retries / Give-up Operation	Test Frequency
UFMServerVersionTest Checks UFM software version and build.	UfmVersionTest Returns UFM software version information.	None	1 Retry None	24 hours
UFMServerLicenseTest Checks UFM License information.	UfmLicenseTest Returns UFM License information.	None	1 Retry None	24 hours
UFMServerHA Configuration Test (HA only) Checks the configuration on master and standby.	UfmHAConfigurationTest Returns information about the master and standby UFM servers.	None	1 Retry None	24 hours
UFMMemoryTest Checks available UFM memory.	UfmMemoryUsageTest Tests that UFM memory usage does not exceed 80% (this percentage is configurable).	None	1 Retry None	1 minute
UFMCpuUsageTest Checks UFM CPU utilization.	CPUTest Tests that UFM CPU usage does not exceed 60% (this percentage is configurable).	None	1 Retry None	1 minute
CheckDrbdTcpConnectionPerformanceTest (HA only)	TcpConnectionPerformanceTest Tests that bandwidth is greater than 100	None	2 Retry None	10 minute

Test Name / Description	Test Operation	Corrective Operation (if Test Operation fails)	No. Retries / Give-up Operation	Test Frequency
Checks the tcp connection between master and standby	Mb/sec and latency is less than 70 usec (configurable).			
CheckGvSqliteCorruptionTest Checks corruption in GV SQLite database.	CheckSqliteCorruptionTest Checks if a list of defined tables exists in the SQLite database file and verifies the schema (columns) for all defined tables.	None	None	1 hour

Note

The Supported Operations section of the configuration file includes additional optional operations that can be used as corrective operations or give-up operations.

UFM Core Files Tracking

To receive a notification every time OpenSM or ibpm creates a core dump, please refer to the list of all current core dumps of OpenSM and ibpm in the UFM health report.



To receive core dump notifications, do the following:

1. Set the core_dumps_directory field in the gv.cfg file to point to the location where all core dumps are created (by default, this location is set to /tmp).

```
core_dumps_directory = /tmp
```

2. Set the naming convention for the core dump file. The name must include the directory configured in the step above.

The convention we recommend is:

```
echo "/tmp/%t.core.%e.%p.%h" > /proc/sys/kernel/core_pattern
```

3. Make sure core dumps directory setting is persistent between reboots. Add the `kernel.core_pattern` parameter with the desired file name format to the `/etc/systctl.conf` file. Example:

```
kernel.core_pattern=/tmp/%t.core.%e.%p.%h
```

4. Configure the core file size to be unlimited.

```
ulimit -c unlimited
```

5. (Only on UFM HA master) Update the UFM configuration file `gv.cfg` to enable core dump tracking.

```
track_core_dumps = yes
```

Example of Health Configuration

The default configuration for the overall memory test in the `opt/ufm/files/conf/UFMHealthConfiguration.xml` file is:

```

<Test Name="MemoryTest" NumOfRetriesBeforeGiveup="3"
RetryTimeoutInSeconds="10">
  <TestOperation Name="MemoryUsageTest">
    <Parameters>
      <Parameter Name="ThresholdInPercents" Value="90" />
    </Parameters>
  </TestOperation>
  <CorrectiveOperation Name="None" />
  <GiveupOperation Name="None" />
</Test>

```

This configuration tests the available memory. If memory usage exceeds 90%, the test is repeated up to 3 times at 10 second intervals, or until memory usage drops to below 90%. No corrective action is taken and no action is taken after 3 retries.

To test with a usage threshold of 80%, and to initiate UFM failover or stop UFM after three retries, change the configuration to:

```

<Test Name="MemoryTest" NumOfRetriesBeforeGiveup="3"
RetryTimeoutInSeconds="10">
  <TestOperation Name="MemoryUsageTest">
    <Parameters>
      <Parameter Name="ThresholdInPercents" Value="80" />
    </Parameters>
  </TestOperation>
  <CorrectiveOperation Name="None" />
  <GiveupOperation Name="UFMFailoverOrStop" />
</Test>

```

Event Burst Management

UFM event burst management can lower the overall CPU usage following an event burst by suppressing events. Event burst management is configured in the *gv.cfg* configuration file.

When the overall CPU usage exceeds the threshold configured by the `CpuUsageTest` in the `/opt/ufm/files/conf/UFMHealthConfiguration.xml` file, a High CPU Utilization event occurs.

This event initiates the UFM event burst management, which:

- Suppresses events. The default level of suppression enables critical events only.
- If, after a specified period of time (30 seconds, by default), no further High CPU Utilization event occurs, the UFM server enables all events.

To modify Event burst management configuration, change the following parameters in the `gv.cfg` file:

```
# The events' level in case events are suppressed (the possible
levels are disable_all_events, enable_critical_events, and
enable_all_events)
# The entire feature can be turned off using the level
"enable_all_events"
suppress_events_level = enable_critical_events
# The amount of time in seconds which events are suppressed
suppress_events_timeout = 30
```

Events and Alarms

UFM offers comprehensive diagnostics for your InfiniBand fabric, covering a range of categories:

1. Fabric configurations
2. Fabric topology
3. Hardware issues
4. Communication errors
5. Maintenance
6. Security
7. Switch module status
8. NVIDIA SHARP notifications

Events are notifications generated by UFM, indicating issues within the mentioned categories in the InfiniBand fabric. On the other hand, alerts are urgent notifications derived from events (many events can be configured as alarms based on customer preferences).

These detections are performed both before running applications and during standard operation. They help troubleshoot and notify network administrators of potential network issues before they escalate.

Events can originate from various sources:

- SM traps
- SHARP AM traps
- UFM internal analysis, encompassing:
 - Internal detection of topology changes
 - Internal fabric analysis (based on IBDiagnet)

- Internal monitoring of managed switches
- Maintenance activities (device action tracking, licensing, cable integrity)
- Threshold-crossing events determined by telemetry counter readings

	WebUI	REST API
Events	UFM events can be viewed via the Events and Alarms WebUI view. Refer to Events & Alarms	Events REST API
	For device-specific events, refer to the Events	N/A
	Configuration of events is managed within the Events Policy Tab in the Settings window	Events Policy REST API
Alarms	UFM alarms can be viewed via the Events and Alarms WebUI view. Refer to Events & Alarms	Alarms REST API
	Configuration of alarms is managed within the Events Policy in the Settings window	N/A

For showing all the UFM-supported events, refer to [Threshold-Crossing Events Reference](#).

Threshold-Crossing Events Reference

This reference lists the threshold-based events that UFM supports, each including a set of attributes listed below. You can view these messages through [Events & Alarms](#). For details about configuring notifications for these events, refer to [Configuring Event Management](#).

- **Event ID:** Unique event identifier

- **Event Name:** Short description of the event
- **To log:** A flag which defines whether the event will be sent to UFM events log or not (1 or 0, respectively).
- **Alarm:** A flag which defines whether UFM alarm is generated when the specified event is triggered by UFM (1 means an alarm is generated). Alarms are used to allow a notification with significant indication.
- **Default Severity:** Indicates the alarm severity (Info, Warning, Minor, Critical)
- **Default Threshold:** Event dependent threshold (for example, event occurrence, counter threshold or temperature threshold).
- **Default TTL:** TTL (Alarm Time to Live) sets the time during which the alarm on the event is visible on UFM Web UI. TTL is defined in seconds. CAUTION: Setting the TTL to 0 makes the alarm permanent, meaning that the alarm does not disappear from the Web UI until cleared manually.
- **Related Object:** The object (context) to which the UFM event is related to (port, switch, gateway, grid, etc).
- **Category:** Indicates the category to which the event is related to.
- **Source:** Indicates the origin source of the specified event (SM, Telemetry, Licensing, UFM)

For information about defining event policy, see [Configuring Event Management](#).

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
64	GID Address In Service	1	0	Info	1	300	Port	Fabric Notification	SM
65	GID Address Out of Service	1	0	Warning	1	300	Port	Fabric Notification	SM
66	New MCast	1	0	Info	1	300	Port	Fabric Notification	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Group Created							tion	
67	MCast Group Deleted	1	0	Info	1	300	Port	Fabric Notification	SM
110	Symbol Error	1	1	Warning	200	300	Port	Hardware	Telemetry
111	Link Error Recovery	1	1	Minor	1	300	Port	Hardware	Telemetry
112	Link Downed	1	1	Critical	1	300	Port	Hardware	Telemetry
113	Port Receive Errors	1	1	Minor	5	300	Port	Hardware	Telemetry
114	Port Receive Remote Physical Errors	0	0	Minor	5	300	Port	Hardware	Telemetry
115	Port Receive Switch Relay Errors	1	1	Minor	999	300	Port	Fabric Configuration	Telemetry
116	Port Xmit Discards	1	1	Minor	200	300	Port	Communication Error	Telemetry
117	Port Xmit Constrains	1	1	Minor	200	300	Port	Communication Error	Telemetry

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	int Errors								
118	Port Receive Constraint Errors	1	1	Minor	200	300	Port	Communication Error	Telemetry
119	Local Link Integrity Errors	1	1	Minor	5	300	Port	Hardware	Telemetry
120	Excessive Buffer Overrun Errors	1	1	Minor	100	300	Port	Communication Error	Telemetry
121	VL15 Dropped	1	1	Minor	50	300	Port	Communication Error	Telemetry
122	Congested Bandwidth (%) Threshold Reached	1	1	Minor	10	300	Port	Hardware	Telemetry
123	Port Bandwidth (%) Threshold Reached	1	1	Minor	95	300	Port	Communication Error	Telemetry
130	Non-optimal	1	1	Minor	1	0	Port	Hardware	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	link width								
134	T4 Port Congested Bandwidth	1	1	Warning	10	300	Port	Communication Error	Telemetry
141	Flow Control Update Watchdog Timer Expired	1	0	Warning	1	300	Port	Hardware	SM
144	Capability Mask Modified	1	0	Info	1	300	Port	Fabric Notification	SM
145	System Image GUID changed	1	0	Info	1	300	Port	Communication Error	SM
156	Link Speed Enforcement Disabled	1	0	Critical	0	300	Site	Fabric Notification	SM
250	Running in Limited Mode	1	1	Critical	1	0	Grid	Maintenance	Licensing
251	Switching to	1	1	Critical	1	0	Grid	Maintenance	Licensing

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Limited Mode								
252	License Expired	1	1	Warning	1	0	Grid	Maintenance	Licensing
253	Duplicated licenses	1	0	Critical	1	0	Grid	Maintenance	Licensing
254	License Limit Exceeded	1	0	Critical	1	0	Grid	Maintenance	Licensing
255	License is About to Expire	1	0	Warning	1	0	Grid	Maintenance	Licensing
256	Bad M_Key	1	0	Minor	1	300	Port	Security	SM
257	Bad P_Key	1	0	Minor	1	300	Port	Security	SM
258	Bad Q_Key	1	0	Minor	1	300	Port	Security	SM
259	Bad P_Key Switch External Port	1	0	Critical	1	300	Port	Security	SM
328	Link is Up	1	0	Info	1	0	Link	Fabric Topology	SM
329	Link is Down	1	0	Warning	1	0	Site	Fabric Topology	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
331	Node is Down	1	0	Warning	1	0	Site	Fabric Topology	SM
332	Node is Up	1	0	Info	1	300	Site	Fabric Topology	SM
336	Port Action Succeeded	1	0	Info	1	0	Port	Maintenance	UFM
337	Port Action Failed	1	0	Minor	1	0	Port	Maintenance	UFM
338	Device Action Succeeded	1	0	Info	1	0	Port	Maintenance	UFM
339	Device Action Failed	1	0	Minor	1	0	Port	Maintenance	UFM
344	Partial Switch ASIC Failure	1	1	Critical	1	0	Switch	Maintenance	UFM
370	Gateway Ethernet Link State Changed	1	0	Warning	1	0	Gateway	Gateway	SM
371	Gateway Reregister Event	1	0	Warning	1	0	Gateway	Gateway	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Received								
372	Number of Gateways Changed	1	0	Warning	1	0	Gateway	Gateway	SM
373	Gateway will be Rebooted	1	0	Warning	1	0	Gateway	Gateway	SM
374	Gateway Reloading Finished	1	0	Info	1	0	Gateway	Gateway	SM
380	Switch Upgrade Error	1	1	Critical	1	0	Switch	Maintenance	UFM
381	Switch Upgrade Failed	1	0	Info	1	0	Switch	Maintenance	UFM
328	Module status NOT PRESENT	1	1	Warning	1	420	Switch	Module Status	UFM
383	Host Upgrade Failed	1	0	Info	1	0	Computer	Maintenance	UFM
384	Switch Module Powered Off	1	1	Info	1	420	Switch	Module Status	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
385	Switch FW Upgrade Started	1	0	Info	1	0	Switch	Maintenance	UFM
386	Switch SW Upgrade Started	1	0	Info	1	0	Switch	Maintenance	UFM
387	Switch Upgrade Finished	1	0	Info	1	0	Switch	Maintenance	UFM
388	Host FW Upgrade Started	1	0	Info	1	0	Computer	Maintenance	UFM
389	Host SW Upgrade Started	1	0	Info	1	0	Computer	Maintenance	UFM
391	Switch Module Removed	1	0	Info	1	0	Switch	Fabric Notification	Switch
392	Module Temperature Threshold Reached	1	0	Info	40	0	Module	Hardware	Switch

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
393	Switch Module Added	1	0	Info	1	0	Switch	Fabric Notification	Switch
394	Module Status FAULT	1	1	Critical	1	420	Switch	Module Status	Switch
395	Device Action Started	1	0	Info	1	0	Port	Maintenance	UFM
396	Site Action Started	1	0	Info	1	0	Port	Maintenance	UFM
397	Site Action Failed	1	0	Minor	1	0	Port	Maintenance	UFM
398	Switch Chip Added	1	0	Info	1	0	Switch	Fabric Notification	Switch
399	Switch Chip Removed	1	0	Critical	1	0	Switch	Fabric Notification	Switch
403	Device Pending Reboot	1	1	Warning	0	300	Device	Maintenance	UFM
404	System Information is missing	1	1	Warning	1	300	Switch	Communication Error	UFM
405	Switch Identity Validation Failed	1	1	Warning	1	300	Switch	Communication Error	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
406	Switch System Information is missing	1	1	Warning	1	300	Switch	Communication Error	UFM
407	COMEX Ambient Temperature Threshold Reached	1	1	Minor	60	300	Switch	Hardware	Switch
408	Switch is Unresponsive	1	1	Critical	1	300	Switch	Communication Error	UFM
502	Device Upgrade Finished	1	0	Info	1	300	Device	Maintenance	UFM
506	Device Upgrade Finished	1	0	Info	1	300	Device	Maintenance	UFM
508	Core Dump Created	1	1	Info	1	300	Grid	Maintenance	UFM
510	SM Failover	0	1	Critical	1	300	Grid	Fabric Notification	SM
511	SM State	0	1	Info	1	300	Grid	Fabric Notification	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Change							tion	
512	SM UP	0	1	Info	1	300	Grid	Fabric Notification	SM
513	SM System Log Message	0	1	Minor	1	300	Grid	Fabric Notification	SM
514	SM LID Change	0	1	Warning	1	300	Grid	Fabric Notification	SM
515	Fabric Health Report Info	1	1	Info	1	300	Grid	Fabric Notification	UFM
516	Fabric Health Report Warning	1	1	Warning	1	300	Grid	Fabric Notification	UFM
517	Fabric Health Report Error	1	1	Critical	1	300	Grid	Fabric Notification	UFM
518	UFM-related process is down	1	1	Critical	1	300	Grid	Maintenance	UFM
519	Logs purge failure	1	1	Minor	1	300	Grid	Maintenance	UFM
520	Restart of UFM-related	1	1	Info	1	300	Grid	Maintenance	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	process succeeded								
521	UFM is being stopped	1	1	Critical	1	300	Grid	Maintenance	UFM
522	UFM is being restarted	1	1	Critical	1	300	Grid	Maintenance	UFM
523	UFM failover is being attempted	1	1	Info	1	300	Grid	Maintenance	UFM
524	UFM cannot connect to DB	1	1	Critical	1	300	Grid	Maintenance	UFM
525	Disk utilization threshold reached	1	1	Critical	1	300	Grid	Maintenance	UFM
526	Memory utilization threshold reached	1	1	Critical	1	300	Grid	Maintenance	UFM
527	CPU utilization	1	1	Critical	1	300	Grid	Maintenance	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	threshold reached								
528	Fabric interface is down	1	1	Critical	1	300	Grid	Maintenance	UFM
529	UFM standby server problem	1	1	Critical	1	300	Grid	Maintenance	UFM
530	SM is down	1	1	Critical	1	300	Grid	Maintenance	UFM
531	DRBD Bad Condition	1	1	Critical	1	300	Grid	Maintenance	UFM
532	Remote UFM-SM Sync	1	1	Info	1	0	Grid	Maintenance	UFM
533	Remote UFM-SM problem	1	1	Critical	1	0	Site	Maintenance	UFM
535	MH Purge Failed	1	1	Warning	1	300	Grid	Maintenance	UFM
536	UFM Health Watchdog Info	1	1	Info	1	300	Grid	Maintenance	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
537	UFM Health Watchdog Critical	1	1	Critical	1	300	Grid	Maintenance	UFM
538	Time Diff Between HA Servers	1	1	Warning	1	300	Grid	Maintenance	UFM
539	DRBD TCP Connection Performance	1	1	Warning	1	900	Grid	Maintenance	UFM
540	Daily Report Completed successfully	1	0	Info	1	300	Grid	Maintenance	UFM
541	Daily Report Completed with Error	1	0	Minor	1	300	Grid	Maintenance	UFM
542	Daily Report Failed	1	0	Critical	1	300	Grid	Maintenance	UFM
543	Daily Report Mail Sent	1	0	Info	1	300	Grid	Maintenance	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	successfully								
544	Daily Report Mail Sent Failed	1	0	Minor	1	300	Grid	Maintenance	UFM
545	SM is not responding	1	1	Critical	1	300	Grid	Maintenance	UFM
560	User Connected							Security	UFM
561	User Disconnected							Security	UFM
602	UFM Server Failover	1	1	Critical	1	0	Site	Fabric Notification	UFM
603	Events Suppression	1	0	Critical	0	300	Site	Maintenance	UFM
604	Report Succeeded	1	1	Info	1	300	Grid	Maintenance	UFM
605	Report Failed	1	1	Critical	1	300	Grid	Maintenance	UFM
606	Correction Attempts Paused	1	0	Warning	1	0	Site	Fabric Notification	UFM
701	Non-optimal	1	1	Minor	1	0	Port	Hardware	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Link Speed								
702	Unhealthy IB Port	1	1	Warning	1	0	Port	Hardware	SM
703	Fabric Collector Connected	1	0	Info	1	0	Grid	Maintenance	UFM
704	Fabric Collector Disconnected	1	1	Critical	1	0	Grid	Maintenance	UFM
750	High data retransmission count on port	1	1	Warning	500	1	Port	Hardware	SM
901	Fabric Configuration Started	0	1	Info	1	0	Grid	Fabric Notification	UFM
902	Fabric Configuration Completed	0	1	Info	1	0	Grid	Fabric Notification	UFM
903	Fabric Configuration Failed	0	1	Critical	1	0	Grid	Fabric Notification	UFM
904	Device Configuration	0	1	Critical	1	0	Device	Fabric Notification	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	ration Failure							tion	
905	Device Configuration Timeout	0	1	Critical	1	0	Device	Fabric Notification	UFM
906	Provisioning Validation Failure	0	1	Critical	1	0	Grid	Fabric Notification	UFM
907	Switch is Down	1	1	Critical	1	0	Site	Fabric Topology	UFM
908	Switch is Up	1	1	Info	1	300	Site	Fabric Topology	UFM
909	Director Switch is Down	1	1	Critical	1	300	Site	Fabric Topology	UFM
910	Director Switch is Up	1	1	Info	1	0	Site	Fabric Topology	UFM
911	Module Temperature Low Threshold Reached	1	1	Warning	60	300	Module	Hardware	Telemetry
912	Module Temperature	1	1	Critical	60	300	Module	Hardware	Telemetry

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	ature High Threshold Reached								
913	Module High Voltage	1	1	Warning	10	420	Switch	Module Status	Telemetry
914	Module High Current	1	1	Warning	10	420	Switch	Module Status	Telemetry
915	BER_ERROR	1	1	Critical	1e-8	420	Port	Hardware	Telemetry
916	BER_WARNING	1	1	Warning	1e-13	420	Port	Hardware	Telemetry
917	SYMBOL_BER_ERROR	1	1	Critical	10	420	Port	Hardware	Telemetry
918	High Symbol BER reported	1	1	Warning	10	420	Port	Hardware	Telemetry
919	Cable Temperature High	1	1	Critical	0	0	Port	Hardware	Telemetry
920	Cable Temperature Low	1	1	Critical	0	0	Port	Hardware	Telemetry
1300	SM_SAKY_VIOLATION	1	1	Warning		5300	Port	Security	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
1301	SM_SGID_SPOOFED	1	1	Warning		5300	Port	Security	SM
1302	SM_RATE_LIMIT_EXCEEDED	1	1	Warning		5300	Port	Security	SM
1303	SM_MULTICAST_GROUPS_LIMIT_EXCEEDED	1	1	Warning		5300	Port	Security	SM
1304	SM_SERVICES_LIMIT_EXCEEDED	1	1	Warning		5300	Port	Security	SM
1305	SM_EVENT_SUBSCRIPTION_LIMIT_EXCEEDED	1	1	Warning		5300	Port	Security	SM
1306	Unallowed SM was detected in the fabric	1	1	Warning	0	300	Port	Fabric Notification	SM
1307	SMInfo SET request was received	1	1	Warning	0	300	Port	Fabric Notification	SM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	d from unallowed SM								
1309	SM was detected with non-matching SMKey	1	1	Warning	0	300	Port	Fabric Notification	SM
1310	Duplicated node GUID was detected	1	1	Critical	1	0	Device	Fabric Notification	SM
1311	Duplicated port GUID was detected	1	1	Critical	1	0	Port	Fabric Notification	SM
1312	Switch was Rebooted	1	1	Info	1	0	Device	Fabric Notification	UFM
1315	Topo Config File Error	1	1	Critical	1	0	Grid	Fabric Notification	UFM
1316	Topo Config Subnet Mismatch	1	1	Critical	1	0	Grid	Fabric Notification	Topodiff

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
1400	High Ambient Temperature	1	1	Warning	0	86400	Switch	Hardware	Switch
1401	High Fluid Temperature	1	1	Warning	0	86400	Switch	Hardware	Switch
1402	Low Fluid Level	1	1	Warning	0	86400	Switch	Hardware	Switch
1403	Low Supply Pressure	1	1	Warning	0	86400	Switch	Hardware	Switch
1404	High Supply Pressure	1	1	Warning	0	86400	Switch	Hardware	Switch
1405	Low Return Pressure	1	1	Warning	0	86400	Switch	Hardware	Switch
1406	High Return Pressure	1	1	Warning	0	86400	Switch	Hardware	Switch
1407	High Differential Pressure	1	1	Warning	0	86400	Switch	Hardware	Switch
1408	Low Differential	1	1	Warning	0	86400	Switch	Hardware	Switch

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Pressure								
1409	System Fail Safe	1	1	Warning	0	86400	Switch	Hardware	Switch
1410	Fault Critical	1	1	Critical	0	86400	Switch	Hardware	Switch
1411	Fault Pump1	1	1	Critical	0	86400	Switch	Hardware	Switch
1412	Fault Pump2	1	1	Critical	0	86400	Switch	Hardware	Switch
1413	Fault Fluid Level Critical	1	1	Critical	0	86400	Switch	Hardware	Switch
1414	Fault Fluid Over Temperature	1	1	Critical	0	86400	Switch	Hardware	Switch
1415	Fault Primary DC	1	1	Critical	0	86400	Switch	Hardware	Switch
1416	Fault Redundant DC	1	1	Critical	0	86400	Switch	Hardware	Switch
1417	Fault Fluid Leak	1	1	Critical	0	86400	Switch	Hardware	Switch
1418	Fault Sensor Failure	1	1	Critical	0	86400	Switch	Hardware	Switch
1419	Cooling Device	1	0	Critical	0	1	Grid	Hardware	Switch

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Monitoring Error								
1420	Cooling Device Communication Error	1	1	Critical	0	86400	Switch	Hardware	Switch
1500	New cable detected	1	0	Info	1	0	Link	Security	UFM
1502	Cable detected in a new location	1	0	Warning	1	0	Link	Security	UFM
1503	Duplicate Cable Detected	1	0	Critical	1	0	Link	Security	UFM
1315	Topo Config File Error	1	1	Critical	1	0	Grid	Fabric Notification	UFM
1504	SHARP Allocation Succeeded	1	1	Info	1	0	Grid	SHARP	SHARP
1505	SHARP Allocation Failed	1	0	Warning	1	0	Grid	SHARP	SHARP

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
1506	SHARP Deallocation Succeeded	1	0	Info	1	0	Grid	SHARP	SHARP
1507	SHARP Deallocation Failed	1	0	Warning	1	0	Grid	SHARP	SHARP
1508	Device Collect System Dump Started	1	0	Info	1	300	Device	Maintenance	UFM
1509	Device Collect System Dump Finished	1	0	Info	1	300	Device	Maintenance	UFM
1510	Device Collect System Dump Error	1	0	Critical	1	300	Device	Maintenance	UFM
1511	Virtual Port Added	1	0	Info	1	0	Port	Fabric Notification	SM
1512	Virtual Port Removed	1	0	Warning	1	0	Port	Fabric Notification	SM
1513	Burn Cables Transce	1	0	Info	1	0	Device	Maintenance	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	ivers Started								
1514	Burn Cables Transceivers Finished	1	0	Info	1	0	Device	Maintenance	UFM
1515	Burn Cables Transceivers Failed	1	0	Warning	1	0	Device	Maintenance	UFM
1516	Activate Cables Transceivers FW Finished	1	0	Info	1	0	Device	Maintenance	UFM
1517	Activate Cables Transceivers FW Failed	1	0	Warning	1	0	Device	Maintenance	UFM
1520	Aggregation Node Discovery Failed	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1521	Job Started	1	0	Info	1	0	SHARP AM	SHARP	SHARP

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
1522	Job Ended	1	0	Info	1	0	SHARP AM	SHARP	SHARP
1523	Job Start Failed	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1524	Job Error	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1525	Trap QP Error	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1526	Trap Invalid Request	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1527	Trap Sharp Error	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1528	Trap QP Alloc timeout	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1529	Trap AMKey Violation	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1530	Unsupported Trap	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1531	Reservation Updated	1	0	Info	1	0	SHARP AM	SHARP	SHARP

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
1532	Sharp is not Responding	1	0	Critical	1	0	SHARP AM	SHARP	SHARP
1533	Agg Node Active	1	0	Info	1	0	SHARP AM	SHARP	SHARP
1534	Agg Node Inactive	1	0	Warning	1	0	SHARP AM	SHARP	SHARP
1535	Trap AMKey Violation Triggered by AM	1	0	Warning	1	0	SHARP AM	SHARP	SHARP
1550	Guids Were Added to Pkey	1	0	Info	1	0	Port	Fabric Notification	UFM
1551	Guids Were Removed from Pkey	1	0	Info	1	0	Port	Fabric Notification	UFM
1600	VS/CC Classes Key Violation							Security	SM
1602	PCI Speed Degradation	1	1	Warning	1	0	Port	Fabric Notification	UFM

Event ID	Event Name	To Log	Alarm	Default Severity	Default Threshold	Default TTL	Related Object	Category	Source
	Warning								
1603	PCI Width Degradation Warning	1	1	Warning	1	0	Port	Fabric Notification	UFM
1609	In Service Switch Upgrade isolate action	1	1	Warning	1	0	Switch	Hardware	SM
1610	In Service Switch Upgrade Deisolate action	1	1	Warning	1	0	Switch	Hardware	SM

Reports

UFM reports provide summarized information about selected topics. Through the different UFM WebUI tabs, you can create reports that run a series of checks on UFM components.

The table below summarizes the types of reports and provides useful links for more information.

Report Type	Description	WebUI	REST API
UFM Health Report	A report that run a series of checks related to UFM server health, including CPU, memory, license, configurations and disk monitoring.	UFM Health Tab	Reports REST API
Fabric Health Report	Through the Fabric Health tab, you can access the fabric health reports. There are two kinds of reports: <ul style="list-style-type: none">• Custom Reports - The user can generate a report that runs a series of checks on the fabric on demand.• Periodic Reports - An automatically generated report that is periodically	Fabric Health Tab	Reports REST API Periodic Fabric Health REST API

Report Type	Description	WebUI	REST API
	generated by the UFM.		
Topology Comparison Report	<p>Reports on topology comparison, available as:</p> <ul style="list-style-type: none"> • Periodic Comparison - allows users to compare the current fabric topology with a preset master topology. • Custom Comparison - compares user-defined topology with the current fabric topology. 	Topology Compare Tab	Topology Compare REST API
Daily Reports	The Daily Report feature collects, analyzes, and reports the most significant issues of the fabric in the last 24 hours	Daily Reports Tab	N/A

Telemetry

UFM Telemetry allows the collection and monitoring of InfiniBand fabric port statistics, such as network bandwidth, congestion, errors, latency, and more.

UFM provides a range of telemetry capabilities:

- Real-time monitoring views
- Monitoring of multiple attributes
- Intelligent Counters for error and congestion counters
- InfiniBand port-based error counters
- InfiniBand congestion XmitWait counter-based congestion measurement
- InfiniBand port-based bandwidth data

The telemetry session panels support the following actions:

- Rearrangement via a straightforward drag-and-drop function
- Resizing by hovering over the panel's border

There are two methods for managing telemetry instances:

1. **Legacy Mode (via UFM):** In this mode, telemetry instances are invoked during UFM startup and fully managed by UFM.
2. **UTM Mode (via UFM Telemetry Manager):** In this mode, telemetry instances are managed by the UFM Telemetry Manager (UTM) plugin.

By default, the system operates in legacy mode. To switch to UTM mode:

1. Start UFM.
2. Deploy and enable the [UFM Telemetry Manager \(UTM\) Plugin](#)

3. Edit the `/opt/ufm/files/conf/gv.cfg` configuration file, and under the [Telemetry] section, set the following flags to `false`:
 - `primary_telemetry_legacy_mode = false`
 - `secondary_telemetry_legacy_mode = false`
4. Save and close the `gv.cfg` file.
5. Restart UFM (or simply restart the telemetry service).

Telemetry Instance	Description	REST API
High-Frequency (Primary) Telemetry Instance	<p>A default telemetry session that collects a predefined set of ~30 counters covering bandwidth, congestion, and error metrics, which UFM analyzes and reports.</p> <p>These counters are used for:</p> <ul style="list-style-type: none"> • Default Telemetry Session - An ongoing session used by the UFM to display UFM WebUI dashboard charts information and for monitoring and analyzing ports threshold events (the session interval is 30 secs by default) • Real-Time Telemetry - allows users to define live telemetry sessions for monitoring small subsets of devices or ports and a 	<p>For Default and Real-time Telemetry: Monitoring REST API</p> <p>For Historical Telemetry: History Telemetry Sessions REST API → History Telemetry Sessions</p>

Telemetry Instance	Description	REST API
	<p>selected set of counters. For more information, refer to Telemetry.</p> <ul style="list-style-type: none"> • Historical Telemetry - based on the primary telemetry and collects statistical data from all fabric ports and stores them in an internal UFM SQLite database (the session interval is 5 mins by default) 	
Low-Frequency (Secondary) Telemetry Instance	<p>Operates automatically upon UFM startup, offering an extended scope of 120 counters. For a list of the Secondary Telemetry Fields, refer to Low-Frequency (Secondary) Telemetry Fields.</p>	N/A

For direct telemetry endpoint access, which exposes the list of supported counters:

For the **High-Frequency (Primary) Telemetry Instance**, run the following command:

```
#curl -s 127.0.0.1:9001/csv/cset/converted_enterprise
```

For the **Low-Frequency (Secondary) Telemetry Instance**, run the following command:

```
#curl -s 127.0.0.1:9002/csv/xcset/low_freq_debug
```

Historical Telemetry Collection in UFM

Storage Considerations

UFM periodically collects fabric port statistics and saves them in its SQLite database. Before starting up UFM Enterprise, please consider the following disk space utilization for various fabric sizes and duration.

The measurements in the table below were taken with sampling interval set to once per 30 seconds.

Note

Be aware that the default sampling rate is once per 300 seconds. Disk utilization calculation should be adjusted accordingly.

Number of Nodes	Ports per Node	Storage per Hour	Storage per 15 Days	Storage per 30 Days
16	8	1.6 MB	576 MB (0.563 GB)	1152 MB (1.125 GB)
100	8	11 MB	3960 MB (3.867 GB)	7920 MB (7.734 GB)
500	8	50 MB	18000 MB (17.58 GB)	36000 MB (35.16 GB)
1000	8	100 MB	36000 MB (35.16 GB)	72000 MB (70.31 GB)

High-Frequency (Primary) Telemetry Fields

The following is a list of available counters which includes a variety of metrics related to timestamps, port and node information, error statistics, firmware versions, temperatures, cable details, power levels, and various other telemetry-related data.

Field Name	Description
timestamp	timestamp
source_id	Node GUID
tag	N/A
node_guid	Node GUID
port_guid	Port GUID
port_num	Port Number
PortXmitDataExtended	Transmitted data rate per egress port in bytes passing through the port during the sample period
PortRcvDataExtended	The received data on the ingress port in bytes during the sample period
PortXmitPktsExtended	Total number of packets transmitted on the port.
PortRcvPktsExtended	Total number of packets received on the port
SymbolErrorCounterExtended	This counter provides information on error bits that were not corrected by phy correction mechanisms.
LinkErrorRecoveryCounterExtended	Total number of times the Port Training state machine has successfully completed the link error recovery process.
LinkDownedCounterExtended	Perf.PortCounters
PortRcvErrorsExtended	Total number of packets containing an error that were received on the port

Field Name	Description
PortRcvRemotePhysicalErrorsExtended	Total number of packets marked with the EBP delimiter received on the port.
PortRcvSwitchRelayErrorsExtended	Total number of packets received on the port that were discarded because they could not be forwarded by the switch relay.
PortXmitDiscardsExtended	Total number of outbound packets discarded by the port because the port is down or congested.
PortXmitConstraintErrorsExtended	Total number of packets not transmitted from the switch physical port.
PortRcvConstraintErrorsExtended	Total number of packets received on the switch physical port that are discarded.
LocalLinkIntegrityErrorsExtended	The number of times that the count of local physical errors exceeded the threshold specified by LocalPhyErrors
ExcessiveBufferOverrunErrorsExtended	The number of times that OverrunErrors consecutive flow control update periods occurred, each having at least one overrun error
VL15DroppedExtended	Number of incoming VL15 packets dropped due to resource limitations (e.g., lack of buffers) in the port
PortXmitWaitExtended	The time an egress port had data to send but could not send it due to lack of credits or arbitration - in time ticks within the sample-time window
hist[0-4]	Hist[i] give the number of FEC blocks that had RS-FEC symbols errors of value i or range of errors
infiniband_CBW	
Normalized_CBW	
NormalizedXW	
Normalized_XmitData	

Low-Frequency (Secondary) Telemetry Fields

The following is a list of available counters which includes a variety of metrics related to timestamps, port and node information, error statistics, firmware versions, temperatures, cable details, power levels, and various other telemetry-related data.

Field Name	Description
Node_GUID	node GUID
Device_ID	PCI device ID
node_description	node description
lid	lid
Port_Number	port number
port_label	port label
Phy_Manager_State	FW Phy Manager FSM state
phy_state	physical state
logical_state	Port Logical link state
Link_speed_active	ib link active speed
Link_width_active	ib link active widthsource_id
Active_FEC	Active FEC
Total_Raw_BER	Pre-FEC monitor parameters
Effective_BER	Post FEC monitor parameters
Symbol_BER	BER after all phy correction mechanism: post FEC + PLR monitor parameters
Raw_Errors_Lane_[0-3]	This counter provides information on error bits that were identified on lane X. When FEC is enabled this induction corresponds to corrected errors. In PRBS test mode, indicates the number of PRBS errors on lane X.
Effective_Errors	This counter provides information on error bits that were not corrected by FEC correction algorithm or that FEC is not active.

Field Name	Description
Symbol_Errors	This counter provides information on error bits that were not corrected by phy correction mechanisms.
Time_since_last_clear_Min	The time passed since the last counters clear event in msec. (physical layer statistical counters)
hist[0-15]	Hist[i] give the number of FEC blocks that had RS-FEC symbols errors of value i or range of errors
FW_Version	Node FW version
Chip_Temp	switch temperature
Link_Down	Perf.PortCounters(LinkDownedCounter)
Link_Down_IB	Total number of times the Port Training state machine has failed the link error recovery process and downed the link.
LinkErrorRecoveryCounter	Total number of times the Port Training state machine has successfully completed the link error recovery process.
PlrRcvCodes	Number of received PLR codewords
PlrRcvCodeErr	The total number of rejected codewords received
PlrRcvUncorrectableCode	The number of uncorrectable codewords received
PlrXmitCodes	Number of transmitted PLR codewords
PlrXmitRetryCodes	The total number of codewords retransmitted
PlrXmitRetryEvents	The total number of retransmitted event
PlrSyncEvents	The number of sync events
HiRetransmissionRate	Recieved bandwidth loss due to codes retransmission
PlrXmitRetryCodesWithinTSecMax	The maximum number of retransmitted events in t sec window
link_partner_description	node description of the link partner
link_partner_node_guid	node_guid of the link partner

Field Name	Description
link_partner_lid	lid of the link partner
link_partner_port_num	port number of the link partner
Cable_PN	Vendor Part Number
Cable_SN	Vendor Serial Number
cable_technology	
cable_type	Cable/module type
cable_vendor	
cable_length	
cable_identifier	
vendor_rev	Vendor revision
cable_fw_version	
rx_power_lane_[0-7]	RX measured power
tx_power_lane_[0-7]	TX measured power
Module_Voltage	Internally measured supply voltage
Module_Temperature	Module temperature
fast_link_up_status	Indicates if fast link-up was performed in the link
time_to_link_up_ext_msec	Time in msec to link up from disable until phy up state. While the phy manager did not reach phy up state the timer will return 0.
Advanced_Status_Opcode	Status opcode: PHY FW indication
Status_Message	ASCII code message
down_blame	Which receiver caused last link down
local_reason_opcode	Opcde of link down reason - local
remote_reason_opcode	Opcde of link down reason - remote
e2e_reason_opcode	see local_reason_opcode for local reason opcode for remote reason opcode: local_reason_opcode+100

Field Name	Description
PortRcvRemotePhysicalErrors	Total number of packets marked with the EBP delimiter received on the port.
PortRcvErrors	Total number of packets containing an error that were received on the port
PortXmitDiscards	Total number of outbound packets discarded by the port because the port is down or congested.
PortRcvSwitchRelayErrors	Total number of packets received on the port that were discarded because they could not be forwarded by the switch relay.
ExcessiveBufferOverrunErrors	The number of times that OverrunErrors consecutive flow control update periods occurred, each having at least one overrun error
LocalLinkIntegrityErrors	The number of times that the count of local physical errors exceeded the threshold specified by LocalPhyErrors
PortRcvConstraintErrors	Total number of packets received on the switch physical port that are discarded.
PortXmitConstraintErrors	Total number of packets not transmitted from the switch physical port.
VL15Dropped	Number of incoming VL15 packets dropped due to resource limitations (e.g., lack of buffers) in the port
PortXmitWait	The time an egress port had data to send but could not send it due to lack of credits or arbitration - in time ticks within the sample-time window
PortXmitDataExtended	Transmitted data rate per egress port in bytes passing through the port during the sample period
PortRcvDataExtended	The received data on the ingress port in bytes during the sample period
PortXmitPktsExtended	Total number of packets transmitted on the port.
PortRcvPktsExtended	Total number of packets received on the port

Field Name	Description
PortUniCastXmitPkts	Total number of unicast packets transmitted on all VLs from the port. This may include unicast packets with errors, and excludes link packets
PortUniCastRcvPkts	Total number of unicast packets, including unicast packets containing errors, and excluding link packets, received from all VLs on the port.
PortMultiCastXmitPkts	Total number of multicast packets transmitted on all VLs from the port. This may include multicast packets with errors.
PortMultiCastRcvPkts	Total number of multicast packets, including multicast packets containing errors received from all VLs on the port.
SyncHeaderErrorCounter	Count of errored block sync header on one or more lanes
PortSwLifetimeLimitDiscards	Total number of outbound packets discarded by the port because the Switch Lifetime Limit was exceeded. Applies to switches only.
PortSwHOQLifetimeLimitDiscards	Total number of outbound packets discarded by the port because the switch HOQ Lifetime Limit was exceeded. Applies to switches only.
rq_num_wrfe	Responder - number of WR flushed errors
rq_num_lle	Responder - number of local length errors
sq_num_wrfe	Requester - number of WR flushed errors
Temp_flags	Latched temperature flags of module
Vcc_flags	Latched VCC flags of module
device_hw_rev	Node HW Revision
sw_revision	Switch revision
sw_serial_number	Switch serial number
measured_freq_[0-1]	Clock frequency measurement in last 100msec
min_freq_[0-1]	Minutes of clock frequency measured. Units of 0.1 KHz

Field Name	Description
max_freq_[0-1]	Max of clock frequency measured. Units of 0.1 KHz
max_delta_freq_[0-1]	Observed max delta frequency in window of 100msec. Units of 0.1 KHz
snr_media_lane_[0-7]	SNR value on the media lane <i>. In unit scale of 1/256 dB. The SNR value represents the electrical signal-to-noise ratio on an optical lane, and is defined as the minimum of the three individual eye SNR values.
snr_host_lane_[0-7]	SNR value on the host lane <i>. In unit scale of 1/256 dB. The SNR value represents the electrical signal-to-noise ratio on an optical lane, and is defined as the minimum of the three individual eye SNR values.
tx_cdr_lol	Bitmask for latched Tx cdr loss of lock flag per lane.
rx_cdr_lol	Bitmask for latched Rx cdr loss of lock flag per lane.
tx_los	Bitmask for latched Tx loss of signal flag per lane.
rx_los	Bitmask for latched Rx loss of signal flag per lane.
phy_received_bits	This counter provides information on the total amount of traffic (bits) received.
rq_general_error	The total number of packets that were dropped since it contained errors. Reasons for this include: Dropped due to MPR mismatch.
host_name	Port's host name.

UFM Web UI

This section is constituted by the following sub-sections:

- [Fabric Dashboard](#)
- [Network Map](#)
- [Managed Elements](#)
- [Telemetry - User-Defined Sessions](#)
- [System Health](#)
- [Events & Alarms](#)
- [Jobs](#)
- [Settings](#)

Access the WebUI

UFM Web UI Supported Browsers

UFM Web UI is supported on all the following web browsers: Internet Explorer, Firefox, Chrome and Opera.

For optimal UFM Web UI performance, make sure you are using the latest version available of Google Chrome.

For more information, see *UFM User Manual*.

Launching UFM Web UI Session

Before accessing the UFM Web UI:

- If required, you can change the configuration of the connection (port and protocol) between the UFM server and the APACHE server in the file *gv.cfg*:

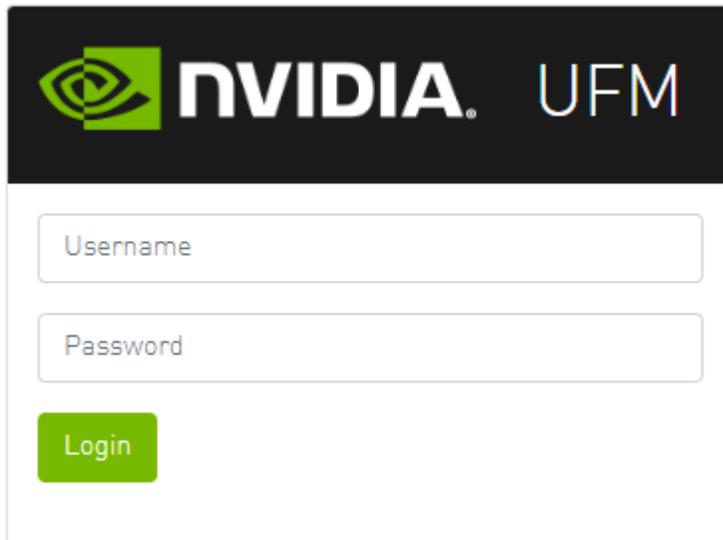
- `ws_protocol` = http or https
 - Setting the parameter `ws_protocol` to `http` allows unsecured access
 - Setting the parameter `ws_protocol` to `https` denies unsecured access.
- `ws_port` = port number

➤ **To launch a UFM Web UI session, do the following:**

1. Launch the Web UI by entering the following URL in your browser:

http://<UFM_server_IP>/ufm

https://<UFM_server_IP>/ufm



The image shows a login form for the NVIDIA UFM. At the top, there is a black header bar containing the NVIDIA logo (a green eye-like shape) and the text 'nVIDIA. UFM'. Below the header, there are two white input fields with rounded corners. The first field is labeled 'Username' and the second is labeled 'Password'. Below the password field is a green rectangular button with the word 'Login' in white text.

2. In the Login page, enter your **User Name** and your predefined user **Password** and click **Login**.

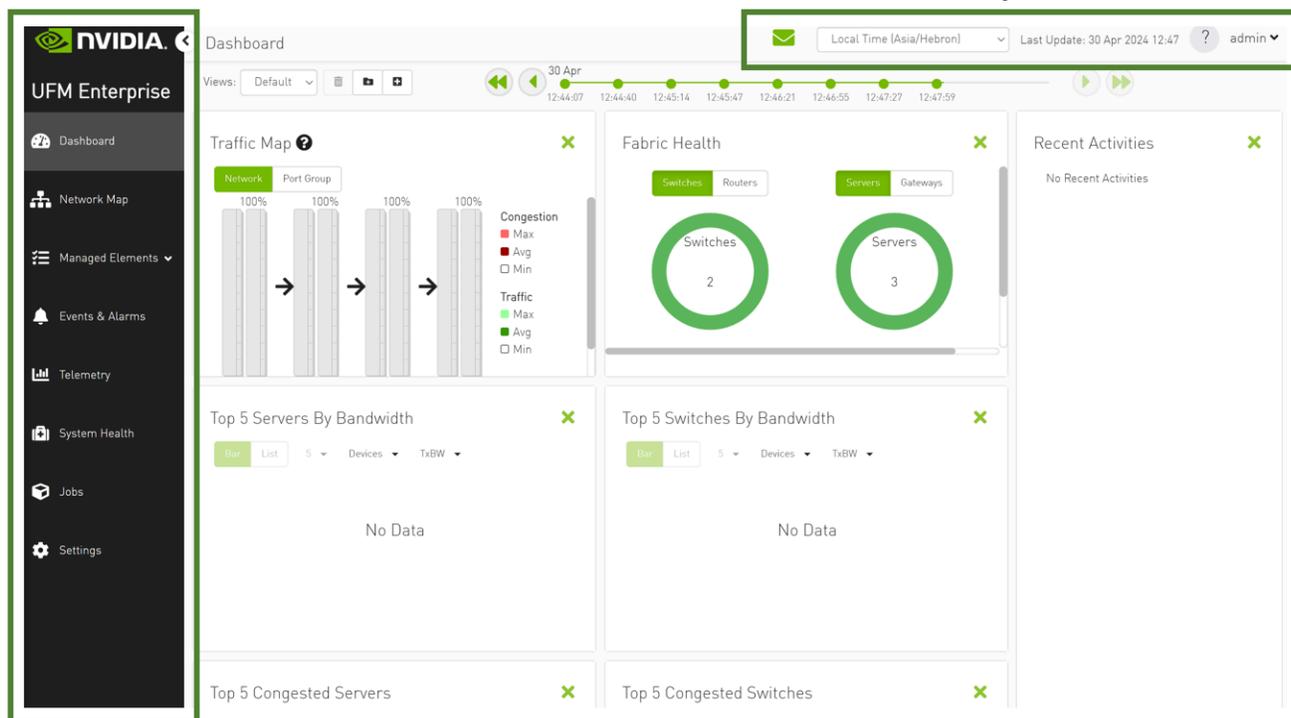
Once you have entered your user name and password, the main window shows the UFM Dashboard. For more information, see the [Fabric Dashboard](#).

WebUI Layout

The UFM WebUI contains two main areas:

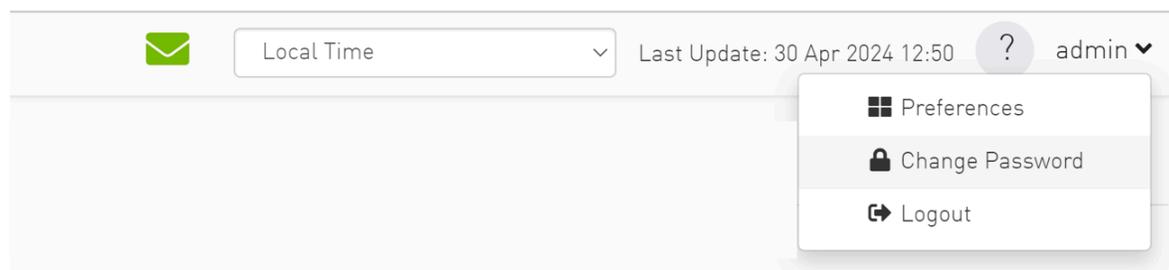
1. Top Bar - Contains local time zone and user information on the top right side of the screen.
2. Sidebar Menu - Contains a taskbar accessible from a sidebar menu on the left side of the screen. For more information on each tab, refer to [UFM Web UI](#).

Sidebar Menu



Top Bar

Each user can customize the UFM display, time zone, and date format, change their account password, and manage their preferences. For details, refer to [Set User Preferences](#).



Sidebar Menu

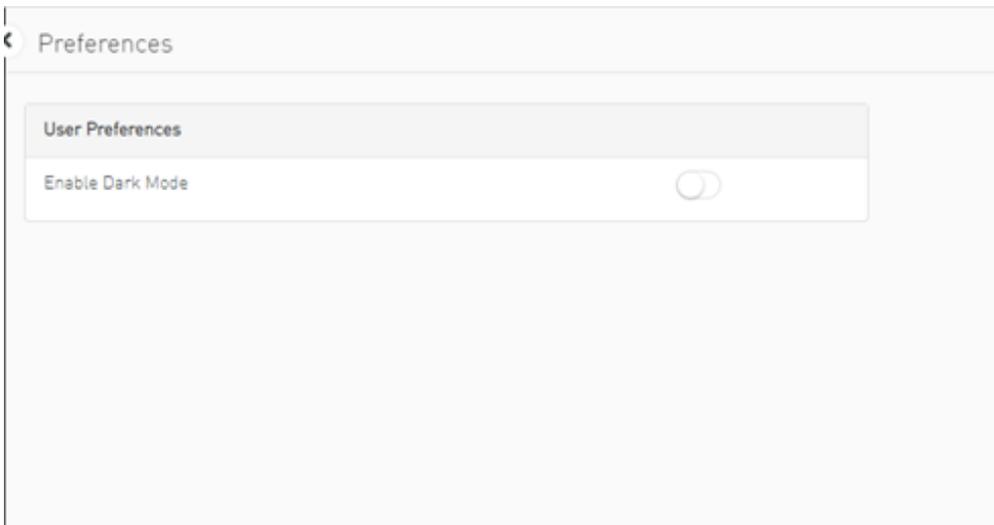
Tab Icon	Description
 Dashboard	Provides a summary view of the fabric status.
 Network Map	Provides a hierarchical topology view of the fabric.
 Managed Elements	Provides information on all fabric devices. This information is presented in a table format.
 Logical Elements	Provides information on all logical servers. This information is presented in a table format.
 Events & Alarms	Provides information on the events & alarms generated by the system.
 Telemetry	Enables establishing monitoring sessions on devices or ports.
 System Health	Enables running and viewing fabric reports, UFM reports, and system logs. You can also back up UFM configuration files.
 Jobs	Provides information on all jobs created, as a result of UFM actions.
 Settings	Enables configuring UFM server and UFM fabric settings, including events policy, device access, network management, subnet manager, and user management

Set User Preferences

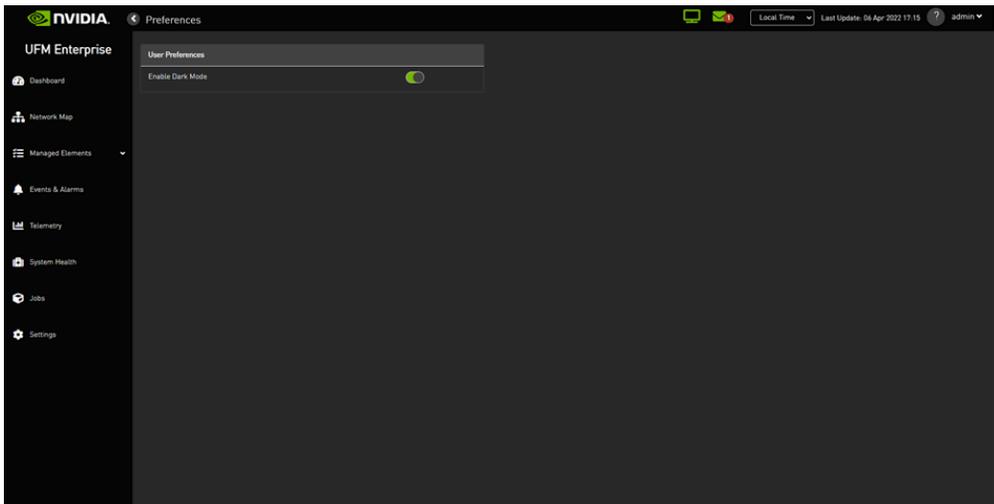
This section describes how to customize your UFM display settings and change your password,

Dark/Light Theme

1. Select **Preferences**.



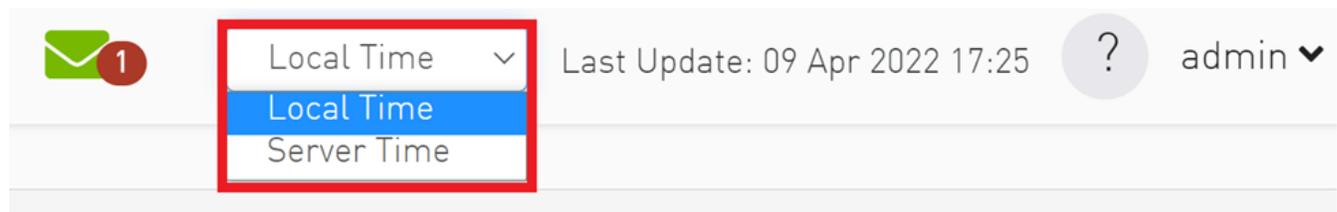
2. In **User Preferences**, enable dark mode for UFM presentation in a dark theme. The following figure shows the dark theme:



Time Zone Converter

Allows you to unify all times in UFM like events and alarms, ibdiagnet, telemetry and logs. You can switch between local and machine time.

In the status bar drop-down menu, switch between local and server/machine time.



Events & Alarms Local Time Last Update: 09 Apr 2022 17:25 ? admin

Alarms

Clear All Alarms ↻ Displayed Columns CSV

Severity	Date/Time ↓	Alarm Name	Source	Source Type	Reason	Count
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 17:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Warning	2022-04-05 15:26:47	Unhealthy IB...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1
Warning	2022-04-05 15:26:27	Unhealthy IB...	default(3) / Switch: SwitchIB Mell	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1

Events & Alarms Server Time Last Update: 09 Apr 2022 11:31 ? admin

Alarms

Clear All Alarms ↻ Displayed Columns CSV

Severity	Date/Time ↓	Alarm Name	Source	Source Type	Reason	Count
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Minor	2022-04-09 11:25:09	Non-optimal ...	default(3) / Switch: SwitchIB Mell	IBPort	Found a [25.0] link that operates in [14.0] speed mode.	1180
Warning	2022-04-05 9:26:47	Unhealthy IB...	default(3) / Switch: r-hyp-sw-01 /	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1
Warning	2022-04-05 9:26:27	Unhealthy IB...	default(3) / Switch: SwitchIB Mell	IBPort	Peer Port is considered by SM as unhealthy due to MANUAL.	1

Note

In the screenshots, the difference between Server Time and Local Time is 6 hours.

Table Enhancements

Look and Feel Improvements

All Displayed Columns

Severity	Name	GUID	Type	Model	IP	Firmware Ve...
<input checked="" type="checkbox"/> Info	r-hyp-sw-01	0x248a070300...	switch	MSB7700	N/A	N/A
<input checked="" type="checkbox"/> Info	SwitchIB Mell...	0xe41d2d0300...	switch	EDR	N/A	N/A
<input checked="" type="checkbox"/> Info	ufm-host86	0x7cfe9003002...	host	Computer	192.168....	N/A
<input checked="" type="checkbox"/> Info	r-ufm254-hyp...	0x043f720300d...	host	Computer	N/A	N/A
<input checked="" type="checkbox"/> Info	r-ufm254-hyp...	0x0c42a10300...	host	Computer	N/A	N/A

Viewing 1-5 of 5 10

Displayed Columns

Displayed Columns

ID ↓ 1	Description	Created ↓ 2	Last Update ↓ 3	Status	Summary
2	mark_device_healthy	2022-10-20 17:03:14	2022-10-20 17:03:14	Completed	View Summary
1	mark_device_unhealthy	2022-10-20 17:02:24	2022-10-20 17:02:24	Completed	View Summary

Restore Default

- ID
- Description
- Created
- Last Update
- Status
- Summary
- Progress

Viewing 1 of 2 10

Last Update ↓ 3	Status	Summary
2022-10-20 17:03:14	Completed	View Summary
2022-10-20 17:02:24	Completed	View Summary

Note

Displayed columns of all tables are persistent per user, with the option to restore defaults.

Export All Data as CSV

There are two options for exporting as CSV

- All Data: all data returned from server.
- Displayed Data: only displayed rows.

>

All  Displayed Columns  CSV 

S...	Name	GUID	Type	Model	IP	
 Filter...	 Filter...	 Filter...	 Filter...	 Filter...	 Filter...	<div style="border: 1px solid #ccc; padding: 2px;"> All Data Displayed Data </div>
 I...	r-hyp-sw-01	0x248a070300...	switch	 MSB7700	N/A	N/A
 I...	SwitchIB Mell...	0xe41d2d0300...	switch	 EDR	N/A	N/A
 I...	ufm-host86	0x7cfe9003002...	host	 Computer	192.168.1.30	N/A
 I...	r-ufm254-hyp...	0x043f720300d...	host	 Computer	N/A	N/A
 I...	r-ufm254-hyp...	0x0c42a10300...	host	 Computer	N/A	N/A

Viewing 1-5 of 5     10 

Multi-Subnet UFM

Overview

The Multi-Subnet UFM feature allows for the management of large fabrics, consisting of multiple sites, within a single product, namely Multi-Subnet UFM.

This feature is comprised of two layers: UFM Multi-Subnet Provider and UFM Multi-Subnet Consumer.

The UFM Provider functions as a Multi-Subnet Provider, exposing all local InfiniBand fabric information to the UFM consumer. On the other hand, the UFM Consumer acts as a Multi-Subnet Consumer, collecting and aggregating data from currently configured UFM Providers, enabling users to manage multiple sites in one place. While UFM Consumer offers similar functionality to regular UFM, there are several behavioral differences related to aggregation.

Setting Up Multi-Subnet UFM

In `/opt/ufm/files/conf/gv.cfg`, fill in the section named `[Multisubnet]` for UFM Multi-Subnet Provider and Consumer.

To set up UFM as a Multi-Subnet Provider, perform the following:

- Set `multisubnet_enabled` to `true`
- Set `multisubnet_role` to `provider`
- Set `multisubnet_site_name` (optional, if not set, it will be randomly generated); e.g., `provider_1`
- Start UFM

To set up UFM as a Multi-Subnet Consumer, perform the following:

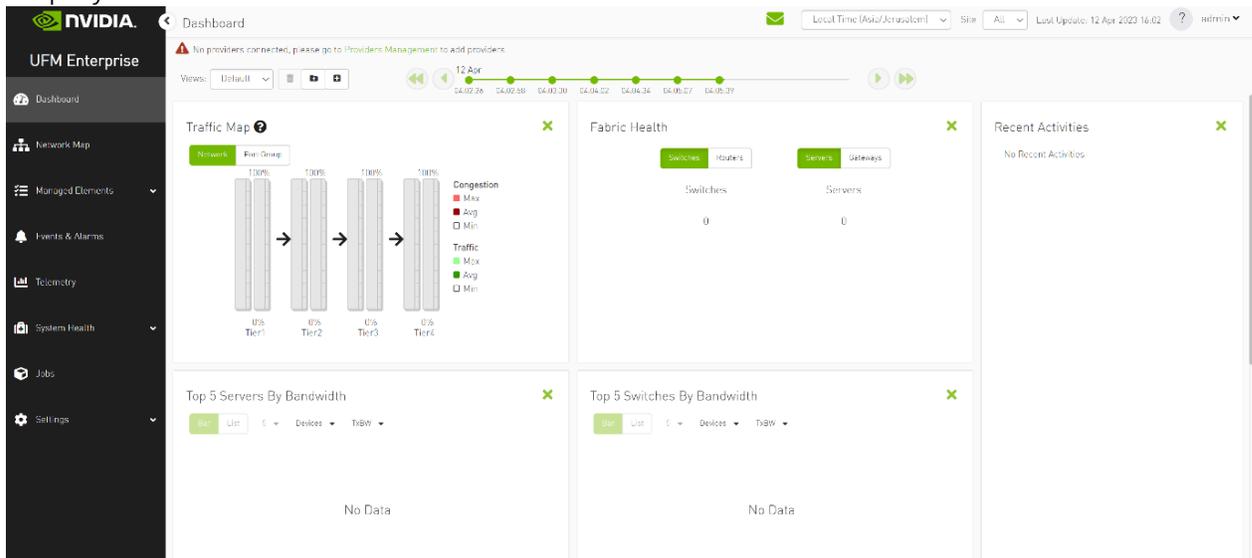
- Set `multisubnet_enabled` to `True`
- Set `multisubnet_role` to `consumer`

- Start UFM

It is important to note that UFM Multi-Subnet Consumer can be configured on a machine or VM without an established InfiniBand connectivity. Additionally, users may customize UFM Provider and Consumer using optional configuration parameters found in the [Multisubnet] section of `/opt/ufm/files/conf/gv.cfg`.

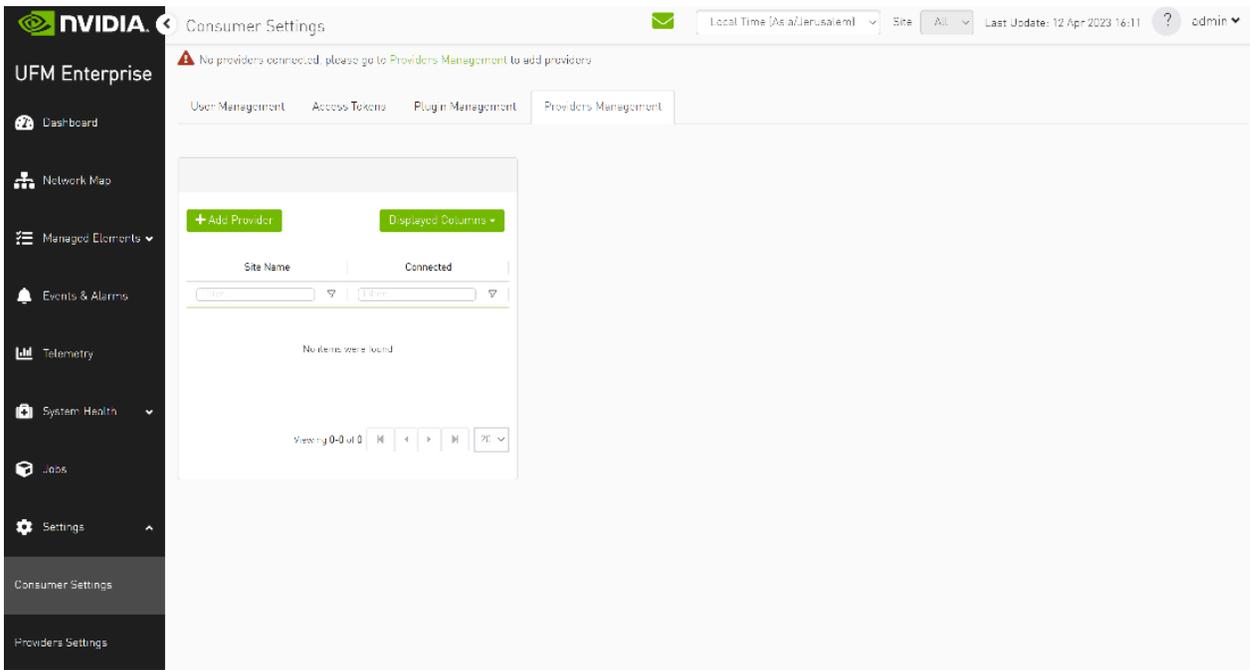
Functionality

1. Following the initial launch of the Consumer, the Dashboard view is devoid of data, and a message containing a hyperlink leading to the Provider Management section is displayed.



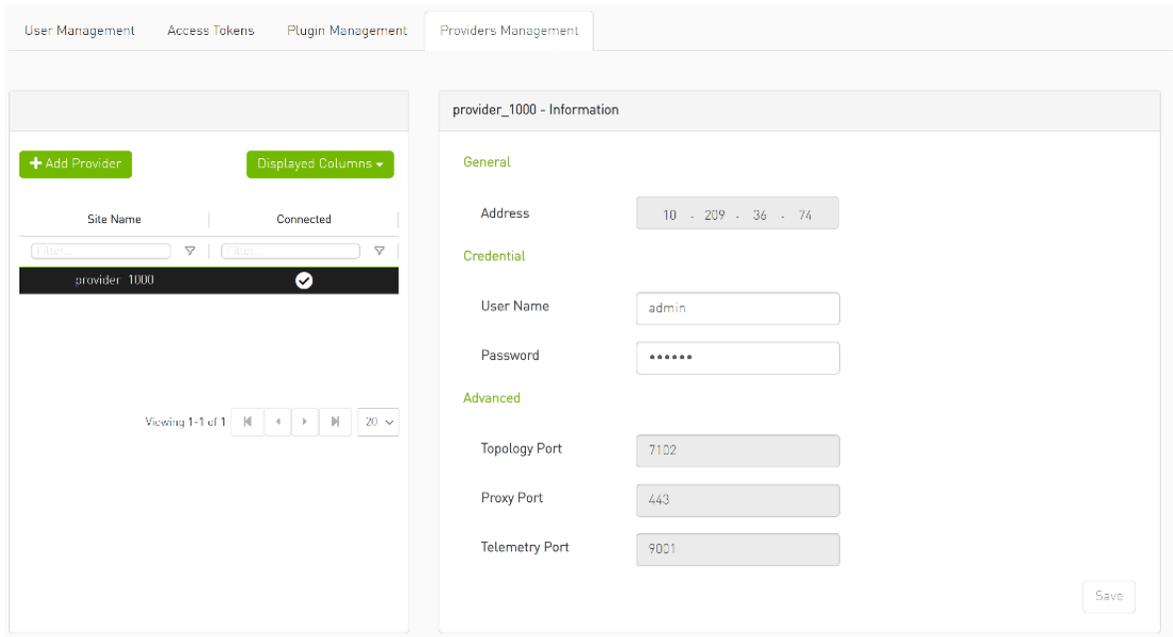
 No providers connected, please go to [Providers Management](#) to add providers

2. As shown in the below snapshot, a new section for Provider Management has been added, enabling users to configure UFM Providers.

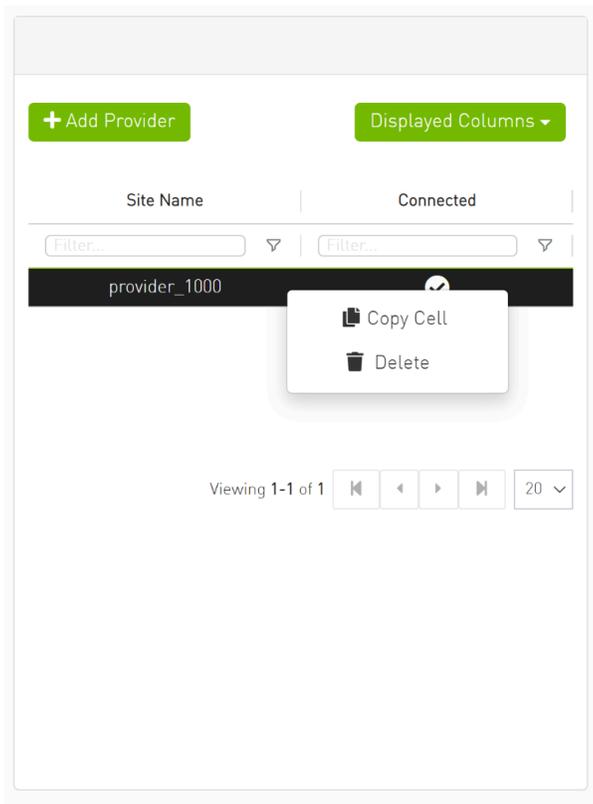


1. To add a provider, the user is required to enter its IP address and credentials. Unless there are multiple instances of UFM providers on a single machine, the advanced section parameters should be set with default values. However, if there are multiple instances, the advanced parameters may be set per Provider and then be configured in the Providers Management view.

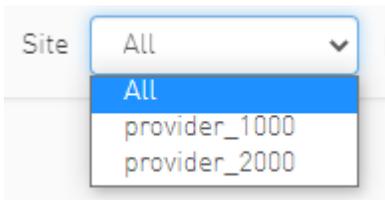
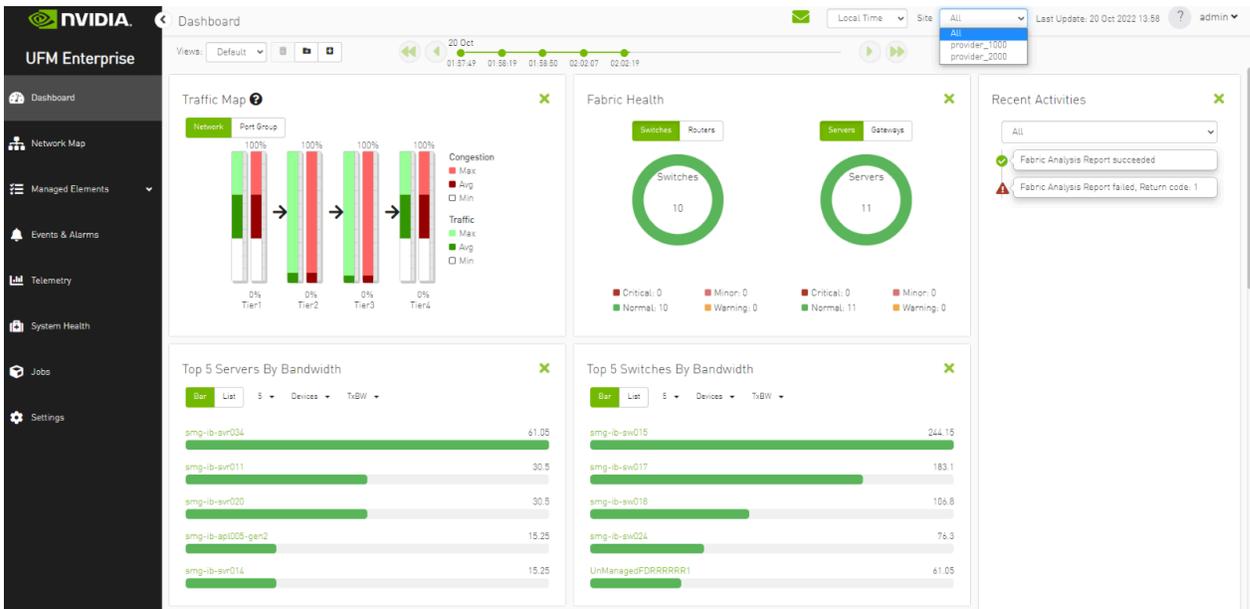
2. By editing the Provider view, you can change Provider's credentials.



3. The "Delete Provider" function removes the selected Provider from the Consumer. Please note that this action may take some time to complete, and changes may only be reflected in the view after approximately 30 seconds.



3. A general filter has been added to the top right corner of the page, enabling users to filter displayed data by site.



Local Time (Asia/Jerusalem) Site: All Last Update: 12 Apr 2023 16:35 admin

Severity	Name	GUID	Type	Model	IP	Firmware Version	Site Name
Warn...	r-utm83	0xecDd9a0300b15214	host		0.0.0.0	16.33.1048	provider_2000
Info	sharp2	0x7cfe900300a5a7a0	switch	MS18/800	0.0.0.0		provider_1000
Info	switchib	0xecDd9a030079dba0	switch	FDR	0.0.0.0		provider_1000
Info	utm-host87	0xecDd9a03007d7f0a	host		0.0.0.0		provider_1000
Info	r-utm214-hyp-04	0x043f720300d1d3c	host		0.0.0.0		provider_1000
Info	r-utm214-hyp-03	0x0c47a103007aca90	host		0.0.0.0		provider_1000
Warn...	desc1	0x043f720300206650	switch	FDR	0.0.0.0	15.2007.354	provider_2000
Info	node001	0xecDd9a0300c04b74	host		0.0.0.0	16.31.1046	provider_2000
Info	swx-tor01	0xecDd9a0300469ffc	host		0.0.0.0		provider_2000

Viewing 1-9 of 9

Devices Local Time (Asia/Jerusalem) Site provider_2000 Last Update: 12 Apr 2023 16:35 admin

All Types All Groups Displayed Columns CSV

Severity	Name	GUID	Type	Model	IP	Firmware Version	Site Name
Warn...	r-ufm83	0xec0d9a0300bf52f4	host		0.0.0.0	16.33.1048	provider_2000
Warn...	desc1	0x043f720300206650	switch	EDR	0.0.0.0	15.2007.354	provider_2000
Info	node001	0xec0d9a0300c04bf4	host		0.0.0.0	16.31.1046	provider_2000
Info	swx-tor01	0xec0d9a0300469ffc	host		0.0.0.0		provider_2000

Viewing 1-4 of 4

4. Network map contains “clouds” for each provider.

Network Map Local Time Site All Last Update: 20 Oct 2022 14:44 admin

Layout: Hierarchical Graph Views: Default Regex Filters: Starts With: Enter filter

View Zoom In Filters: Select nodes to highlight and display in Zoom In tab



4 Nodes
provider_2000



19 Nodes
provider_1000

View Properties

Display Label: System Name

Type

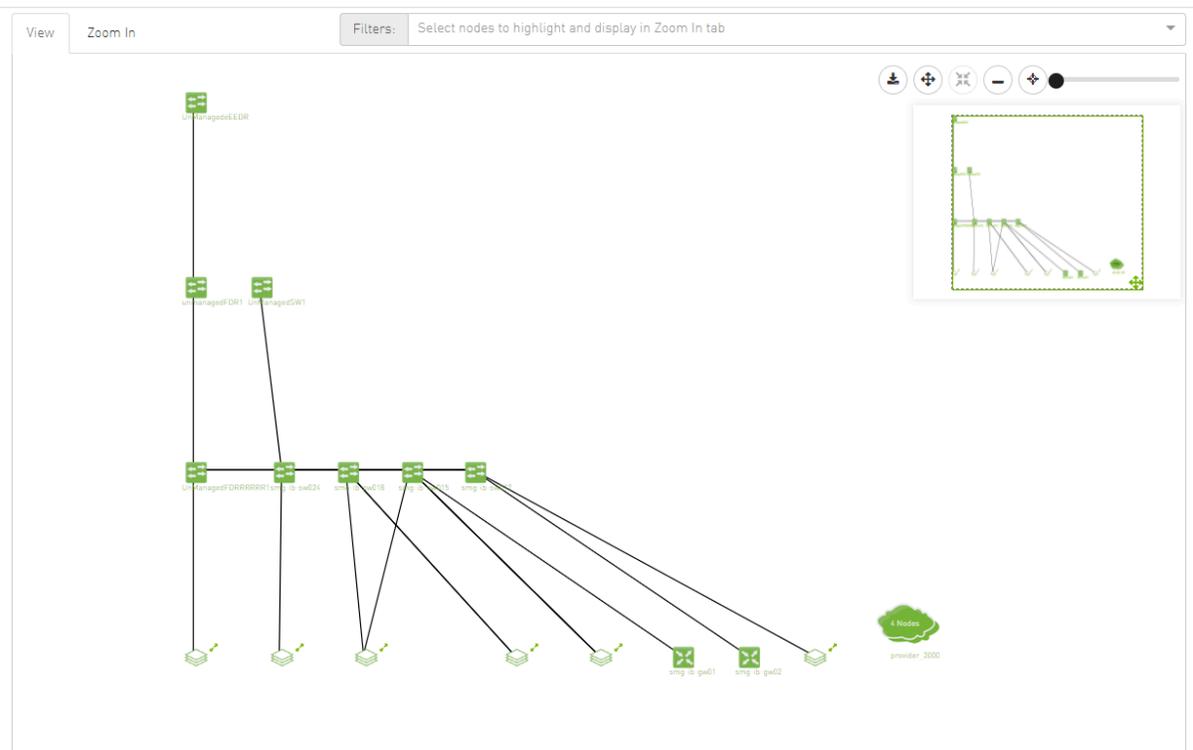
- Rack
- Host
- Gateway
- Switch
- Router

Severity

- Info
- Warning
- Minor
- Critical

Network Analysis

- Link Analysis



5. A "Site Name" column is present in all Managed Elements sections. The column is disabled (hidden) by default.

Displayed Columns CS

Restore Default

- Severity
- Name
- GUID
- Type
- Model
- IP
- Firmware Version
- Site Name

Devices Local Time (Asia/Jerusalem) Site All Last Update: 12 Apr 2023 16:56 admin

All Types All Groups Displayed Columns CSV

Severity	Name	GUID	Type	Model	IP
Info	r-ufm83	0xec0d9a0300b52f4	host		0.0.0.0
Info	sharp2	0x7cfe900300a5a2a0	switch	MSB7800	0.0.0.0
Info	switchib	0xec0d9a030029dba0	switch	LDIR	0.0.0.0
Info	ufm-host87	0xec0d9a03007d7f0a	host		0.0.0.0
Info	r-ufm254-hyp-04	0x043f720300d1d3c	host		0.0.0.0
Info	r-ufm254-hyp-03	0x0c42a103007aca90	host		0.0.0.0
Info	desc1	0x043f720300206650	switch	FDR	0.0.0.0
Info	node001	0xec0d9a0300c04bf4	host		0.0.0.0
Info	swx-tor01	0xec0d9a0300469ffc	host		0.0.0.0

Viewing 1-9 of 9

Restore Default

- Severity
- Name
- GUID
- Type
- Model
- IP
- Firmware Version
- Site Name

Devices Local Time (Asia/Jerusalem) Site All Last Update: 12 Apr 2023 16:56 admin

All Types All Groups Displayed Columns CSV

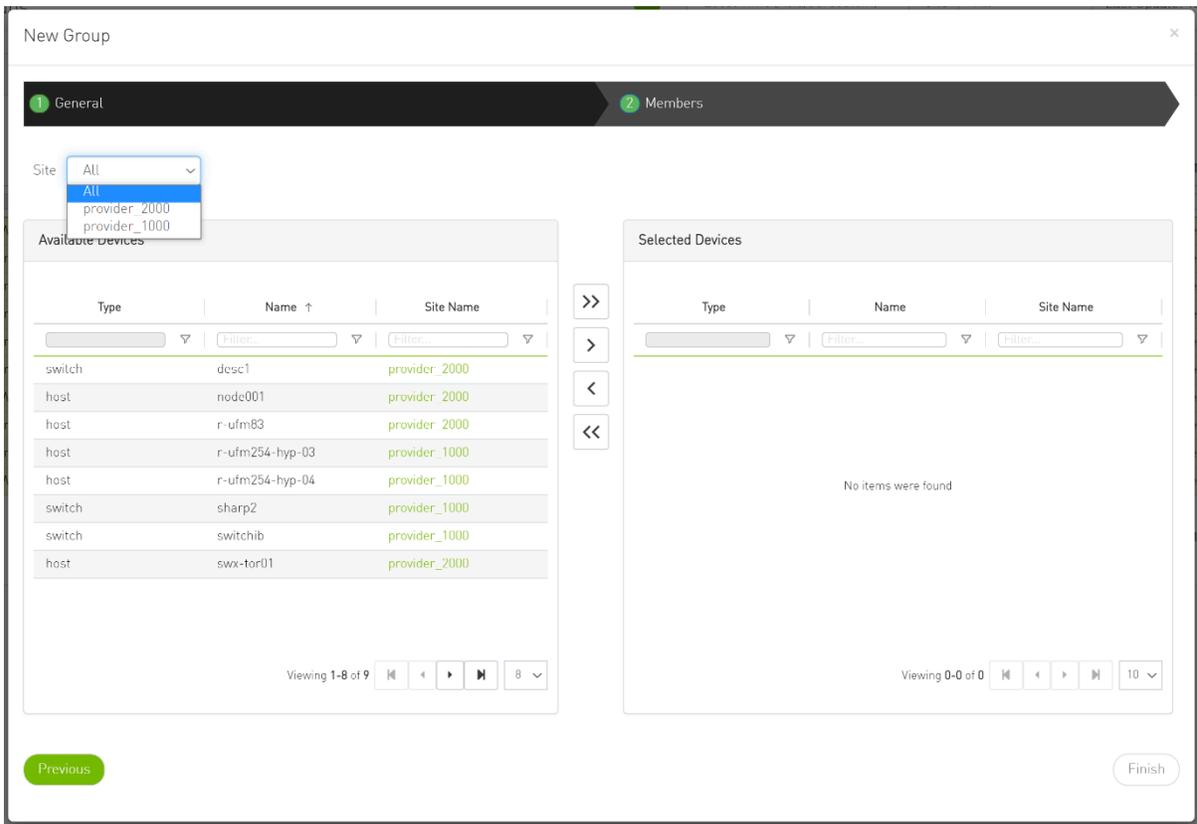
Severity	Name	GUID	Type	Model	IP	Site Name
Info	r-ufm83	0xec0d9a0300b52f4	host		0.0.0.0	provider_2000
Info	sharp2	0x7cfe900300a5a2a0	switch	MSB7800	0.0.0.0	provider_1000
Info	switchib	0xec0d9a030029dba0	switch	EDR	0.0.0.0	provider_1000
Info	ufm-host87	0xec0d9a03007d7f0a	host		0.0.0.0	provider_1000
Info	r-ufm254-hyp-04	0x043f720300d1d3c	host		0.0.0.0	provider_1000
Info	r-ufm254-hyp-03	0x0c42a103007aca90	host		0.0.0.0	provider_1000
Info	desc1	0x043f720300206650	switch	EDR	0.0.0.0	provider_2000
Info	node001	0xec0d9a0300c04bf4	host		0.0.0.0	provider_2000
Info	swx-tor01	0xec0d9a0300469ffc	host		0.0.0.0	provider_2000

Viewing 1-9 of 9

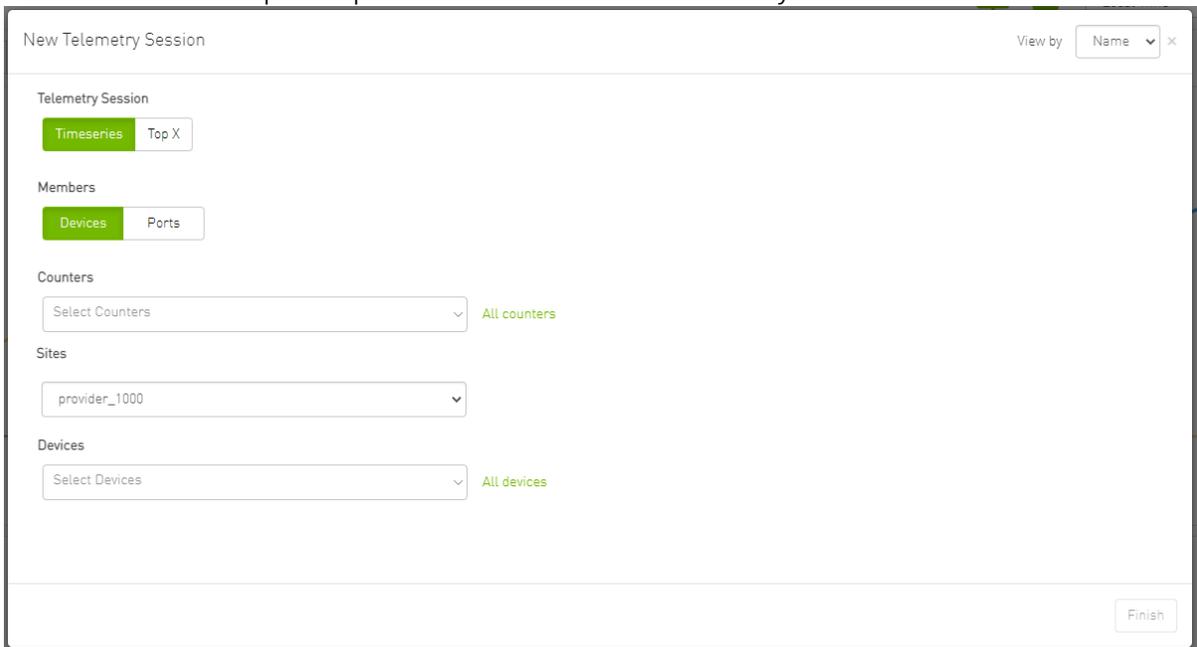
Restore Default

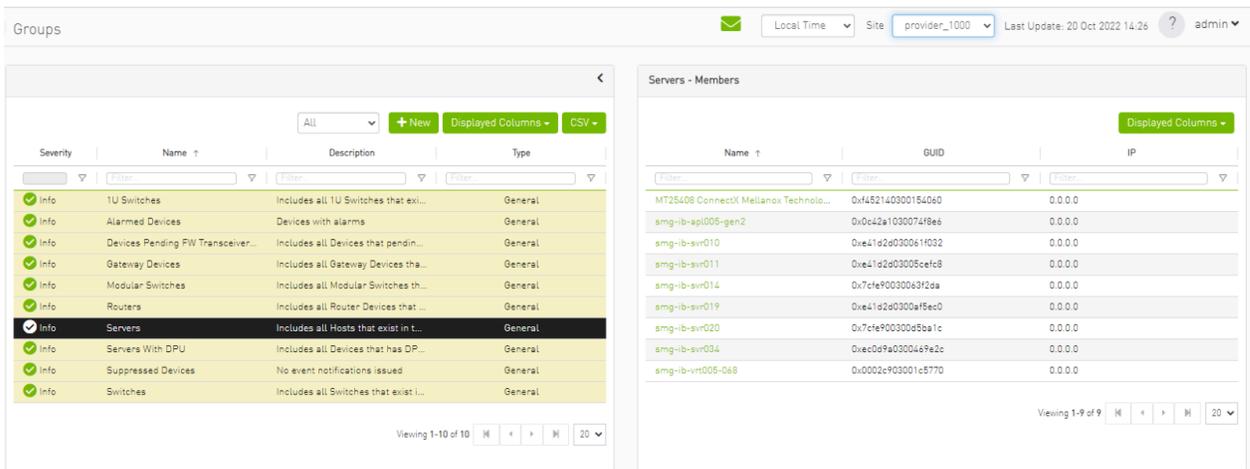
- Severity
- Name
- GUID
- Type
- Model
- IP
- Firmware Version
- Site Name

6. The "Group" and "Telemetry" sections include "Site" filters.



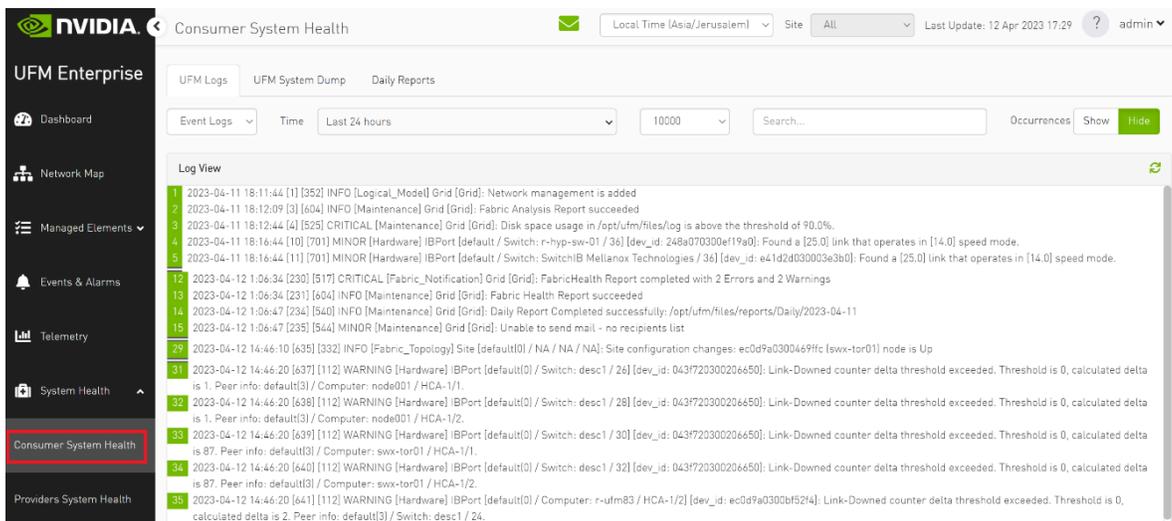
7. The filter in "Groups" impacts the Members table only.



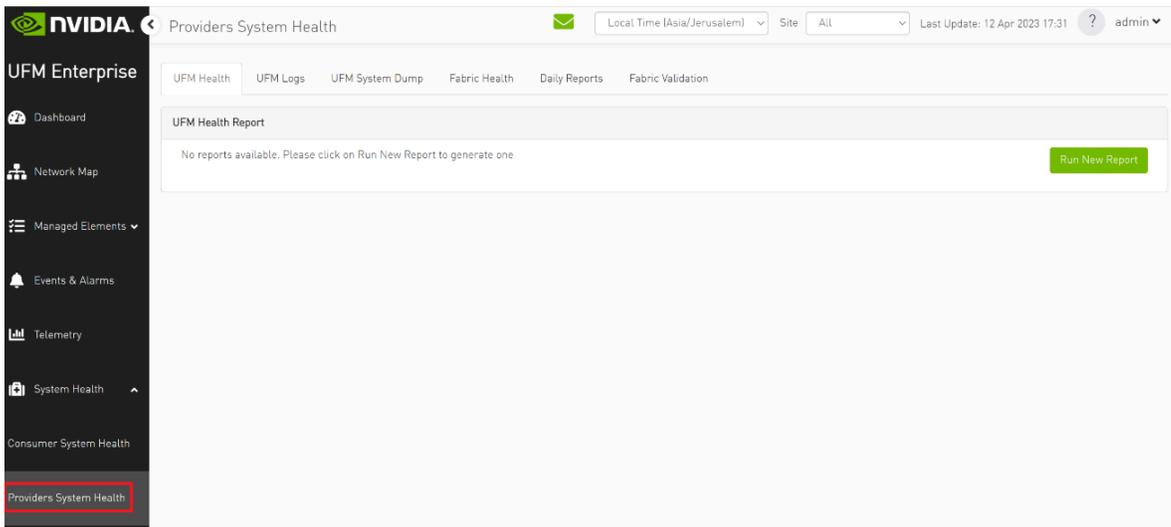


8. In the System Health tab, subsections for Consumer and Provider are available.

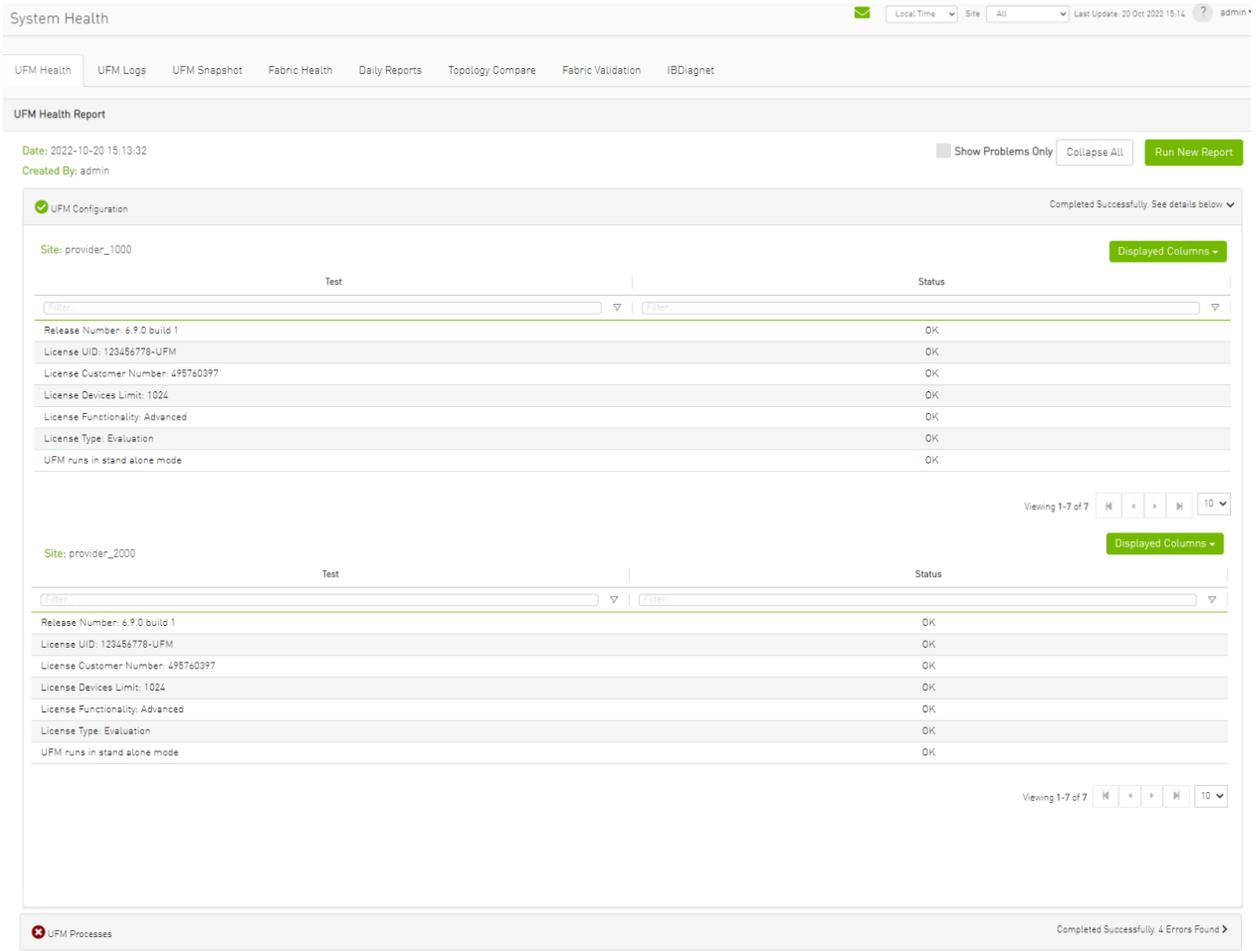
1. Consumer System Health tab contains sections applicable to Consumer UFM specifically (e.g., logs from Consumer UFM).



2. Provider System Health contains sections applicable to one or multiple providers (e.g., Fabric Health Report can be triggered on multiple Providers from the Consumer).



9. UFM Health tab contains sub report tables for each provider.



10. Fabric Health contains sub report tables for each provider.

System Health Local Time Site All Last Update: 20 Oct 2022 15:14 admin

UFM Health UFM Logs UFM Snapshot **Fabric Health** Daily Reports Topology Compare Fabric Validation IBDiagnet

Fabric Health Report

Date: 2022-10-20 14:49:44 Show Problems Only Collapse All Run New Report

Created By: admin

Report Summary

Site: provider_1000 Displayed Columns

Fabric Test	Warnings	Errors	Total
Non-unique and Zero LID Values	0	0	0
Non-unique Node Descriptions	2	0	2
SM Status	0	0	0
Bad Links	0	0	0
Link Width	0	0	0
Link Speed	0	6	6
Firmware Versions	2	0	2
UFM Alarms	0	1	1
BER Error and Warning check	0	0	0
Symbol BER Error and Warning check	0	0	0

Viewing 1-10 of 11

Site: provider_2000 Displayed Columns

Fabric Test	Warnings	Errors	Total
Non-unique and Zero LID Values	0	0	0
Non-unique Node Descriptions	2	0	2
SM Status	0	0	0
Bad Links	0	0	0
Link Width	0	0	0
Link Speed	0	6	6
Firmware Versions	2	0	2
UFM Alarms	198	2	200
BER Error and Warning check	0	0	0
Symbol BER Error and Warning check	0	0	0

Viewing 1-10 of 11

Fabric Summary

11. Daily Reports:

1. Consumer Daily reports display consumer reports.

Consumer System Health Local Time (Asia/Jerusalem) Site All

UFM Logs UFM System Dump **Daily Reports**

Recipients List Displayed Columns

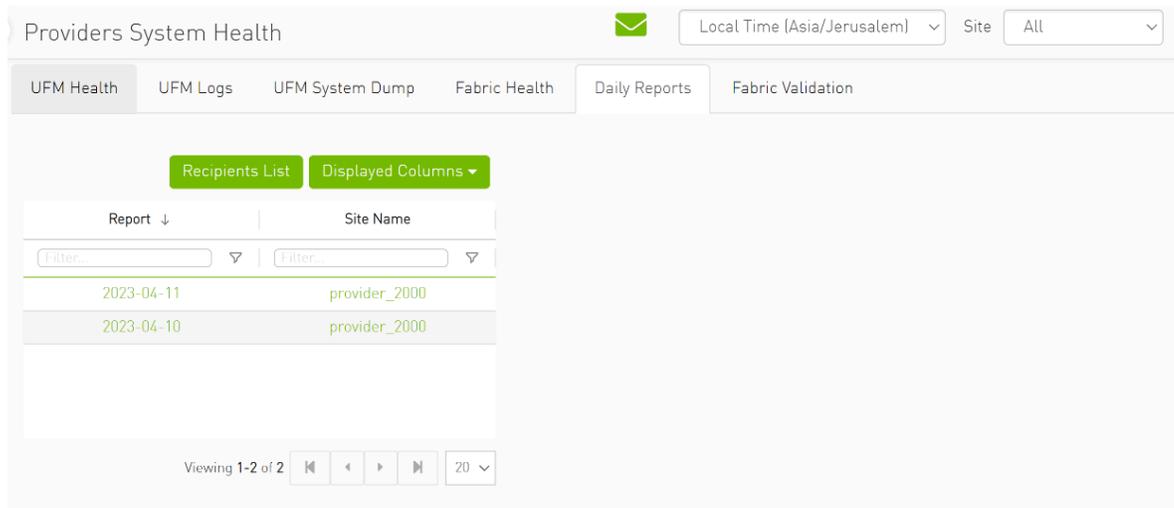
Report ↓

Filter

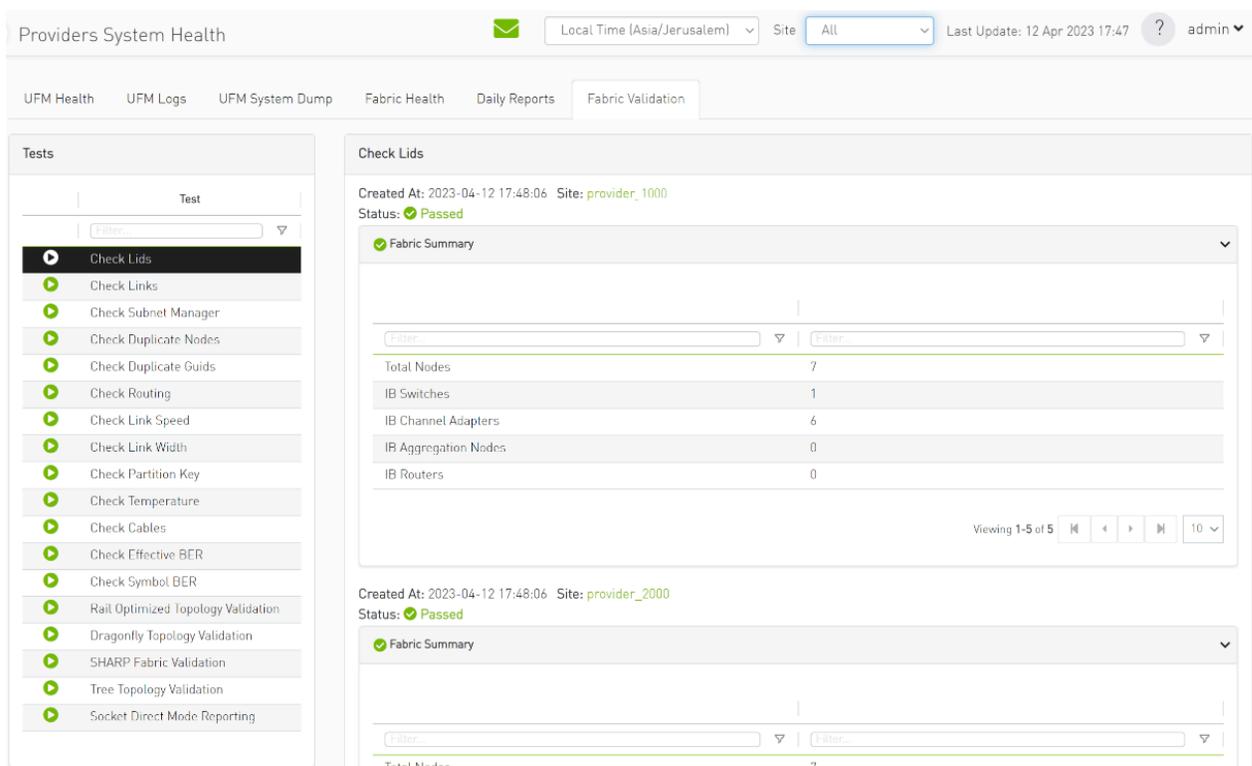
2023-04-11

Viewing 1-1 of 1 20

2. Providers Daily reports display reports from all providers.



12. The "Fabric Validation" tab contains sub report tables for each provider.



13. In "UFM Logs" Tab:

1. Consumer logs:

Consumer System Health

Local Time (Asia/Jerusalem) Site All Last Update: 12 Apr 2023 18:01 admin

UFM Logs UFM System Dump Daily Reports

Event Logs Time Last 24 hours 10000 Search... Occurrences Show Hide

Log View

- 1 2023-04-11 18:11:44 [1] [352] INFO [Logical_Model] Grid [Grid]: Network management is added
- 2 2023-04-11 18:12:09 [3] [604] INFO [Maintenance] Grid [Grid]: Fabric Analysis Report succeeded
- 3 2023-04-11 18:12:44 [4] [525] CRITICAL [Maintenance] Grid [Grid]: Disk space usage in /opt/ufm/files/log is above the threshold of 90.0%
- 4 2023-04-11 18:16:44 [10] [701] MINOR [Hardware] IBPort [default / Switch: r-hyp-sw-01 / 36] [dev_id: 268a070300e1f9a0]: Found a [25.0] link that operates in [14.0] speed mode.
- 5 2023-04-11 18:16:44 [11] [701] MINOR [Hardware] IBPort [default / Switch: SwitchB Mellanox Technologies / 36] [dev_id: e41d2d030003e3b0]: Found a [25.0] link that operates in [14.0] speed mode.
- 12 2023-04-12 1:06:34 [230] [517] CRITICAL [Fabric_Notification] Grid [Grid]: FabricHealth Report completed with 2 Errors and 2 Warnings
- 13 2023-04-12 1:06:34 [231] [604] INFO [Maintenance] Grid [Grid]: Fabric Health Report succeeded
- 14 2023-04-12 1:06:47 [234] [540] INFO [Maintenance] Grid [Grid]: Daily Report Completed successfully:/opt/ufm/files/reports/Daily/2023-04-11
- 15 2023-04-12 1:06:47 [235] [544] MINOR [Maintenance] Grid [Grid]: Unable to send mail - no recipients list
- 29 2023-04-12 14:46:10 [635] [332] INFO [Fabric_Topology] Site [default(0) / NA / NA / NA]: Site configuration changes: ec0d9a0300469ffc (swx-tor01) node is Up
- 31 2023-04-12 14:46:20 [637] [112] WARNING [Hardware] IBPort [default(0) / Switch: desc1 / 26] [dev_id: 043f720300206650]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 1. Peer info: default(3) / Computer: node001 / HCA-1/1.
- 32 2023-04-12 14:46:20 [638] [112] WARNING [Hardware] IBPort [default(0) / Switch: desc1 / 28] [dev_id: 043f720300206650]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 1. Peer info: default(3) / Computer: node001 / HCA-1/2.
- 33 2023-04-12 14:46:20 [639] [112] WARNING [Hardware] IBPort [default(0) / Switch: desc1 / 30] [dev_id: 043f720300206650]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 87. Peer info: default(3) / Computer: swx-tor01 / HCA-1/1.
- 34 2023-04-12 14:46:20 [640] [112] WARNING [Hardware] IBPort [default(0) / Switch: desc1 / 32] [dev_id: 043f720300206650]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 87. Peer info: default(3) / Computer: swx-tor01 / HCA-1/2.
- 35 2023-04-12 14:46:20 [641] [112] WARNING [Hardware] IBPort [default(0) / Computer: r-ufm83 / HCA-1/2] [dev_id: ec0d9a0300b52f4]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 2. Peer info: default(3) / Switch: desc1 / 24.
- 36 2023-04-12 16:28:20 [642] [332] INFO [Fabric_Topology] Site [default(0) / NA / NA / NA]: Site configuration changes: ec0d9a0300b52f4 (r-ufm83) node is Up
- 38 2023-04-12 16:29:10 [644] [525] CRITICAL [Maintenance] Grid [Grid]: Disk space usage in /opt/ufm/tmp is above the threshold of 80.0%
- 39 2023-04-12 16:29:10 [645] [605] CRITICAL [Maintenance] Grid [Grid]: Fabric Analysis Report failed, Return code: 1
- 40 2023-04-12 16:31:40 [647] [112] WARNING [Hardware] IBPort [default(6) / Computer: r-ufm83 / HCA-1/2] [dev_id: ec0d9a0300b52f4]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta is 2. Peer info: default(3) / Switch: desc1 / 24.
- 41 2023-04-12 16:31:40 [648] [112] WARNING [Hardware] IBPort [default(6) / Switch: desc1 / 26] [dev_id: 043f720300206650]: Link-Downed counter delta threshold exceeded. Threshold is 0, calculated delta

2. Providers logs display providers log separately, displaying logs for all providers is not supported.

Providers System Health

Local Time (Asia/Jerusalem) Site provider_2000 Last Update: 12 Apr 2023 18:05 admin

UFM Health UFM Logs UFM System Dump Fabric Health Daily Reports Fabric Validation

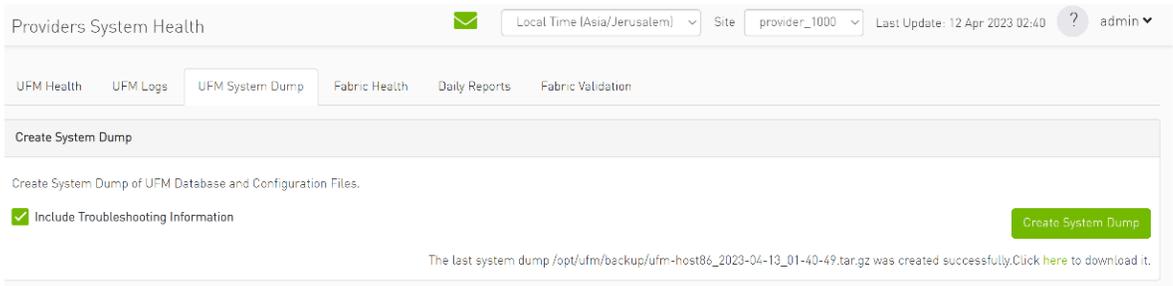
Event Logs Time Last 24 hours 10000 Search... Occurrences Show Hide

Log View

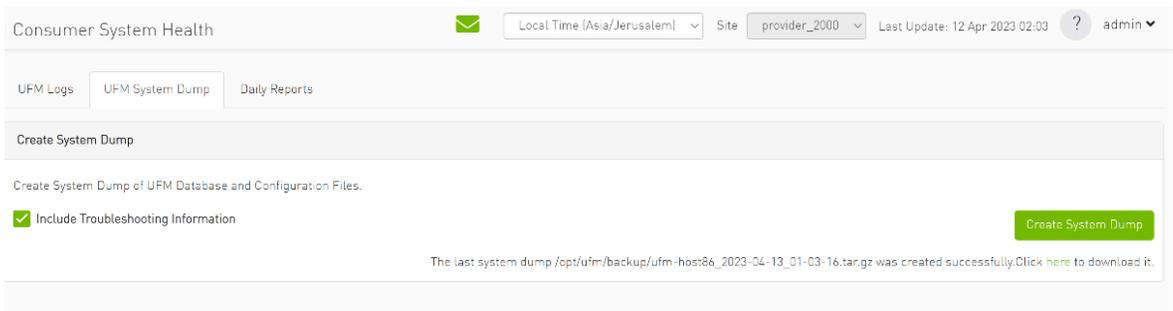
- 1 2023-04-12 1:07:52 [53] [516] WARNING [Fabric_Notification] Grid [Grid]: FabricHealth Report completed with 4 Warnings
- 2 2023-04-12 1:07:52 [54] [604] INFO [Maintenance] Grid [Grid]: Fabric Health Report succeeded
- 3 2023-04-12 1:08:03 [55] [540] INFO [Maintenance] Grid [Grid]: Daily Report Completed successfully:/opt/ufm/files/reports/Daily/2023-04-11
- 4 2023-04-12 1:08:03 [56] [544] MINOR [Maintenance] Grid [Grid]: Unable to send mail - no recipients list
- 5 2023-04-12 2:34:20 [57] [65] WARNING [Fabric_Notification] IBPort [default(3) / Computer: swx-tor01 / HCA-1/2] [dev_id: ec0d9a0300469ffc]: GID Address Out of Service: prefix fe80000000000000.guid ec0d9a0300469fd Link Source 043f720300206650_32 TO Dest: ec0d9a0300469fd_2
- 6 2023-04-12 2:34:20 [58] [65] WARNING [Fabric_Notification] IBPort [default(3) / Computer: swx-tor01 / HCA-1/1] [dev_id: ec0d9a0300469ffc]: GID Address Out of Service: prefix fe80000000000000.guid ec0d9a0300469fc Link Source 043f720300206650_30 TO Dest: ec0d9a0300469fc_1
- 7 2023-04-12 2:34:20 [59] [329] WARNING [Fabric_Topology] Link [Source 043f720300206650_30 TO Dest: ec0d9a0300469fc_1]: Link went down: [Switch:desc1:30]043f720300206650:30 - [Computer:swx-tor01 mlx5_0]ec0d9a0300469fc:1, cable S/N: MT2042V504276
- 8 2023-04-12 2:34:20 [60] [329] WARNING [Fabric_Topology] Link [Source 043f720300206650_32 TO Dest: ec0d9a0300469fd_2]: Link went down: [Switch:desc1:32]043f720300206650:32 - [Computer:swx-tor01 mlx5_1]ec0d9a0300469fc:2, cable S/N: MT2042V504200
- 9 2023-04-12 2:34:20 [61] [331] WARNING [Fabric_Topology] Site [default(2) / NA / NA / NA]: Site configuration changes: ec0d9a0300469ffc (swx-tor01) node is Down
- 10 2023-04-12 2:36:45 [63] [64] INFO [Fabric_Notification] Site [default(2) / NA / NA / NA]: GID Address In Service: prefix fe80000000000000.guid ec0d9a0300469fd
- 11 2023-04-12 2:36:50 [65] [332] INFO [Fabric_Topology] Site [default(3) / NA / NA / NA]: Site configuration changes: ec0d9a0300469ffc (swx-tor01) node is Up
- 12 2023-04-12 2:36:50 [66] [329] INFO [Fabric_Topology] Link [Source 043f720300206650_30 TO Dest: ec0d9a0300469fc_1]: Link is up: [Switch:desc1:30]043f720300206650:30 - [Computer:swx-tor01 mlx5_0]ec0d9a0300469fc:1
- 13 2023-04-12 2:36:50 [67] [328] INFO [Fabric_Topology] Link [Source 043f720300206650_32 TO Dest: ec0d9a0300469fd_2]: Link is up: [Switch:desc1:32]043f720300206650:32 - [Computer:swx-tor01 mlx5_1]ec0d9a0300469fc:2
- 14 2023-04-12 2:36:58 [68] [1500] INFO [Security] Link [Source 043f720300206650_30 TO Dest: ec0d9a0300469fc_1]: New cable S/N: MT2042V504276 is detected
- 15 2023-04-12 2:36:58 [69] [1500] INFO [Security] Link [Source 043f720300206650_32 TO Dest: ec0d9a0300469fd_2]: New cable S/N: MT2042V504200 is detected
- 16 2023-04-12 2:36:58 [70] [604] INFO [Maintenance] Grid [Grid]: Fabric Analysis Report succeeded
- 26 2023-04-12 7:38:24 [82] [702] WARNING [Hardware] IBPort [default(3) / Switch: desc1 / 30] [dev_id: 043f720300206650]: Peer Port swx-tor01 mlx5_0 is considered by SM as unhealthy due to FLAPPING.
- 27 2023-04-12 7:38:24 [83] [702] WARNING [Hardware] IBPort [default(3) / Computer: swx-tor01 / HCA-1/1] [dev_id: ec0d9a0300469ffc]: Peer Port desc1:30 is considered by SM as unhealthy due to FLAPPING.

14. In the "System Dump" tab:

1. "Consumer System Dump" collects system dump for consumer

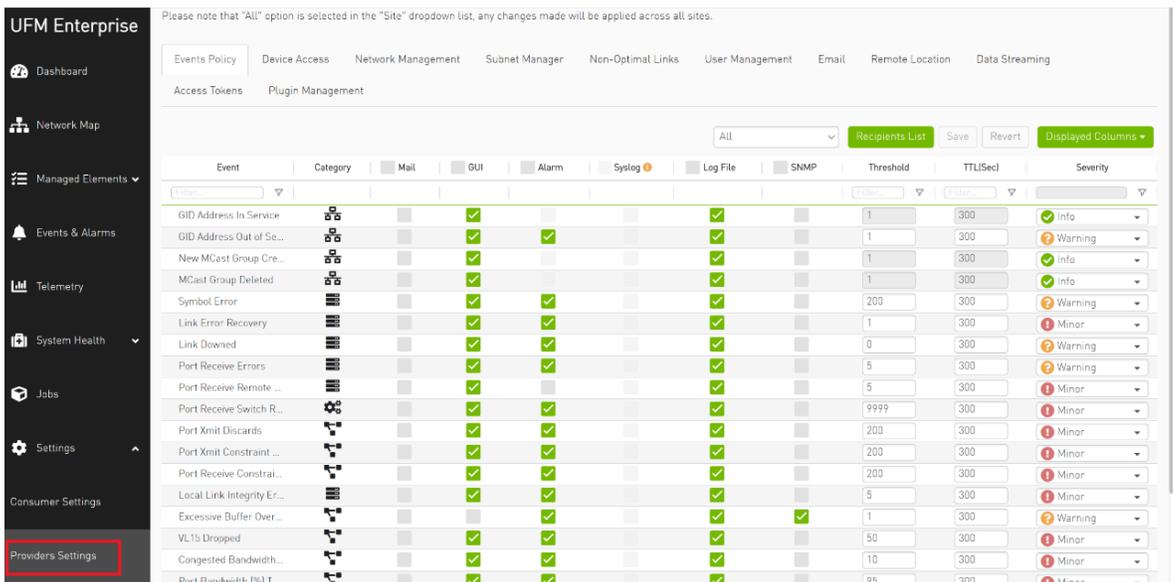


2. "Providers System Dump" collect system dumps for one or all providers and mergeS them into one folder



15. Under "Settings", subsections for Consumer and Provider are available.

1. "Consumer Settings" contain sections applicable to Consumer UFM specifically (e.g., creation of access tokens for UFM consumer authentication);



2. "Provider Settings" contain sections applicable to one or multiple providers (e.g., Event Policies can be changed for multiple Providers at once from the Consumer).

UFM Enterprise

Dashboard
Network Map
Managed Elements
Events & Alarms
Telemetry
System Health
Jobs
Settings
Consumer Settings
Providers Settings

User Management | Access Tokens | Plugin Management | Providers Management

+ New | Displayed Columns

ID ↓	Name	Group
1	admin	System Admin

Filter... Filter... Filter...

Viewing 1-1 of 1 | 10

UFM Plugins

The **UFM Plugin** (Unified Fabric Manager Plugin) refers to an add-on or extension used in conjunction with NVIDIA's **UFM software**. The table below lists the available UFM plugins and provides descriptions on their functionalities.

Plugin Deployment

To deploy UFM plugins, download the plugin image location from the **Docker Hub or NLP**. Refer to the table below for the image location per plugin.

The plugins can be deployed either via the **WebUI** or the **UFM management script**.

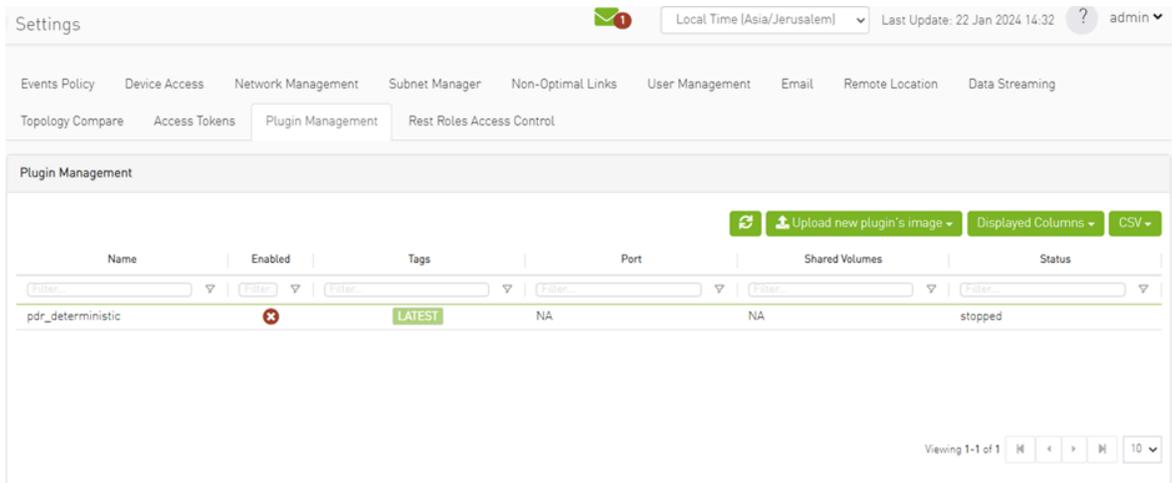
To deploy the UFM plugin via **WebUI**, perform the following:

1. Load the downloaded image onto the UFM server. This can be done either by using the UFM GUI by navigating to the Settings -> Plugins Management tab or by loading the image via the following instructions:

1. Log in to the UFM server terminal.
2. Run:

```
docker load -I <path_to_image>
```

3. **Via the WebUI:** After successfully loading the plugin image, the plugin should become visible in the plugin management table within the UFM GUI. To initiate the plugin's execution, simply right-click on the respective in the table.



To deploy the UFM plugin via the **Management Script**, refer to [UFM Plugins Management](#).

Plugin	Image Location
rest-rdma Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-rest-rdma
NDT Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-ndt
UFM Telemetry Fluent Streaming (TFS) Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-tfs
UFM Events Fluent Streaming (EFS) Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-efs
UFM Bright Cluster Integration Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-bright
UFM Cyber-AI Plugin	Refer to NVIDIA UFM Cyber-AI Documentation
Autonomous Link Maintenance (ALM) Plugin	Refer to Plugins Bundle
DTS Plugin	Refer to Plugins Bundle
Sysinfo Plugin	N/A
SNMP Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-snmpp
Packet Mirroring Collector (PMC) Plugin	Refer to Plugins Bundle
GNMI-Telemetry Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-gnmi-telemetry

Plugin	Image Location
UFM Telemetry Manager (UTM) Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-utm
UFM Consumer Plugin	TBD
Model-2 Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-fast_api
UFM Light Plugin	https://hub.docker.com/r/mellanox/ufm-plugin-ufm-light
Key Performance Indexes (KPI) Plugin	Refer to Plugins Bundle

UFM Plugins Management

UFM Plugins Management

UFM plugin management can be done either via the `manage_ufm_plugins.sh` script or via the Web UI.

UFM Plugin Management Using the `manage_ufm_plugins.sh` Script

The `manage_ufm_plugins.sh` script, located in the `/opt/ufm/scripts` directory, is designed to manage UFM plugins through the command line interface.

To see the actions supported by this script, run:

```

/manage_ufm_plugins.sh --help
usage: manage_ufm_plugins.sh <command> [<args>]
positional arguments:
  {show,get-all,enable,start,stop,disable,add,upgrade,remove_image,remove,is-running,is-enable,get-http-proxy-port,debug,deploy,deploy-bundle}
                                Commands
  show                          Show plugins info
  get-all                       get all loaded plugins

```

enable	Enable plugin
start	Start plugins
stop	Stop all plugins
disable	Disable plugin
add	Add plugin
upgrade	Upgrade plugin
remove_image	Remove plugin`s image
remove	Remove plugin
is-running	Test plugin is running
is-enable	Test plugin is enabled
get-http-proxy-port	Get plugin HTTP proxy port
debug	Debug
deploy	Deploy plugin image
deploy-bundle	Deploy bundle of plugins

Optional Arguments:

-h, --help	show this help message and exit
-v, --version	Print version information

Each supported option has its own help flag, which can be received by requesting help for a specific parameter. For example:

```
./manage_ufm_plugins.sh add --help
```

Usage:

```
manage_ufm_plugins.pyc <command> [<args>] add [-h] -p <[A-Za-z0-9_-] Name size: 32> [-t <[A-Za-z0-9._-] Name size: 128>]
```

Optional Arguments:

```
-h, --help                show this help message and exit
-p <[A-Za-z0-9_-] Name size: 32>, --plugin-name <[A-Za-z0-9_-]
Name size: 32>                Plugin name
-t <[A-Za-z0-9._-] Name size: 128>, --plugin-tag <[A-Za-z0-9._-]
Name size: 128>                Plugin tag
```

The following table lists the supported commands and provides their description and information on the parameters.

Command	Description	Parameters
<code>show</code>	Shows information about running plugins	N/A
<code>get-all</code>	Gets information about deployed plugins in JSON format	N/A
<code>enable</code>	Enables plugin	Loaded Parameter: plugin image name
<code>start</code>	Starts UFM plugin	Loaded Parameter: plugin name
<code>stop</code>	Stops UFM plugin	Loaded Parameter: plugin name
<code>disable</code>	Disables UFM plugin	Loaded Parameter: plugin name
<code>add</code>	Adds UFM plugin	Loaded Parameter: image name
<code>upgrade</code>	Upgrades UFM plugin	Loaded Parameter: plugin name
<code>remove_image</code>	Removes UFM plugin's image	Loaded Parameter: plugin image name
<code>remove</code>	Removes UFM plugin	Loaded Parameter: plugin name
<code>is-running</code>	Tests plugin is running	Loaded Parameter: plugin name
<code>is-enable</code>	Tests plugin is enabled	Loaded Parameter: plugin name
<code>get-http-proxy-port</code>	Gets plugin HTTP proxy port	Loaded Parameter: plugin name

Command	Description	Parameters
<code>deploy</code>	Deploys plugin image	Loaded Parameter: - <code>f</code> flag with path to UFM plugin image
<code>deploy-bundle</code>	Deploys bundle of plugins	Loaded Parameter: - <code>f</code> flag with path to tarball file, that will contain number of UFM plugins. All the plugin images from the tar ball will be deployed to UFM. Operation could take some time. The progress of the plugin images from the tar file deployment will be printed to terminal, including error messages, if exists.

UFM Plugins Upgrade

The following plugins support the upgrade option:

- [GNMI-Telemetry Plugin](#)
- [Key Performance Indexes \(KPI\) Plugin](#)

UFM Plugin Upgrade Procedure

Follow the steps below to upgrade a UFM plugin.

Step 1: Disable the plugin

Before upgrading, the plugin needs to be disabled to ensure a smooth upgrade process.

```
/opt/ufm/scripts/manage_ufm_plugins.sh disable -p <plugin_name>
```

Replace `<plugin_name>` with the actual name of the plugin you want to upgrade.

Step 2: Upgrade the plugin

Run the upgrade command with the version flag to specify the desired version. Replace `<plugin_name>` with the actual plugin name and `<version>` with the desired plugin

version.

```
/opt/ufm/scripts/manage_ufm_plugins.sh upgrade -p <plugin_name> -  
t <version>
```

Example:

```
/opt/ufm/scripts/manage_ufm_plugins.sh upgrade -p ufm-plugin-  
gnmi_telemetry -t 1.1.8-3158
```

Step 3: Enable the plugin

Once the plugin has been successfully upgraded, enable the plugin again.

```
/opt/ufm/scripts/manage_ufm_plugins.sh enable -p <plugin_name>
```

Example:

1. Disable the plugin:

```
/opt/ufm/scripts/manage_ufm_plugins.sh disable -p ufm-plugin-  
gnmi_telemetry
```

2. Upgrade the plugin to version 1.1.8-3158:

```
/opt/ufm/scripts/manage_ufm_plugins.sh upgrade -p ufm-plugin-  
gnmi_telemetry -t 1.1.8-3158
```

3. Enable the plugin:

```
/opt/ufm/scripts/manage_ufm_plugins.sh enable -p ufm-plugin-  
gnmi_telemetry
```

Plugins Bundle

The default plugin bundle contains the [NDI](#), [TFS](#), [KPI](#), [PMC](#), [IB Link Resiliency](#), [GNMI-Telemetry](#), [UFM Telemetry Manager \(UTM\)](#) and [ClusterMinders](#) plugins, packaged in a tarball file. To download this bundle, refer to [NVIDIA's Licensing Portal](#).

To deploy the plugin bundle within the UFM ecosystem, follow these steps:

For a UFM Bare Metal Deployment

1. Download the bundle from NVIDIA's Licensing Portal.
2. For **Master High-Availability or Standalone Mode**, run the following command:

```
/opt/ufm/scripts/manage_ufm_plugins.sh deploy-bundle -f  
/opt/ufm/ufm_plugins_data/<plugins bundle file name>
```

For **Standby High-Availability Mode**, run the following command:

```
/usr/bin/docker run --rm -t --name=ufm \  
  --volume /dev/log:/dev/log \  
  --volume /var/run/docker.sock:/var/run/docker.sock \  
  --volume  
/opt/ufm/ufm_plugins_data/:/opt/ufm/ufm_plugins_data/ \  
  --privileged \  
  --entrypoint /bin/bash \  
mellanox/ufm-enterprise \  

```

```
-C "/opt/ufm/scripts/manage_ufm_plugins.sh deploy-bundle -f
/opt/ufm/ufm_plugins_data/<plugins bundle file name>"
```

3. Restart Apache. Run:

For Ubuntu:

```
service apache2 restart
```

For RedHat:

```
service httpd restart
```

For Docker Container-Based Deployment

1. Download the bundle from NVIDIA's Licensing Portal.
2. For **Standby High-Availability Mode**, run the following command:

```
/usr/bin/docker run --rm -t --name=ufm \
  --volume /dev/log:/dev/log \
  --volume /var/run/docker.sock:/var/run/docker.sock \
  --volume
/opt/ufm/ufm_plugins_data:/opt/ufm/ufm_plugins_data/ \
  --privileged \
  --entrypoint /bin/bash \
  mellanox/ufm-enterprise \
  -C "/opt/ufm/scripts/manage_ufm_plugins.sh deploy-bundle -f
/opt/ufm/ufm_plugins_data/<plugins bundle file name>"
```

3. For **Master High-Availability or Standalone Mode**

1. **When UFM docker is running**, run the following command:

```
docker exec ufm /opt/ufm/scripts/manage_ufm_plugins.sh
deploy-bundle -f /opt/ufm/ufm_plugins_data/<plugins
bundle file name>
```

2. **When UFM docker is not running**, run the following command:

```
/usr/bin/docker run --rm -t --name=ufm \
  --volume
/opt/ufm/files:/opt/ufm/shared_config_files/ \
  --volume /dev/log:/dev/log \
  --volume /var/run/docker.sock:/var/run/docker.sock \
  --volume
/opt/ufm/ufm_plugins_data:/opt/ufm/ufm_plugins_data/ \
  --privileged \
  --entrypoint /bin/bash \
  mellanox/ufm-enterprise \
  -c "/opt/ufm/scripts/manage_ufm_plugins.sh deploy-bundle -f
/opt/ufm/ufm_plugins_data/<plugins bundle file name>"
```

All plugin images from the tarball will be deployed to UFM. The process may take some time, and progress, including any error messages, will be displayed in the terminal.

REST-RDMA Plugin

The REST-RDMA is a tool designed for sending requests over InfiniBand to the UFM server. These REST requests can fall into three categories:

1. UFM REST API requests
2. ibdiagnet requests
3. Telemetry requests

The rest-rdma utility is distributed as a Docker container, capable of functioning both as a server and a client.

Deployment Server

Deploy Plugin on UFM Appliance

1. Log into your UFM as admin.
2. Enter config mode. Run:

```
enable
config terminal
```

Note

Make sure that UFM is running with `show ufm status`. If UFM is down, then run with `ufm start`.

3. Ensure that rest-rdma plugin is disabled with the `show ufm plugin` command.
4. Pull the plugin container with `docker pull mellanox/ufm-plugin-rest-rdma:[version]`.
5. Run `ufm plugin rest-rdma add tag [version]` to enable the plugin.
6. Check that plugin is up and running with `docker pull mellanox/ufm-plugin-rest-rdma:[version]`

Deploy Plugin on Bare Metal Server

1. Verify that UFM is installed and running.

2. Pull image from docker hub:

```
docker pull mellanox/ufm-plugin-rest-rdma:[version]
```

3. To load image run:

```
/opt/ufm/scripts/manage_ufm_plugins.py add -p rest-rdma
```

Example with credentials:

Deployment Client

Run the following command to pull the image from the docker hub:

```
docker pull mellanox/ufm-plugin-rest-rdma:[version]
```

Verify that the `/tmp/ibdiagnet` directory exists on the client's computer. If not – create it.

To start container as client (on any host in the same fabric as UFM server) run:

```
docker run -d --network=host --privileged --name=ufm-plugin-rest-rdma --rm -v /tmp/ibdiagnet:/tmp/ibdiagnet mellanox/ufm-plugin-rest-rdma:[version] client
```

To check that plugin is up and running, run:

```
docker ps
```

How to Run

Server

In server mode `ufm_rdma.py` is started automatically and is restarted if exited. If the `ufm_rdma.py` server is not running – enter to the docker and run the following commands to start the server:

```
cd /opt/ufm/src/ufm-plugin-ufm-rest
./ufm_rdma.py -r server
```

Client

There are three options to run client. Running the client from inside the Docker container, using a custom script from the hosting server to execute the client or using the "docker exec" command from the hosting server.

1. **Option 1:** Run the client from inside the Docker container

1. Enter the docker container using

```
docker exec -it ufm-plugin-rest-rdma bash
```

2. Then, run `cd /opt/ufm/src/ufm-plugin-rest-rdma`

3. Use the `-h` help option to see the available parameters

```
./ufm_rdma.py -h
```

2. **Option 2:** From the host server, the scripts can be located at

`/opt/ufm/ufm-plugin-ufm-rest/ directory` inside the docker container.

They can copied using the following command:

Note

```
cp <containerId>:/opt/ufm/ufm-plugin-ufm-rest/[script name]
/host/path/target
```

Example:

Note

```
cp <containerId>:/opt/ufm/ufm-plugin-ufm-rest/ufm-rest-  
rdma_client.sh /host/path/target
```

1. To see the available options, run:

```
./ufm-rest-rdma_client.sh -h
```

3. **Option 3:** From hosting server, use the `docker exec` command.

Note

To run from inside docker, run:

```
docker exec ufm-plugin-rest-rdma prior to the  
command.
```

For example:

```
docker exec ufm-plugin-rest-rdma /opt/ufm/ufm-  
plugin-ufm-rest/src/ufm_rdma.py -r client -u  
admin -p password -t simple -a GET -w  
ufmRest/app/ufm_version
```

Authentication Configuration

Telemetry and ibdiagnet request authentication options could be enabled or disabled (enabled by default – set to True) in `ufm_rdma.ini file` in [Server] section on the server. The `rest_rdma` server performs simple requests to UFM server, using supplied credentials to verify that the user is allowed to run telemetry or ibdiagnet requests.

```
[Server]
use_ufm_authentication=True
```

Remote ibdiagnet Request

The following two user scripts can run on the hosting server.

- remote_ibdiagnet_auth.sh
- remote_ibdiagnet.sh

These scripts should be copied from the container to the hosting server using the following command:

```
cp <containerId>:/opt/ufm/ufm-plugin-ufm-rest/[script name]
/host/path/target
```

Example :

```
cp <containerId>:/opt/ufm/ufm-plugin-ufm-
rest/remote_ibdiagnet_auth.sh /host/path/target
```

The `remote_ibdiagnet.sh` script does not require authentication as the server side can run on a machine which does not run UFM (which is responsible for the authentication). This means it can run from the hosting server.

```
/remote_ibdiagnet.sh [options]
```

Authenticated Remote ibdiagnet Request

The `remote_ibdiagnet_auth.sh` script can receive parameters as credentials for authentication with UFM server.

```
/remote_ibdiagnet_auth.sh [options]
```

To get all the options, run the following command:

```
/remote_ibdiagnet_auth.sh -h
```

Note

Important Note:

When using `remote_ibdiagnet.sh`, authentication is not required and the the `ibdiagnet` parameters should be sent in `ibdiagnet` format.

Example: `./remote_ibdiagnet.sh --get_phy_info`

When using the `remote_ibdiagnet_auth.sh`, the `ibdiagnet` parameters should be sent using the `-l` key.

Examples without credentials:

- `./remote_ibdiagnet_auth.sh -l '--get_phy_info'`
- `./remote_ibdiagnet_auth.sh -u username -p password`
- `./remote_ibdiagnet_auth.sh -u username -p password -l '--get_phy_info'`
- `./remote_ibdiagnet_auth.sh -k [token string] -l '--get_phy_info'`

- ```
./remote_ibdiagnet_auth.sh -s [defined for client certificate host name] -d [path to client certificate pfx file] -l '--get_phy_info'
```

Please use the -h option to see the examples of credential usage.

## Rest Request with Username/Password Authentication

To get the UFM version from inside the docker:

```
./ufm_rdma.py -r client -u admin -p admin_pwd -t simple -a GET -w ufmRest/app/ufm_version
```

To get the UFM version from hosting server using script:

```
./ufm_rest_rdma_client.sh -u admin -p admin_pwd -t simple -a GET -w ufmRest/app/ufm_version
```

For telemetry:

```
./ufm_rdma.py -r client -u admin -p admin_pwd -t telemetry -a GET -g 9001 -w /csv/enterprise
```

To get ibdiagnet run result using UFM REST API from inside the docker:

```
./ufm_rdma.py -r client -u admin -p admin_pwd -t ibdiagnet -a POST -w ufmRest/reports/ibdiagnetPeriodic -l '{"general":{"name":
```

```
"IBDiagnet_CMD_1234567890_199_88", "location": "local", "running_mode": "once"}, "command_flags": {"--pc": ""}}
```

## Rest Request with Client Certificate Authentication

need to pass path to client certificate file and name of UFM server machine:

```
6. ./ufm_rdma.py -r client -t simple -a GET -w
ufmRest/resources/modules -d /path/to/certificate/file/ufm-
client.pfx -s ufm.azurehpc.core.azure-test.net
for telemetry if need authentication from inside the docker
./ufm_rdma.py -r client -t telemetry -a GET -g 9001 -w
csv/enterprise -d /path/to/certificate/file/ufm-client.pfx -s
ufm.azurehpc.core.azure-test.net
```

### Note

Client certificate file should be located INSIDE the docker container.

## Rest Request with Token Authentication

need to pass token for authentication

```
./ufm_rdma.py -r client -k OGUY7TwLvTmFkXyTkcsEWD9KKNvq6f -t
simple -a GET -w ufmRestV3/app/ufm_version
for telemetry if need to perform authentication
```

```
./ufm_rdma.py -r client -k 4rQRf7i7wEeliuJEurGbeecc210V6G -t
telemetry -a GET -g 9001 -w /csv/enterprise
```

### **Note**

Token could be generated using UFM UI.

### **Note**

If a token is used for client authentication, `ufmRestV3` must be used.

## NDT Plugin

### Overview

NDT plugin is a self-contained Docker container with REST API support managed by UFM. The NDT plugin introduces the following capabilities:

1.

1. **NDT topology comparison:** Allows the user to compare InfiniBand fabric managed by the UFM and NDT files which are used for the description of InfiniBand clusters network topology.
  - Verifies the IB fabric connectivity during cluster bring-up.
  - Verifies the specific parts of IB fabric after component replacements.
  - Automatically detects any changes in topology.

## 2. Subnet Merger - Expansion of the fabric based on NDT topology files

Allows users to gradually extend the InfiniBand fabric without causing any disruption to the running fabric. The system administrator should prepare the NDT topology files, which describe the InfiniBand fabric extensions. Then, an intuitive and user-friendly UI wizard facilitates the topology extension process with a step-by-step guidance for performing necessary actions.

- The Subnet Merger tool verifies the fabric topology within a predefined NDT file, and reports issues encountered for immediate resolution.
- Once the verification results are acceptable by the network administrator, the tool creates a topoconfig file to serve as input for OpenSM. This allows setting the physical port states of the designated boundary ports as desired (physical ports can be set as disabled or no-discover).
- Once the topoconfig file is deployed, the IB network can be extended and verified for the next IB extension.

## Deployment

The following are the possible ways NDT plugin can be deployed:

1. On UFM Appliance
2. On UFM Software

For detailed instructions on how to deploy the NDT plugin refer to this [page](#).

## Authentication

Following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

## REST API

The following REST APIs are supported:

## Topodiff

- GET /help
- GET /version
- POST /upload\_metadata
- GET /list
- POST /compare
- POST /cancel
- GET /reports
- GET /reports/<report\_id>
- POST /delete

## Subnet Merger

- GET /merger\_ndts\_list
- GET /merger\_ndts\_list/<ndt\_file\_name>
- POST /merger\_upload\_ndt
- POST /merger\_verify\_ndt
- GET /merger\_verify\_ndt\_reports
- GET /merger\_verify\_ndt\_reports/<report\_id>
- POST /merger\_update\_topoconfig
- POST /merger\_deploy\_ndt\_config
- POST /merger\_update\_deploy\_ndt\_config
- POST /merger\_delete\_ndt

- GET /merger\_deployed\_ndt
- POST /merger\_create\_topoconfig

For detailed information on how to interact with NDT plugin, refer to the [NVIDIA UFM Enterprise > Rest API > NDT Plugin REST API](#).

## NDT Format – Topodiff

NDT is a CSV file containing data relevant to the IB fabric connectivity. The NDT plugin extracts the IB connectivity data based on the following fields:

1. Start device
2. Start port
3. End device
4. End port
5. Link type

## Switch to Switch NDT

By default, IB links are filtered by:

- Link Type is Data
- Start Device and End Device end with IBn, where n is a numeric value.

For TOR switches, Start port/End port field should be in the format **Port N**, where **N** is a numeric value.

For Director switches, Start port/End port should be in the format **Blade N\_Port i/j**, where **N** is a leaf number, **i** is an internal ASIC number and **j** is a port number.

Examples:

| Start Device           | Start Port | End Device             | End Port         | Link Type |
|------------------------|------------|------------------------|------------------|-----------|
| DSM07-0101-0702-01IB0  | Port 21    | DSM07-0101-0702-01IB1  | Blade 2_Port 1/1 | Data      |
| DSM07-0101-0702-01IB0  | Port 22    | DSM07-0101-0702-01IB1  | Blade 2_Port 1/1 | Data      |
| DSM07-0101-0702-01IB0  | Port 23    | DSM07-0101-0702-02IB1  | Blade 3_Port 1/1 | Data      |
| DSM09-0101-0617-001IB2 | Port 33    | DSM09-0101-0721-001IB4 | Port 1           | Data      |
| DSM09-0101-0617-001IB2 | Port 34    | DSM09-0101-0721-001IB4 | Port 2           | Data      |
| DSM09-0101-0617-001IB2 | Port 35    | DSM09-0101-0721-001IB4 | Port 3           | Data      |

## Switch to Host NDT

NDT is a CSV file containing data not only relevant to the IB connectivity.

Extracting the IB connectivity data is based on the following five fields:

1. Start device
2. Start port
3. End device
4. End port
5. Link type

IB links should be filtered by the following:

- Link type is "Data".
- "Start Device" or "End Device" end with **IBN**, where **N** is a numeric value.

- The other Port should be based on persistent naming convention: **ibpXsYfZ**, where **X**, **Y** and **Z** are numeric values.

For TOR switches, Start port/End port field will be in the format Port n, where n is a numeric value.

For Director switches, Start port/End port will be in the format **Blade N\_Port i/j**, where **N** is a leaf number, **i** is an internal ASIC number and **j** is a port number.

Examples:

| Start Device         | Start Port         | End Device            | End Port | Link Type |
|----------------------|--------------------|-----------------------|----------|-----------|
| DSM07170081704019019 | DSM081700817090110 | DSM07-0101-0514-01IB0 | Port 1   | Data      |

| Start Device          | Start Port            | End Device                                                  | End Port | Link Type |
|-----------------------|-----------------------|-------------------------------------------------------------|----------|-----------|
| DSM071087108417094019 | DSM071087108417094019 | DSM071087108417094019<br>ibp21s0f0<br>DSM071087108417094019 | Port 2   | Data      |
| DSM071087108417094019 | DSM071087108417094019 | DSM071087108417094019                                       | Port 3   | Data      |

| Start Device | Start Port | End Device | End Port | Link Type |
|--------------|------------|------------|----------|-----------|
| 4019         | 4019       |            |          |           |
|              | ibp750f0   |            |          |           |

## Other

Comparison results are forwarded to syslog as events. Example of `/var/log/messages` content:

1. Dec 9 12:32:31 <server\_ip> ad158f423225[4585]: NDT: missing in UFM "SAT111090310019/SAT111090310019 ibp203s0f0 - SAT11-0101-0903-19IB0/15"
2. Dec 9 12:32:31 <server\_ip> ad158f423225[4585]: NDT: missing in UFM "SAT11-0101-0903-09IB0/27 - SAT11-0101-0905-01IB1-A/Blade 12\_Port 1/9"
3. Dec 9 12:32:31 <server\_ip> ad158f423225[4585]: NDT: missing in UFM "SAT11-0101-0901-13IB0/23 - SAT11-0101-0903-01IB1-A/Blade 08\_Port 2/13"

For detailed information about how to check syslog, please refer to the [NVIDIA UFM-SDN Appliance Command Reference Guide](#) > UFM Commands > UFM Logs.

Minimal interval value for periodic comparison in five minutes.

In case of an error the clarification will be provided.

For example, the request “`POST /compare`” without NDTs uploaded will return the following:

- URL: [https://<server\\_ip>/ufmRest/plugin/ndt/compare](https://<server_ip>/ufmRest/plugin/ndt/compare)
- response code: 400
- Response:

```
{
 "error": [
 "No NDTs were uploaded for comparison"
]
}
```

Configurations could be found in “`ufm/conf/ndt.conf`”

- Log level (default: INFO)
- Log size (default: 10240000)
- Log file backup count (default: 5)
- Reports number to save (default: 10)
- NDT format check (default: enabled)
- Switch to switch and host to switch patterns (default: see NDT format section)

For detailed information on how to export or import the configuration, refer to the [NVIDIA UFM-SDN Appliance Command Reference Guide > UFM Commands > UFM Configuration Management](#).

Logs could be found in “`ufm/logs/ndt.log`”.

For detailed information on how to generate a debug dump, refer to the [NVIDIA UFM-SDN Appliance Command Reference Guide > System Management > Configuration Management > File System](#).

# NDT Format – Subnet Merger

The Subnet Merger tool facilitates the seamless expansion of the InfiniBand fabric based on Non-Disruptive Topology (NDT) files. This section outlines the process of extending the fabric while ensuring uninterrupted operation. The tool operates through an intuitive UI wizard, guiding users step-by-step in extending the fabric topology.

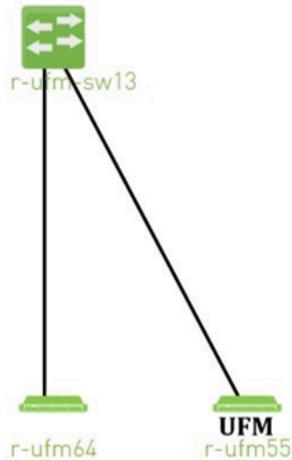
The Subnet Merger tool enables the gradual expansion of the InfiniBand fabric without causing disruptions to the existing network. To achieve this, system administrators need to prepare NDT topology files that describe the planned fabric extensions. The tool offers an intuitive UI wizard that simplifies the extension process.

## Functionality

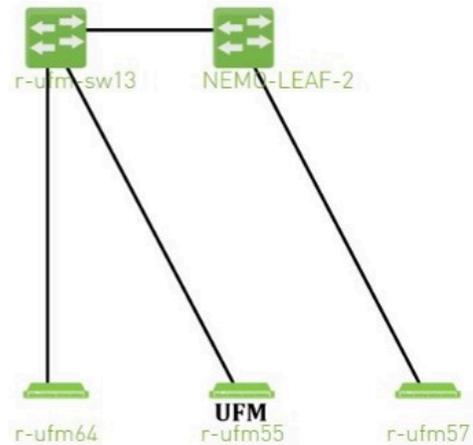
1. **NDT Topology File Verification:** The Subnet Merger tool verifies the InfiniBand fabric topology specified in a predefined NDT file. During this verification, any issues encountered are reported to the user for immediate resolution. This step ensures the integrity of the planned fabric extension.
1. **Topology Extension Preparation:** Upon successful verification of the NDT topology file, the tool generates a comprehensive verification report. The network administrator reviews this report and ensures its acceptability.
1. **Topoconfig File Generation:** After obtaining acceptable verification results, the tool generates a topoconfig file. This file serves as input for OpenSM, the Subnet Manager for InfiniBand fabrics. The topoconfig file allows the network administrator to define the desired physical port states for designated boundary ports. These states include "disabled" or "no-discover."
1. **Fabric Extension and Verification:** With the topoconfig file prepared, the Subnet Merger tool initiates the deployment of the extended fabric configuration. The tool ensures that the defined physical port states are implemented. Once the extension is in place, the IB network can be extended further as needed. The fabric extension is executed while maintaining the operational stability of the existing network.
1. **Conclusion:** The Subnet Merger tool offers a reliable and user-friendly solution for expanding InfiniBand fabrics using NDT topology files. By following the steps provided in the intuitive UI wizard, system administrators can seamlessly extend the fabric while adhering to predefined physical port states. This tool ensures the smooth operation of the fabric throughout the expansion process, eliminating disruptions and enhancing network scalability.

# Subnet Merger Flow

## Initial Fabric Topology



## Target Fabric Topology



1. Create NDT, file that describes initial topology with definition of boundary ports. Boundary ports – switch ports that will be used for fabric extension. In our case it will be r-ufm-sw13 switch ports number 1 and 3. In NDT file those ports should be defined as boundary and disabled:

```
rack #,U
height,#Fields:StartDevice,StartPort,StartDeviceLocation,EndDe
height_1,LinkType,Speed,_2,Cable
Length,_3,_4,_5,_6,_7,State,Domain
,,MF0;r-ufm-sw13:MQM8700/U1,Port
1,,,,,,,,,,,,,Disabled,Boundary
,,MF0;r-ufm-sw13:MQM8700/U1,Port 30,,r-ufm55 mlx5_1,Port
1,,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 29,,r-ufm55 mlx5_0,Port
1,,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 26,,r-ufm64 mlx5_0,Port
1,,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port
3,,,,,,,,,,,,,Disabled,Boundary
```

2. Upload a new NDT topology file which describes the desired topology. Before deploying to UFM, the new NDT topology file should be verified against the existing topology – to find out mismatches and problems.

After the verification, the plugin generates reports including information about:

- - Duplicated GUIDs
  - Misswired links
  - Non-existent links in the pre-defined NDT files
- 1.
  - Links that exist in the fabric and not in the NDT file
- 2. Following the issues detected in the plugin reports, the network administrator changes the NDT file or the fabric. The verification process can be repeated as many times as necessary until the network administrator is satisfied with the results.
- 3. If the NDT verification results are satisfactory, a topoconfig file is generated and can be deployed to the UFM server to be used as configuration input for OpenSM. Topoconfig file should be located at /opt/ufm/files/conf/opensm/topoconfig.cfg on UFM server. By sending SIGHUP signal to opensm it forced to read configuration and to deploy it. In topoconfig file at this stage boundary ports will be defined as **Disabled**.

Example of topoconfig.cfg:

```
0xb83fd2030080302e,1,-,-,Any, Disabled
0xb83fd2030080302e,30,0xf452140300280081,1,Any,Active
0xb83fd2030080302e,29,0xf452140300280080,1,Any,Active
0xb83fd2030080302e,26,0xf452140300280040,1,Any,Active
0xb83fd2030080302e,3,-,-,Any, Disabled
```

4. Next stage is to extend the fabric. Prepare separately new subnet that will be added to the existing fabric and, once it is ready, connect to the boundary ports, that are defined as Disabled in configuration file, so newly added subnet will not be discovered by opensm and will not affect in any way current setup functionality.

- Once new subnet connected to the fabric - prepare next NDT file, that contains setup, that describes current fabric with extended, when previously defined as boundary ports defined as Active and if planned to continue with extension new ports defined as boundary.

For example port number 9 of switch r-ufm-sw13:

```

rack #,U
height,#Fields:StartDevice,StartPort,StartDeviceLocation,EndDe
height_1,LinkType,Speed,_2,Cable
Length,_3,_4,_5,_6,_7,State,Domain
,,MF0;r-ufm-sw13:MQM8700/U1,Port 1,,NEMO-LEAF-2,Port
1,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 30,,r-ufm55 mlx5_1,Port
1,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 29,,r-ufm55 mlx5_0,Port
1,,,,,,,,,,,,Active,In-Scope
,,NEMO-LEAF-2,Port 11,,r-ufm57 mlx5_0,Port
1,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 26,,r-ufm64 mlx5_0,Port
1,,,,,,,,,,,,Active,In-Scope
,,NEMO-LEAF-2,Port 1,,MF0;r-ufm-sw13,Port
1,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port 3,,NEMO-LEAF-2,Port
3,,,,,,,,,,,,Active,In-Scope
,,NEMO-LEAF-2,Port 3,,MF0;r-ufm-sw13,Port
3,,,,,,,,,,,,Active,In-Scope
,,MF0;r-ufm-sw13:MQM8700/U1,Port
9,,,,,,,,,,,,Disabled,Boundary

```

- After new subnet connected physically to the fabric, in opensm configuration file (topoconfig.cfg) boundary ports previously defined as Disabled should be set as No-discover. Example:

```
0xb83fd2030080302e,1,-,-,Any,No-discover
```

```
0xb83fd2030080302e , 30, 0xf452140300280081 , 1, Any, Active
0xb83fd2030080302e , 29, 0xf452140300280080 , 1, Any, Active
0xb83fd2030080302e , 26, 0xf452140300280040 , 1, Any, Active
0xb83fd2030080302e , 3, -, -, Any, No-discover
```

7. Updated file should be deployed to UFM. In case boundary ports will be defined as No-discover – fabric, connected beyond those ports will not be discovered by opensm, but all the ibutils (ibdiagnet...) could send mads beyond those ports to newly added subnet - so NDT file verification for extended setup could be performed.
8. Upload new NDT file and run verification for this file. Fix problems detected by verification. Once satisfied with results – deploy configuration to UFM.

Example of topoconfig file for extended setup:

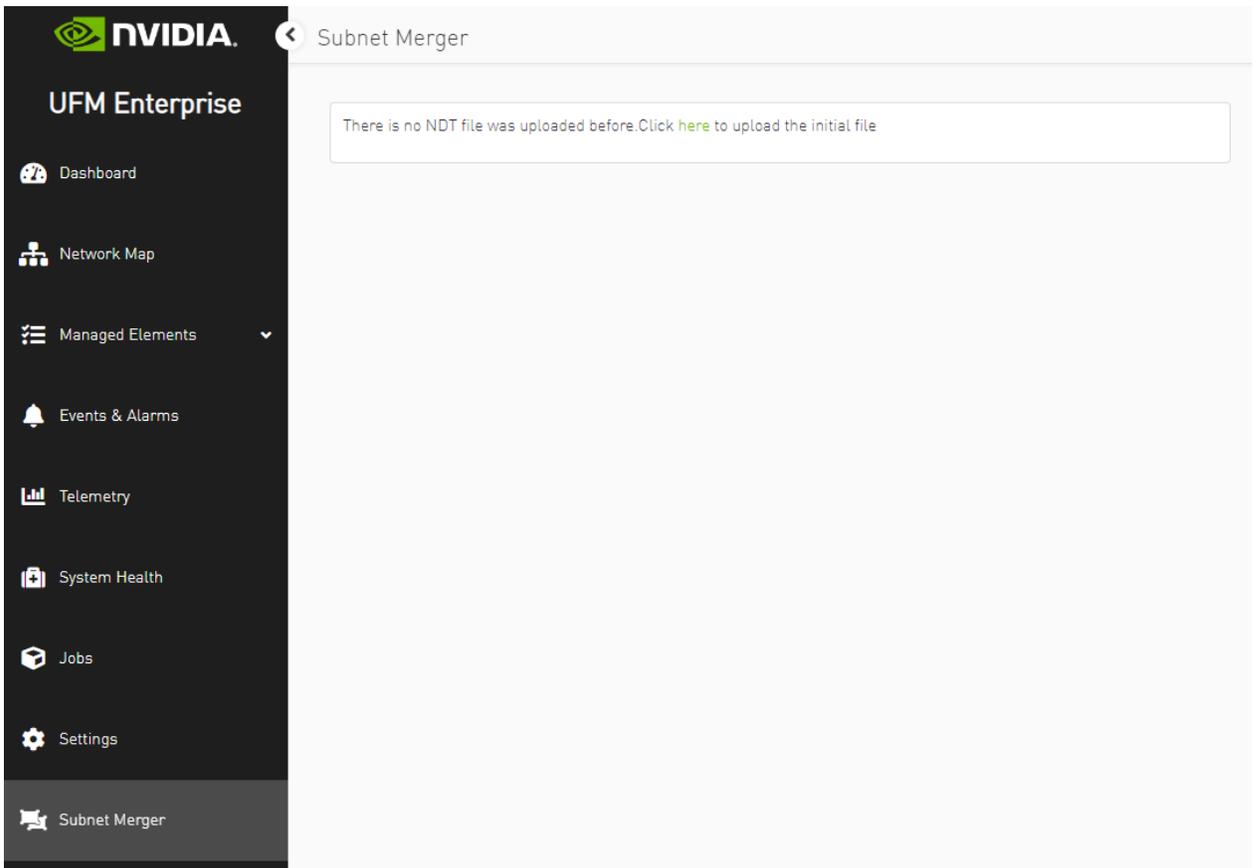
```
0xb83fd2030080302e , 1, 0x98039b0300867bba , 1, Any, Active
0xb83fd2030080302e , 30, 0xf452140300280081 , 1, Any, Active
0xb83fd2030080302e , 29, 0xf452140300280080 , 1, Any, Active
0x98039b0300867bba , 11, 0x248a0703009c0066 , 1, Any, Active
0xb83fd2030080302e , 26, 0xf452140300280040 , 1, Any, Active
0x98039b0300867bba , 1, 0xb83fd2030080302e , 1, Any, Active
0xb83fd2030080302e , 3, 0x98039b0300867bba , 3, Any, Active
0x98039b0300867bba , 3, 0xb83fd2030080302e , 3, Any, Active
0xb83fd2030080302e , 9, -, -, Any, Disabled
```

9. Repeat previous steps if need to perform additional setup extension.

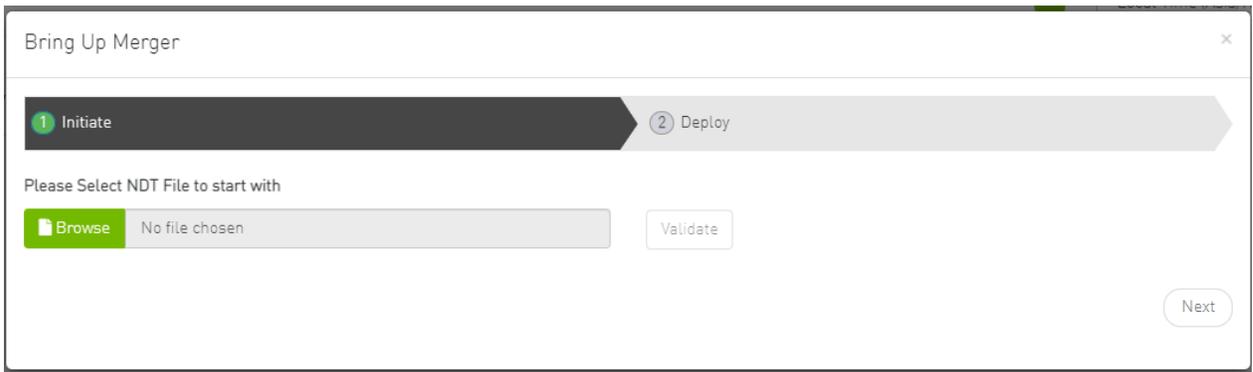
## Subnet Merger UI

### Bring-Up Merger Wizard

1. Add the NDT plugin to UFM by loading the plugin's image through Settings->Plugins Management. A new item will appear in the main left navigator menu of the UFM labeled "Subnet Merger".

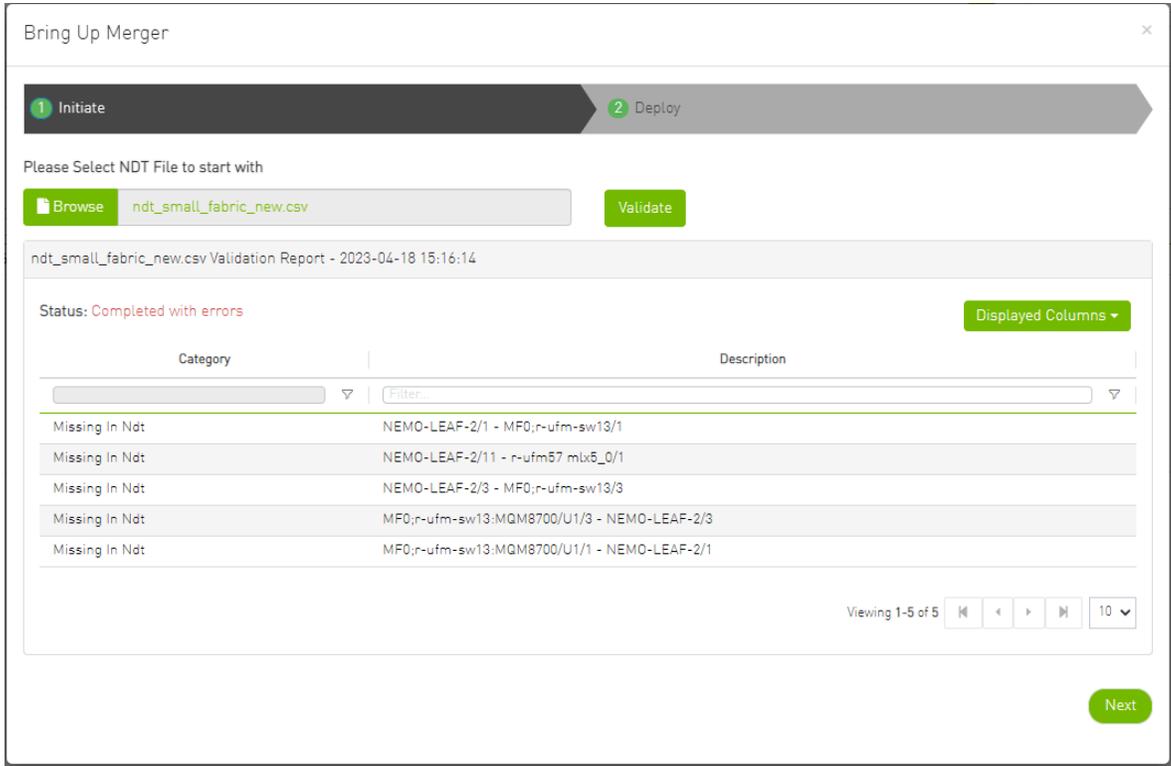
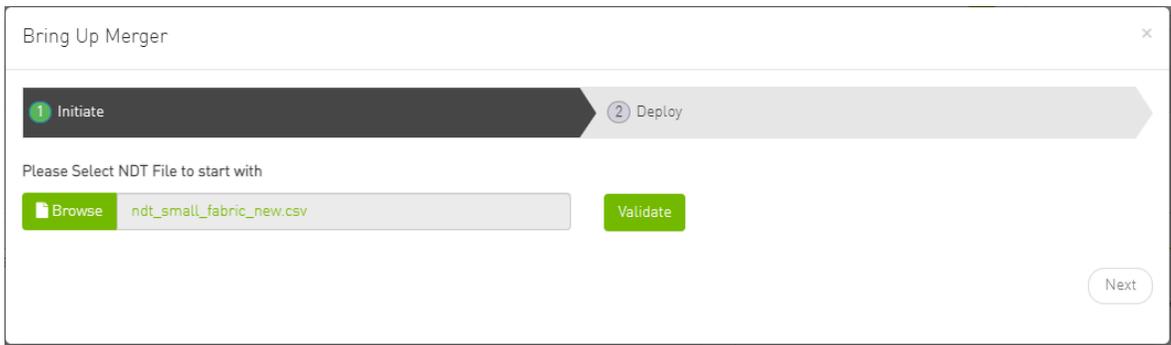


2. Access "Subnet Merger" to initiate the bring-up wizard.

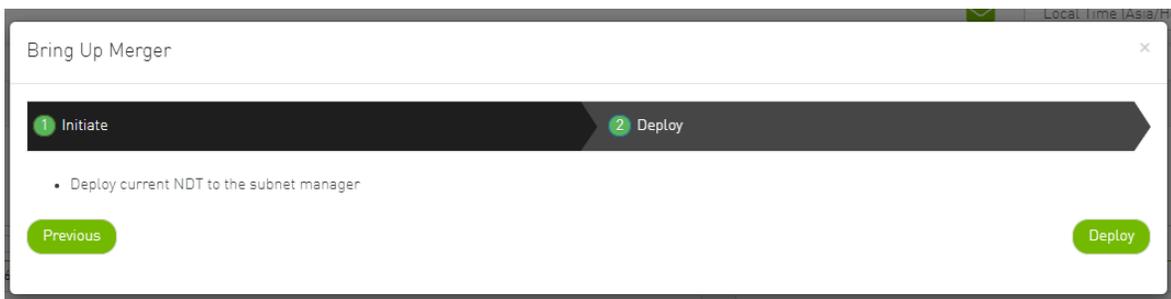


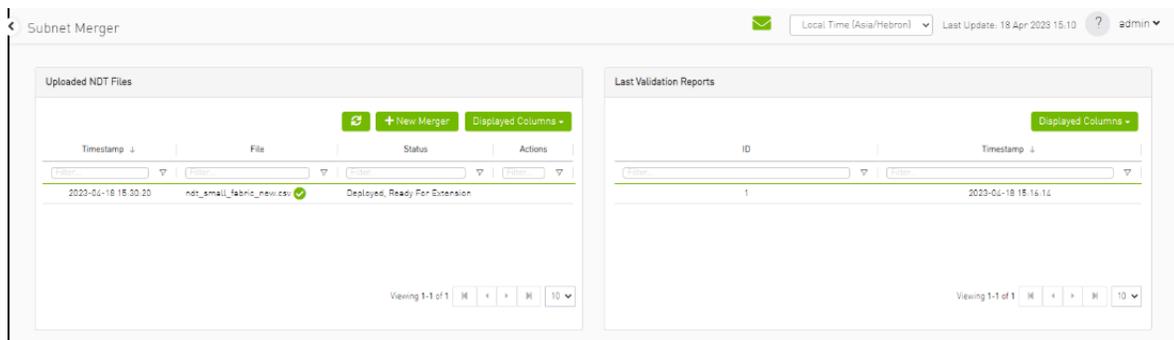
3. The wizard will guide you through the process, containing the following steps:

1. Upload the initial NDT tab and validate it.



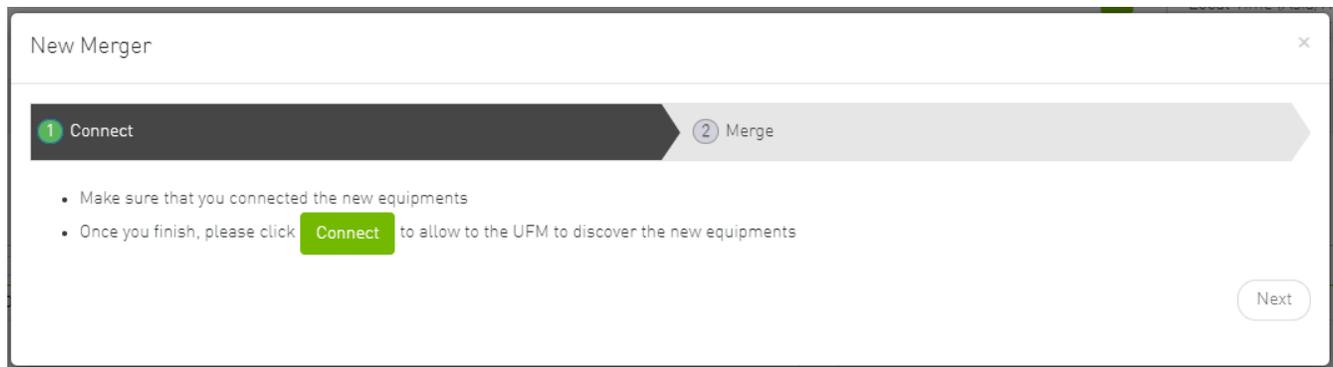
2. Once you are satisfied with the results of the validation in the previous tab, you can proceed to deploy the file.



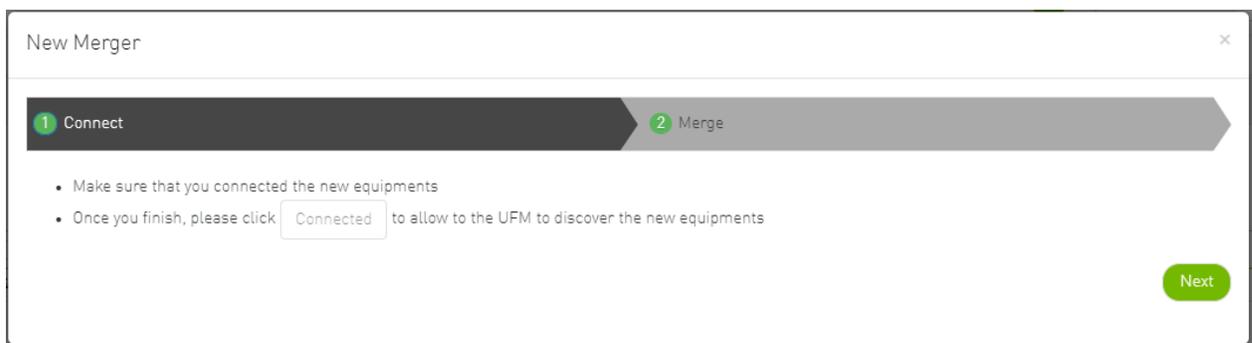


## New Subnet Merger

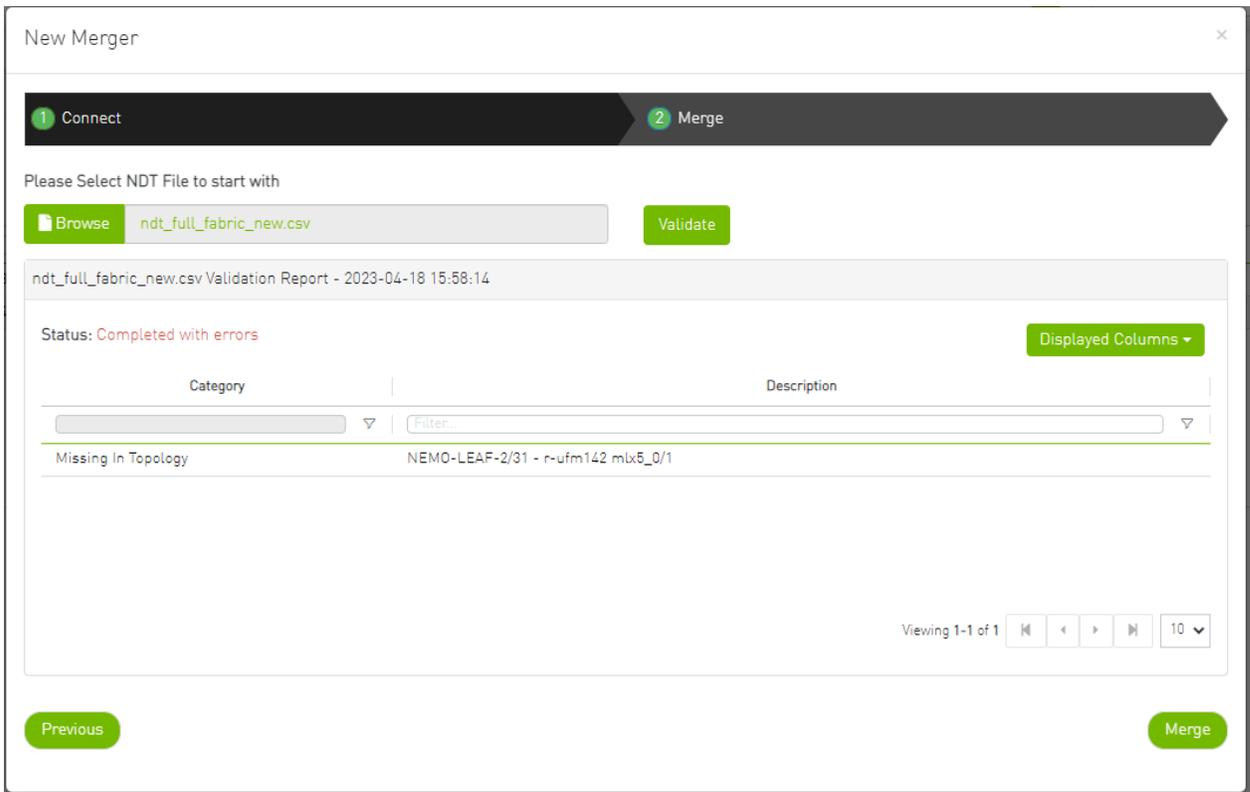
Once you have successfully deployed the initial NDT file, you can initiate a new merger process by clicking the "New Merger" button.



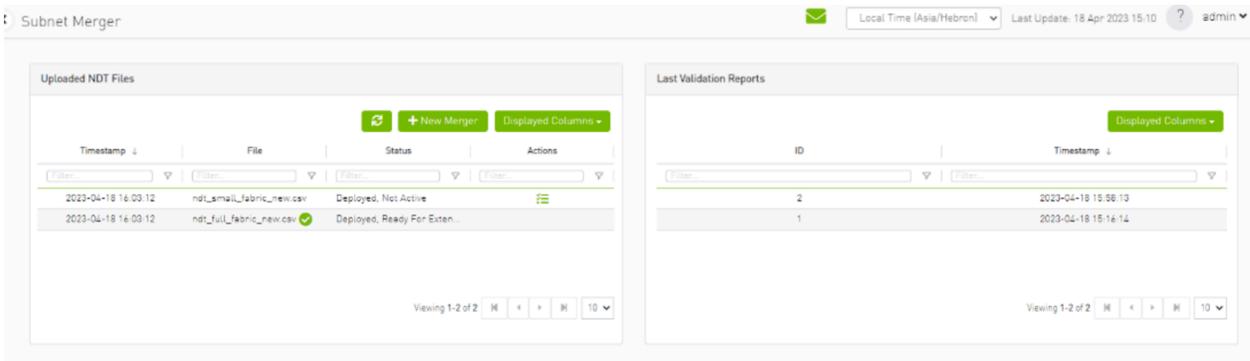
1. "Connect" Tab, it is important to physically connect the new equipment and confirm the connection. Then, click on a button which will open the boundary ports, change their state from Disabled to No-discover, and then deploy the active file again.



2. "Merge" Tab: Once the new equipment is connected and the boundary ports are updated, upload a new NDT file that includes both the current and newly added equipment, along with their boundary ports for future merges. Please note that you cannot merge the file if there are duplicate GUIDs in the report's results.



3. After completing the merge wizard, and if necessary, you can further proceed to extend the IB fabric.



## Extending the InfiniBand Setup via Subnet Merger

The following instructions outline the necessary steps for expanding the InfiniBand setup or fabric using subnet merging.

### 1. Step 1: NDT File Upload (Repeatable)

Upload the NDT file, performing this action as many times as required, especially when addressing file-related issues.

## 2. **Step 2: NDT File Validation and Verification (Repeatable)**

Validate the NDT file, a process that can be repeated multiple times, particularly after fixing fabric topology or NDT file errors. After initiating this call, you will obtain a validation report ID. The progress of this process is asynchronous, with the report's status initially indicated as "running." Once the report is completed, the status will change to either "Successfully completed" or "Completed with errors."

## 3. **Step 3: Retrieving and Monitoring the Validation Report**

Retrieve the validation report by its corresponding ID, running this step through continuous polling until the report reaches completion.

## 4. **Step 4: Review and Potential Fixes**

Inspect the report and address any necessary fixes to either the NDT file or the topology. Should changes be made to the file, upload the corrected NDT file anew. Alternatively, in case of topology has changed, repeat the verification process.

## 5. **Step 5: Topology Deployment to UFM**

Deploy the verified topology to UFM once you are satisfied with the verification outcomes.

## 6. **Step 6: Adjusting Boundary Ports and Deployment**

Following the physical connection of the setup extension, change the boundary ports' state from "Disabled" to "No-discover."

## 7. **Step 7: Uploading Updated Topoconfig File**

Deploy the updated topoconfig file to the UFM server.

## 8. **Step 8: Next NDT File Upload (Combined Fabric and Extension)**

Upload the next NDT file, which consolidates the current fabric and extension components.

## 9. **Step 9: NDT File Verification**

Conduct the NDT file verification process.

## 10. **Step 10: Reviewing Verification Report**

Review the verification report.

### 11. **Step 11: Addressing Setup or NDT File Issues**

If necessary, make necessary adjustments to the setup or NDT file.

### 12. **Step 12: Final Configuration Deployment**

Once content with the modifications, proceed to deploy the configuration to UFM.

### 13. **Step 13: Iterative Workflow**

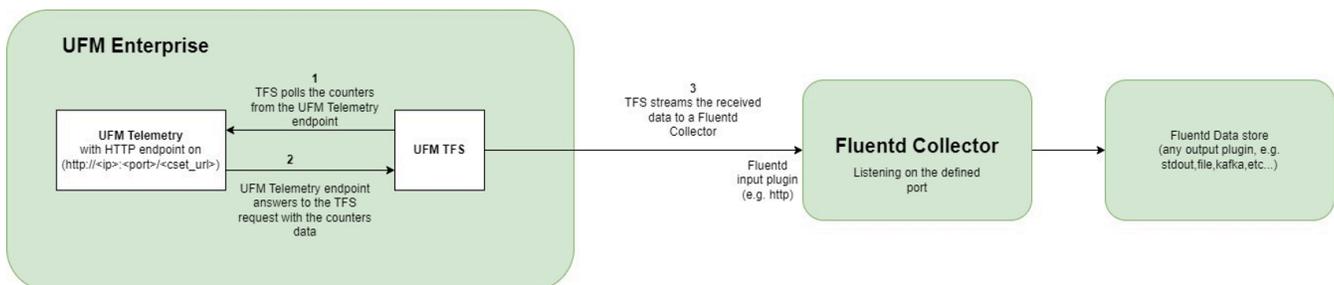
Repeat this flow as many times as needed to further the expansion process.

# UFM Telemetry Fluentd Streaming (TFS) Plugin

## Overview

The TFS plugin is designed to extract UFM Telemetry counters from specified telemetry HTTP endpoints and stream them to the designated [Fluentd](#) collector destination.

The diagram below illustrates the plugin's stream flow:



## Deployment

The following are the possible ways the TFS plugin can be deployed:

1. On UFM Appliance
2. On UFM Software

For complete instructions on deploying the TFS plugin, refer to [UFM Telemetry endpoint stream To Fluentd endpoint \(TFS\)](#).

## Authentication

The following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

## Rest API

The following REST APIs are supported:

- POST /plugin/tfs/conf
- GET /plugin/tfs/conf
- POST /plugin/tfs/conf/attributes
- GET /plugin/tfs/conf/attributes

For detailed information on interacting with TFS plugin, refer to the [NVIDIA UFM Enterprise > Rest API > TFS Plugin REST API](#).

# UFM Events Fluent Streaming (EFS) Plugin

## Overview

EFS plugin is a self-contained Docker container with REST API support managed by UFM. EFS plugin extracts the UFM events from UFM Syslog and streams them to a remote FluentD destination. It also has the option to duplicate current UFM Syslog messages and forward them to a remote Syslog destination. As a fabric manager, it will be useful to collect the UFM Enterprise events/logs, stream them to the destination endpoint and monitor them.

## Deployment

The following are the ways EFS plugin can be deployed:

1. On UFM Appliance
2. On UFM Software

For detailed instructions on how to deploy EFS plugin, refer to [UFM Event Stream to FluentBit endpoint \(EFS\)](#).

## Authentication

The following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

## Rest API

The following REST APIs are supported:

- PUT /plugin/efs/conf
- GET /plugin/efs/conf

For detailed information on how to interact with EFS plugin, refer to the [NVIDIA UFM Enterprise > Rest API > EFS Plugin REST API](#).

# UFM Bright Cluster Integration Plugin

## Overview

The Bright Cluster Integration plugin is a self-contained docker container managed by UFM and is managed by the REST APIs. It enables integrating data from Bright Cluster Manager (BCM) into UFM, providing a more comprehensive network perspective. This integration improves network-centered Root Cause Analysis (RCA) tasks and enables better scoping of workload failure domains.

## Deployment

The Bright Cluster Integration plugin can be deployed either on the UFM Appliance or on UFM Software.

For detailed instructions on Bright Cluster Integration plugin deployment, refer to [UFM Bright Cluster Integration Plugin](#).

## Authentication

The following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

## Bright Cluster Integration UI

1. After the successful deployment of the plugin, a new tab is shown under the UFM settings section for bright configurations management:

**NVIDIA UFM Enterprise**

Settings

Events Policy | Device Access | Network Management | Subnet Manager | Non-Optimal Links | User Management | Email | Remote Lo

Bright Configuration

**Bright Configurations**

Status:  Disabled  **Enabled**

Connection Status: **Healthy**

Host:  :

Certificate (.pem): 

```
-----BEGIN CERTIFICATE-----
MIIDfzCCAmegAwIBAgIBEDANBgkqhkiG9w0BAQ0FAD
```

Certificate Key(.key): 

```
-----BEGIN PRIVATE KEY-----
MIIEvQIBADANBgkqhkiG9w0BAQEFAASCBCkwwggSjAg
```

Data Retention Period:  Days

Save

**NVIDIA UFM Enterprise**

Settings

Events Policy | Device Access | Network Management | Subnet Manager | Non-Optimal Links | User Management | Email | Remote Lo

Bright Configuration

**Bright Configurations**

Status:  **Disabled**  Enabled

Connection Status: **Disabled**

Host:  :

Certificate (.pem):

Certificate Key(.key):

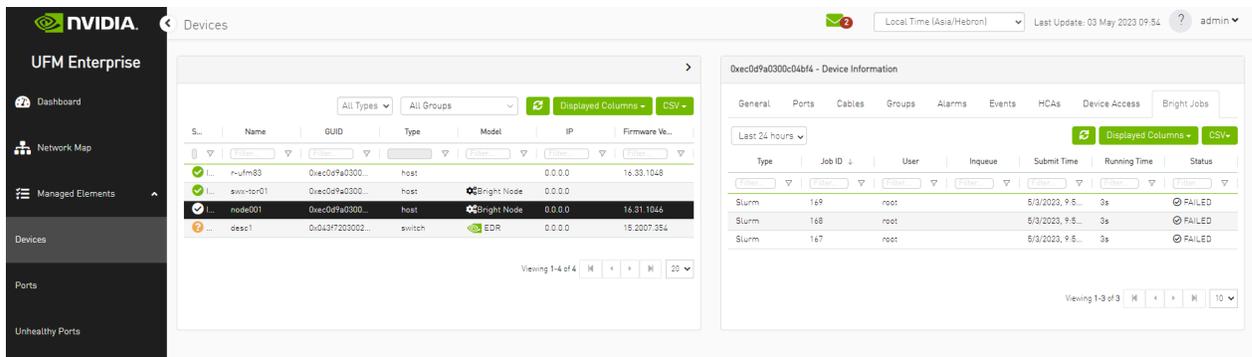
Data Retention Period:  Days

Save

Fill the below required configurations:

| Parameter             | Description                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Host                  | Hostname or IP of the BCM server                                                                               |
| Port                  | Port of the BCM server, is typically 8081                                                                      |
| Certificate           | BMC client certificate content that could be located in the BMC server machine under <code>.cm/XXX.pem</code>  |
| Certificate key       | BMC client certificate key that could be located in the BMC server machine under <code>.cm/XXX.key</code>      |
| Data retention period | UFM erases the data gathered in the database after the configured retention period. By default, after 30 days. |

2. After you ensure you have successfully completed the plugin configuration, and that you have established a healthy connection with the BMC, navigate to the UFM Web GUI -> Managed Elements -> Devices



## Rest API

The following REST APIs are supported:

- PUT plugin/bright/conf
- GET plugin/bright/conf
- GET plugin/bright/data/nodes
- GET plugin/bright/data/jobs

For detailed information on how to interact with bright plugin APIs, refer to [NVIDIA UFM Enterprise > Rest API > UFM Bright Cluster Integration Plugin REST API](#).

# IB Link Resiliency Plugin

## Overview

The primary objective of the IB Link Resiliency (IBLR) plugin is to enhance cluster availability and improve the rate of job completion.

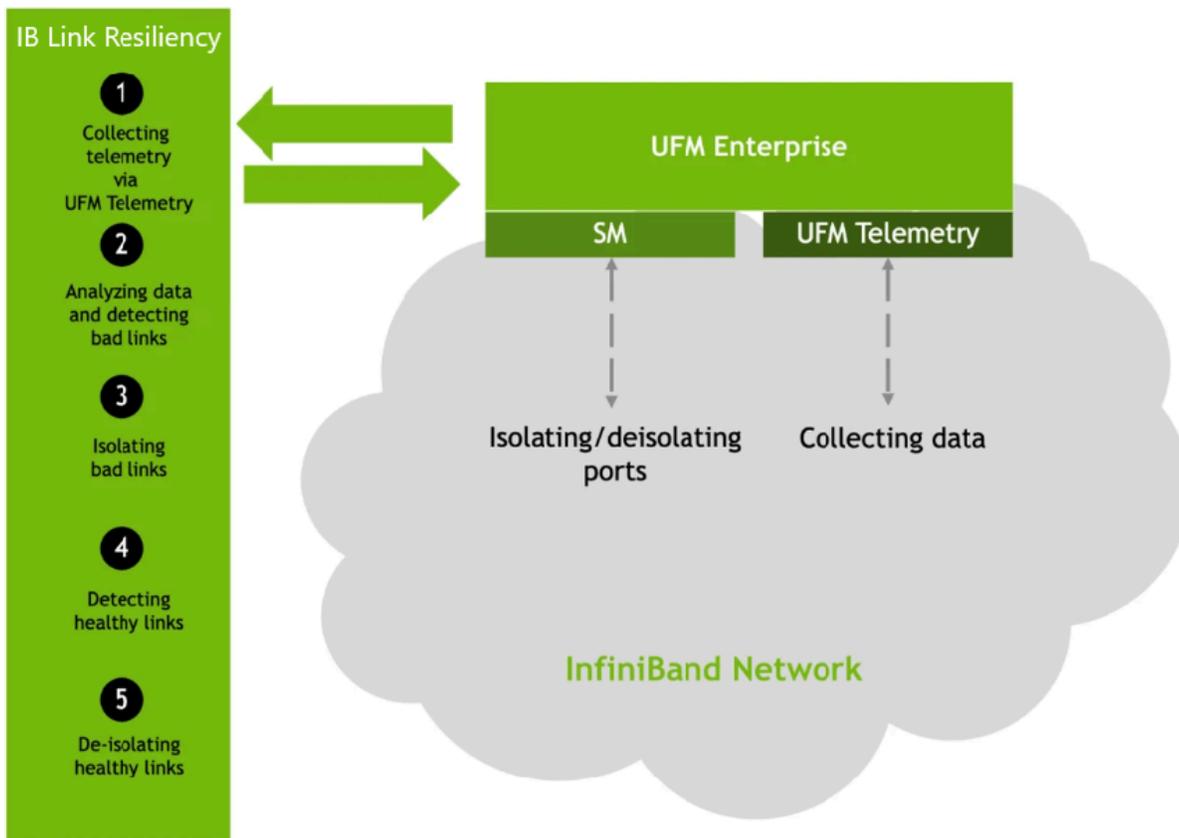
This objective is accomplished by combining different mechanisms, both ML-based and rule-based, for identifying problematic links. Then, the plugin autonomously applies corrective measures to these links with the aim of restoring their normal function.

For cluster topologies where no redundancy exists at the level of access links, the plugin will only execute a mitigation procedure for trunk links.

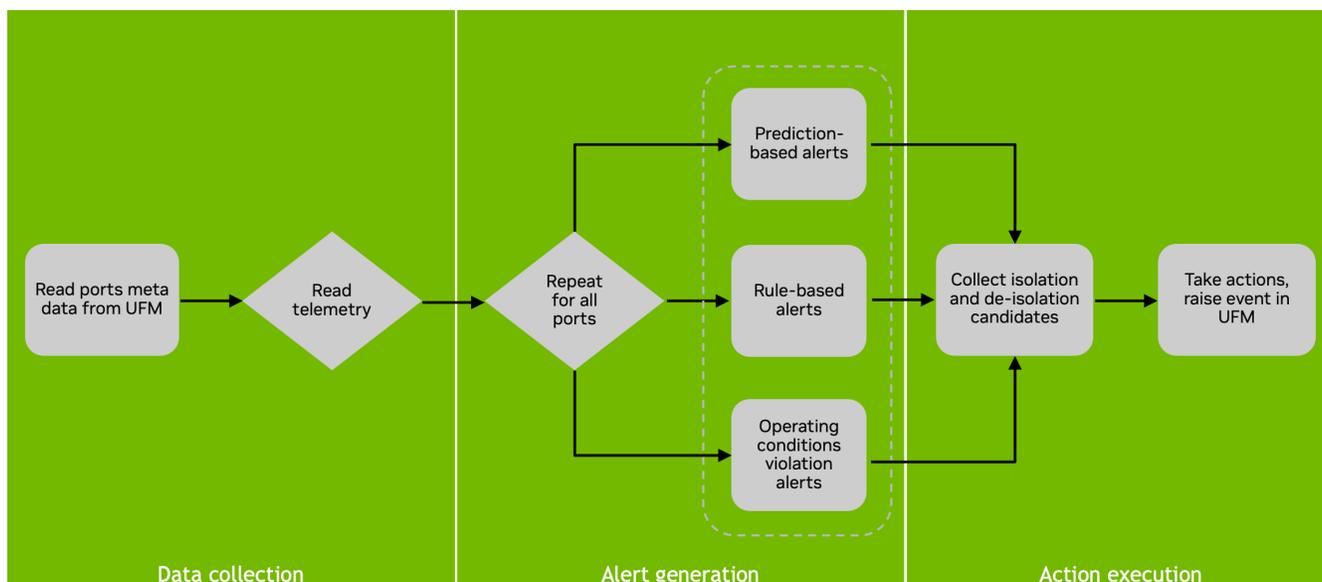
The IBLR plugin execution cycle is composed of the following tasks:

1. Collects telemetry data from the UFM secondary telemetry service, which by default collects telemetry data every 5 minutes.
2. Employs ML-based prediction models and rule-based detection logic to alert on problematic ports.
3. Based on the alerts issued by the different alert engines, determines which measures should be taken:
  1. Which links are underperforming and should be isolated from the fabric.
  2. Which isolated links have recovered following the mitigation process, and hence should be reinstated to the fabric.
4. Applies the required actions through the UFM and reports to the UFM events table.

## Schematic Flow: External View



## Schematic Flow: Internal View



## Data Collection

The plugin collects its telemetry data from the secondary telemetry endpoint, a low-frequency UFM Telemetry service which collects a large set of counters. Secondary telemetry is enabled by default, and in case it is being de-activated by the user, the plugin will not be able to operate.

In addition to telemetry data, the plugin periodically reads from the UFM the cluster topology information in order to align its internal logic with any changes that has taken place in the cluster.

## Main Collected Counters

| Name                                       | Description                                                                                                                                  |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <code>hist0-hist15</code>                  | FEC histogram counters. Counter <code>hist{i}</code> is incremented by one every time a FEC block is arrives with <code>i</code> bit errors. |
| <code>phy_effective_errors</code>          | Number of FEC blocks that could not be corrected (8 or more errors for FEC8 algorithm).                                                      |
| <code>phy_symbol_errors</code>             | Number of symbols dropped due to errors.                                                                                                     |
| <code>PortRcvErrorsExtended</code>         | Number of data blocks dropped due to errors.                                                                                                 |
| <code>PortRcvDataExtended</code>           | Number of received data blocks.                                                                                                              |
| <code>CableInfo.Temperature</code>         | Module temperature.                                                                                                                          |
| <code>CableInfo.diag_supply_voltage</code> | Module voltage.                                                                                                                              |
| <code>link_down_events</code>              | Number of times the link was down.                                                                                                           |

## Alert Generation

The alert generation block is composed of four independent engines, each employing either ML-based or rule-based logic in order to identify problematic links:

1. Failure prediction
2. Failure detection

3. Link flaps detection

4. Operating conditions violation

Per each alert engine, each port can be configured to operate in one of two modes:

- Shadow mode: the plugin will not act upon this link based on alerts from this engine.
- Active mode: the plugin is allowed to automatically execute mitigation steps upon this link in case an alert was raised from this engine.

## Alert Engine Operation Mode Configurations

| Name                     | Type      | Values                                               | Default Value | Description                                                                                  |
|--------------------------|-----------|------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------|
| <code>mode</code>        | str       | shadow, active                                       | <b>shadow</b> | This configuration assigns the default operation mode for the respective alert engine.       |
| <code>except_list</code> | List[str] | List of port identifiers (node guid and port number) | empty         | Ports included in the exception list are operating in the mode opposite to that indicated in |

| Name | Type | Values | Default Value | Description                                                                                                                                                     |
|------|------|--------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |      |        |               | <p>the <code>mode</code> configuration field. This enables to define a subset of the ports that will operate differently from the remainder of the cluster.</p> |

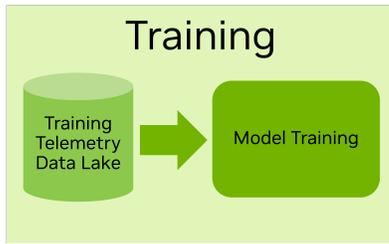
## Failure Prediction

The port failure prediction logic is based on a binary classification ML model, trained to predict ahead of time cases where physical layer issues will eventually result in data loss.

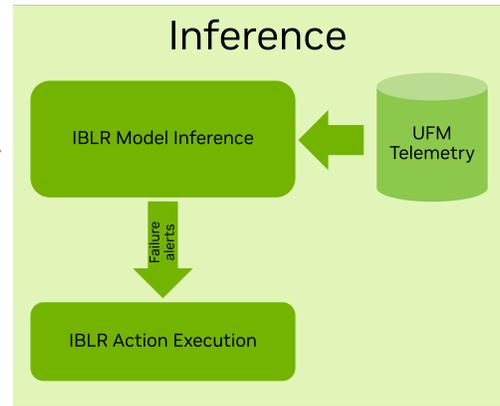
The model relies mainly on the error histogram counters of the Forward Error Correction (FEC) block.

The model was validated to provide valuable predictions on both HDR and NDR generation clusters.

## Offline by NVIDIA



## Online on Premise



## Failure Prediction Configurations

| Name            | Type  | Values | Default Value | Description                                                                                                                                                                                                                                                           |
|-----------------|-------|--------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| model-threshold | float | (0, 1) | <b>0.8</b>    | The decision threshold of the binary classification model. If the model's output probability exceeds this threshold an alert is triggered. The recommended value range is 0.65-0.8, with lower values favoring high recall and higher values favoring high precision. |

## Failure Detection

The failure detection module is comprised of two distinct rules, aimed at detecting based on post-FEC errors when a link is not meeting the desired performance specifications:

1. Packet drop rate: calculates the rate of dropped packets (local and remote errors) vs. successfully received packets.
2. Symbol errors: calculates the rate of symbol errors during two different time intervals (12 minutes and 125 minutes). If the threshold is exceeded for either interval, the rule triggers the failure detection alert.

This rule is only supported in NDR clusters, and is ignored in HDR clusters.

In case either of the rules exceeds its respective threshold, a failure detection alert will be raised.

## Failure Detection Configurations

| Name                    | Type | Default Value | Description                 |
|-------------------------|------|---------------|-----------------------------|
| detect_pdr_rule_enabled | bool | <b>True</b>   | Flag indicating whether the |

| Name | Type | Default Value | Description                                                |
|------|------|---------------|------------------------------------------------------------|
|      |      |               | Packet drop rate rule is enabled. If disabled, alerts will |

| Name                             | Type | Default Value | Description                          |
|----------------------------------|------|---------------|--------------------------------------|
|                                  |      |               | not be generated based on this rule. |
| detect_symbol_error_rule_enabled | bool | <b>True</b>   | Flag in indication                   |

| Name | Type | Default Value | Description                                           |
|------|------|---------------|-------------------------------------------------------|
|      |      |               | Whether the symbol error rule is enabled. If disabled |

| Name | Type | Default Value | Description                                          |
|------|------|---------------|------------------------------------------------------|
|      |      |               | ed, alerts will not be generated based on this rule. |

| Name                                                                                                                     | Type  | Default Value | Description                             |
|--------------------------------------------------------------------------------------------------------------------------|-------|---------------|-----------------------------------------|
| <div data-bbox="164 1136 407 1262" style="border: 1px solid gray; padding: 2px;"> detect_pdr_error_rate_threshold </div> | float | <b>1e-12</b>  | The threshold for the packet drop rate. |

| Name                                                    | Type  | Default Value | Description                                         |
|---------------------------------------------------------|-------|---------------|-----------------------------------------------------|
| <pre>detect_symbol_error_short_interval_threshold</pre> | float | <b>2.88</b>   | The threshold for the symbol error rule, 12 minutes |

| Name                                                                                                                                     | Type  | Default Value | Description                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                          |       |               | e<br>s<br>i<br>n<br>t<br>e<br>r<br>v<br>a<br>l<br>.                                                                                                |
| <div data-bbox="162 913 406 1081" style="border: 1px solid gray; padding: 2px;"> detect_symbol_error_long<br/>_interval_threshold </div> | float | <b>3</b>      | T<br>h<br>e<br>t<br>h<br>r<br>e<br>s<br>h<br>o<br>l<br>d<br>f<br>o<br>r<br>t<br>h<br>e<br>s<br>y<br>m<br>b<br>o<br>l<br>e<br>r<br>r<br>o<br>r<br>s |

| Name | Type | Default Value | D<br>e<br>s<br>c<br>r<br>i<br>p<br>t<br>i<br>o<br>n                                                              |
|------|------|---------------|------------------------------------------------------------------------------------------------------------------|
|      |      |               | r<br>u<br>l<br>e,<br>1<br>2<br>5<br>m<br>i<br>n<br>u<br>t<br>e<br>s<br>i<br>n<br>t<br>e<br>r<br>v<br>a<br>l<br>. |

## Link Flaps Detection

A heuristic for detection of link flap events is being utilized. This rule defines a link flap as a scenario where link down occurred on both ends of the link more times than defined by the link flap threshold.

By setting the right threshold, this rule is meant to capture unintentional link flaps, and filter out links that were intentionally reset or suffered from a rare link down event.

### Link Flaps Detection Configurations

| Name                                               | Type | Default Value | Description                                       |
|----------------------------------------------------|------|---------------|---------------------------------------------------|
| <pre>link_down_threshold_flapping_trunk_link</pre> | int  | <b>15</b>     | The minimum number of link down events considered |

| Name                                     | Type | Default Value | Description                               |
|------------------------------------------|------|---------------|-------------------------------------------|
|                                          |      |               | redalink flap, for switch - switch links. |
| link_down_threshold_flapping_access_link | int  | <b>15</b>     | The minimum                               |

| Name | Type | Default Value | Description                                                                                                                                                                                 |
|------|------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |      |               | al<br>n<br>u<br>m<br>b<br>e<br>r<br>o<br>f<br>l<br>i<br>n<br>k<br>d<br>o<br>w<br>n<br>e<br>v<br>e<br>n<br>t<br>s<br>c<br>o<br>n<br>s<br>i<br>d<br>e<br>r<br>e<br>d<br>a<br>l<br>i<br>n<br>k |

| Name | Type | Default Value | Description                   |
|------|------|---------------|-------------------------------|
|      |      |               | flap, for hosts switch links. |

## Operating Conditions Violation

A module aimed at validating that the ports are within their nominal operating conditions. Configurable lower and upper thresholds are used to indicate whether the voltage and temperature of the port are exceeding the desired range.

### Operating Conditions Violation Configurations

| Name                             | Type | Default Value | Description                                   |
|----------------------------------|------|---------------|-----------------------------------------------|
| port_temperature_upper_threshold | int  | <b>70</b>     | The temperature upper threshold value, in °C. |
| port_temperature_lower_threshold | int  | <b>-10</b>    | The temperature lower threshold value, in °C. |
| port_voltage_upper_threshold     | int  | <b>3500</b>   | The voltage upper threshold value, in mV.     |
| port_voltage_lower_threshold     | int  | <b>3100</b>   | The voltage lower threshold value, in mV.     |

## Action Execution

The action execution block processes inputs from the alert generation module, the UFM and the internal port state table in order to determine which links should undergo isolation or de-isolation.

Then, it executes the actions via a UFM API, and finally it updates both on the actions that were and were not taken via messages to the UFM events table.

## Action Execution Flow

The action execution flow is comprised of 6 main modules (below image, right side), which can be aggregated into three main steps:

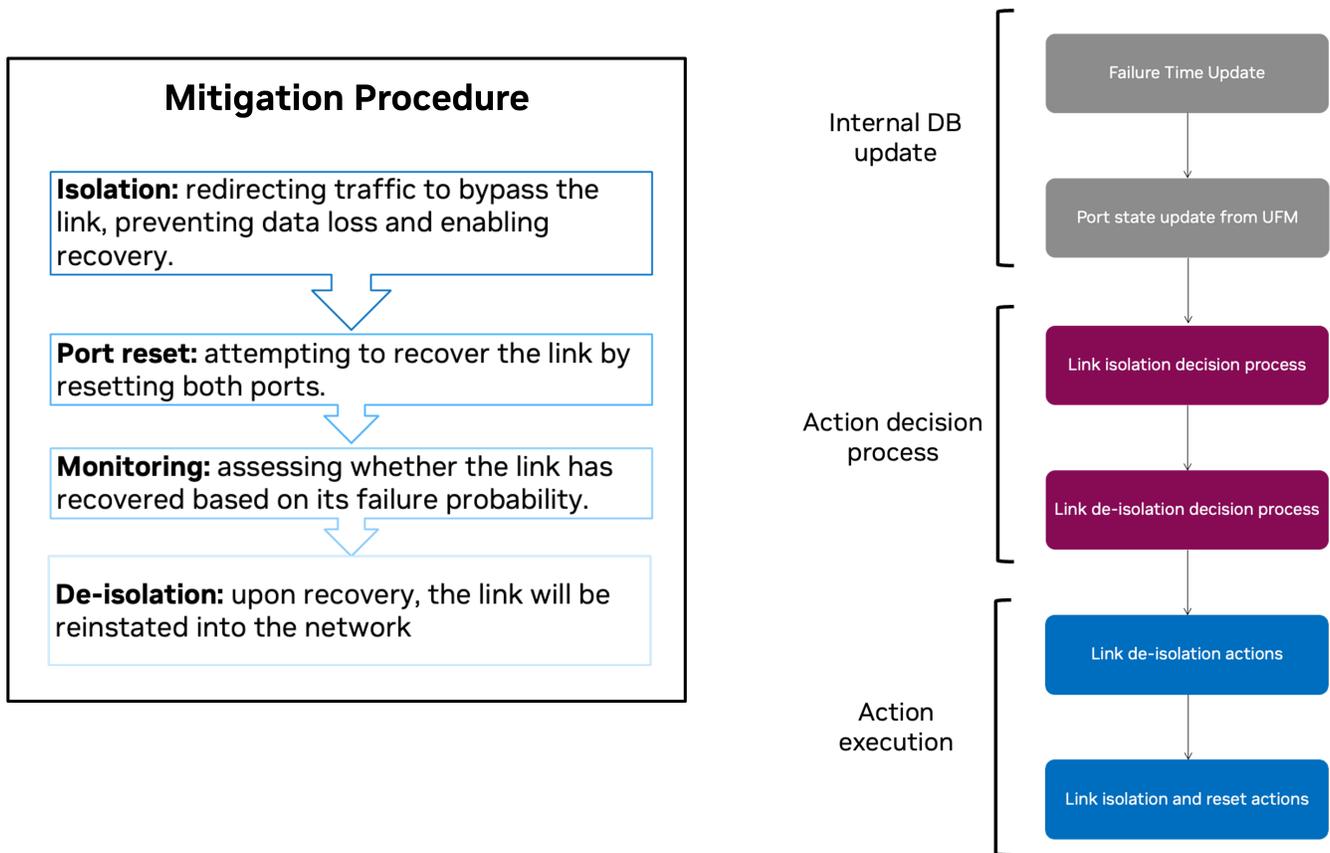
1. Update of the internal port state DB, based on data collected from the alert generation module and from the UFM.
2. Based on the ports' state as captured by the port state DB, run two decision processes to determine which links should be isolated and which should be de-isolated.
3. Apply the necessary actions through the UFM.

Once a link is selected for action, it enters a mitigation cycle as outlined below.

Isolation and de-isolation of links is done via updating the UFM **Unhealthy Ports** file. This file is submitted by the UFM to the SM, triggering the update of the routing tables throughout the fabric.

Notably, even while the link is isolated and no application traffic flows through it, the physical layer remains active hence we are able to keep monitoring the state of the link using the same aforementioned alert engines.

This enables the the decision process to determine if the link has successfully recovered following the mitigation procedure, and if so reinstate it back into the network.



## Link State Transition Diagram

The below diagram depicts the link state machine managed by the IBLR plugin.

Application traffic will flow through the link only if it is in **Healthy** state. In all other states, the link is isolated and traffic is redirected to other parallel links.

The black arrows in the diagram indicate state transitions triggered by the plugin, while the red dotted arrows indicate state transitions triggered outside the plugin (e.g. by the

user).

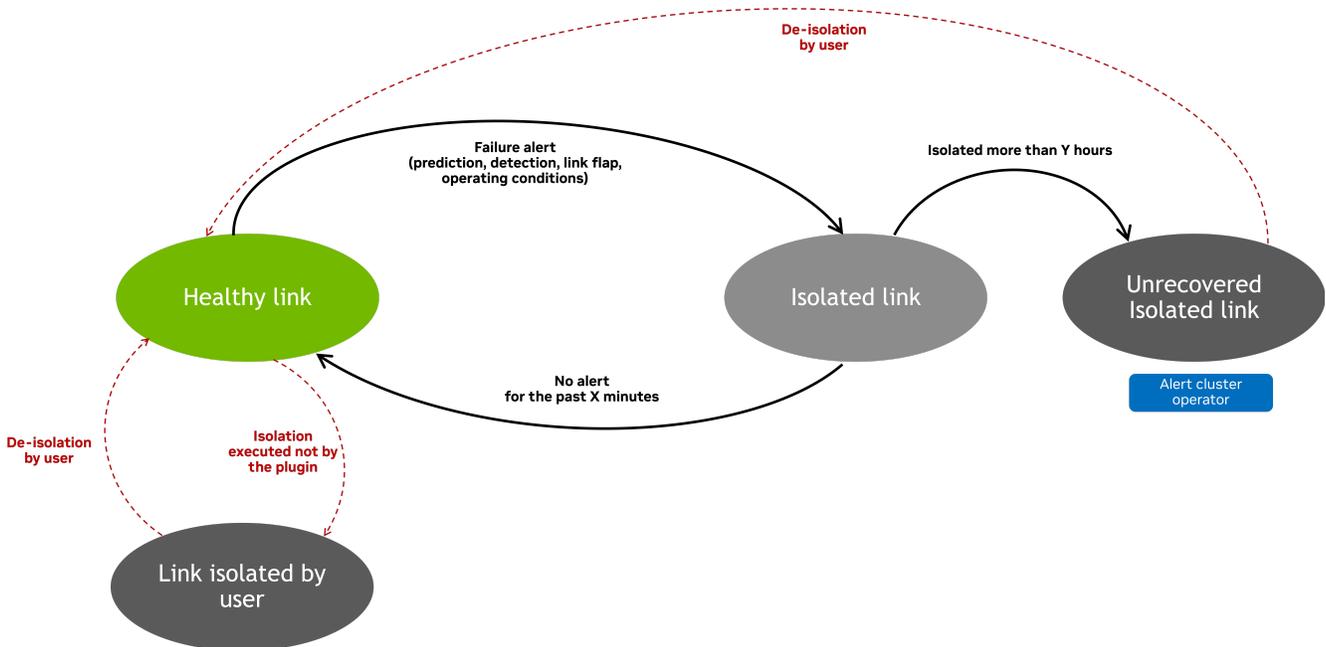
While the main flow of isolating a problematic link, waiting for it to recover and reinstating it is fully operated by the plugin, there are two additional flows that require user intervention:

1. If a link that was isolated by the plugin has not recovered within a pre-determined period, it will be moved into the **unrecoverable** state.

This comes to suggest that the network operator should inspect the link, attempt to recover it, and if successful de-isolate the link to signal the link was maintained.

2. If a link was isolated outside the scope of the plugin, the plugin will not de-isolate the link automatically as it has insufficient knowledge with respect to the isolation reason.

In that case, de-isolation should also be handled by the user or external system that isolated the link.



## Action Execution Checkpoints

The action execution decision process includes a set of configurable checkpoints, that provide the user the ability to determine under what conditions actions will be taken.

These configurable checkpoints can be broadly divided into the following groups:

1. Isolation and de-isolation rate limit constraints.
2. Topology-dependent constraints that prevent isolations in case this will lead to insufficient redundancy in the fabric.
3. Isolated links' time limits to qualifying for de-isolation or be considered unrecoverable.

The below tables describe the main configuration parameters used by the decision process checkpoints.

## Isolation Checkpoints Configurations

| Name                        | Type | Description                                                                                                   |
|-----------------------------|------|---------------------------------------------------------------------------------------------------------------|
| max_per_hour/day/week/month | int  | The maximum number of distinct links allowed to be <b>isolated</b> within a specific time window.             |
| min_links_per_switch_pair   | int  | The minimum number of healthy links between two switches, when reached no further isolations will be allowed. |
| min_active_ports_per_switch | int  | The minimum number of active ports per switch, when reached no further isolations will be allowed.            |

## De-isolation Checkpoints Configurations

| Name                                   | Type | Description                                                                                                    |
|----------------------------------------|------|----------------------------------------------------------------------------------------------------------------|
| max_per_hour                           | int  | The maximum number of distinct links allowed to be <b>de-isolated</b> within an hour.                          |
| min_health_time_before_deisolation_min | int  | The minimum period in minutes that a link has to be clean of alerts in order to be qualified for de-isolation. |

| Name                              | Type | Description                                                                                                             |
|-----------------------------------|------|-------------------------------------------------------------------------------------------------------------------------|
| max_recovery_time_threshold_hours | int  | The maximum period in hours that a link is granted for recovery and de-isolation, before declaring it as unrecoverable. |

## Reporting

Customers may be looking to extend or replace the plugin's mitigation procedure with their private business logic.

For that purpose, the action execution module reports both on actions it has taken, as well as on actions it has not taken due to the decision process failing at one of the checkpoints.

Reporting is done via sending event-specific messages to the UFM events table.

### Event Messages: Indication of Action

| Event                        | Message Format                                                                                                                                                      | Comments                                                              |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Isolation                    | Completed isolation of the link between ports <src_guid>_<src_num> <-> <dest_guid>_<dest_num>, isolation reasons: <alert_reasons>                                   |                                                                       |
| De-isolation                 | Completed deisolation of the link between ports <src_guid>_<src_num> <-> <dest_guid>_<dest_num> after no alerts were triggered for <isolation_reasons>              | Isolation reasons are the alerts that triggered the initial isolation |
| Declaring unrecoverable port | Port <src_guid>_<src_num> could not be deisolated for more than <threshold value> hours due to repeating <alert_reason> alerts, hence it is marked as unrecoverable | Threshold is configurable, the plugin will not deisolate              |

| Event | Message Format | Comments            |
|-------|----------------|---------------------|
|       |                | unrecoverable ports |

## Event Messages: Indication of Action Not Taken

| Event                                                      | Message Format                                                                                                                                                                                                                               | Comments                                                                     |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Total alerts count exceeding alert threshold per iteration | Isolation will not be performed because the number of ports alerted for isolation (<actual count>) is greater than the threshold for the maximum number of isolation alerts (<threshold value>)                                              | Threshold is configurable                                                    |
| Access link alert                                          | Isolation will not be performed for port <guid>_<num> because this is an access link, triggered alerts: <alert_reasons>                                                                                                                      |                                                                              |
| Shadow mode preventing isolation                           | Isolation will not be performed for port <guid>_<num> because the port is in shadow mode, triggered alerts: <alert_reasons>                                                                                                                  |                                                                              |
| Shadow mode preventing de-isolation                        | Deisolation will not be performed for port <guid>_<num> because the port is in shadow mode, triggered alerts: <alert_reasons>                                                                                                                | Only if mode changed from active to shadow while port is isolated            |
| Exceeding isolation count per time                         | Isolation will not be performed for port <guid>_<num> because the number of isolated ports in the last <time frame> (<actual count>) exceeds the threshold for max isolations allowed (<threshold value>), triggered alerts: <alert_reasons> | Time frame is in (hour, day, week, month), each has a configurable threshold |

| Event                                                            | Message Format                                                                                                                                                                                                                                                              | Comments                                                                          |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Exceeding de-isolation count per time                            | Deisolation will not be performed for port <guid>_<num> because the number of de-isolated ports in the last <time frame> (<actual count>) exceeds the threshold for max de-isolations allowed (<threshold value>)                                                           | Time frame is hour, threshold is configurable                                     |
| Insufficient redundancy in the connectivity between the switches | Isolation will not be performed for port <guid>_<num> because the number of links between switches <src_guid> and <dest_guid> (<actual count>) will decrease below the threshold for minimum number of healthy links (<threshold value>), triggered alerts: <alert_reasons> | Threshold is configurable                                                         |
| Insufficient number of active ports in the switch                | Isolation will not be performed for port <guid>_<num> because the number of active ports for switch <switch_guid> (<actual count>) will decrease below the threshold for minimum number of active ports (<threshold value>), triggered alerts: <alert_reasons>              | Threshold is configurable, validated for the two switches which the link connects |

## Deployment

The IB Link Resiliency plugin can be deployed using the following methods:

1. On the UFM Appliance
2. On the UFM Software

To deploy the plugin, follow these steps:

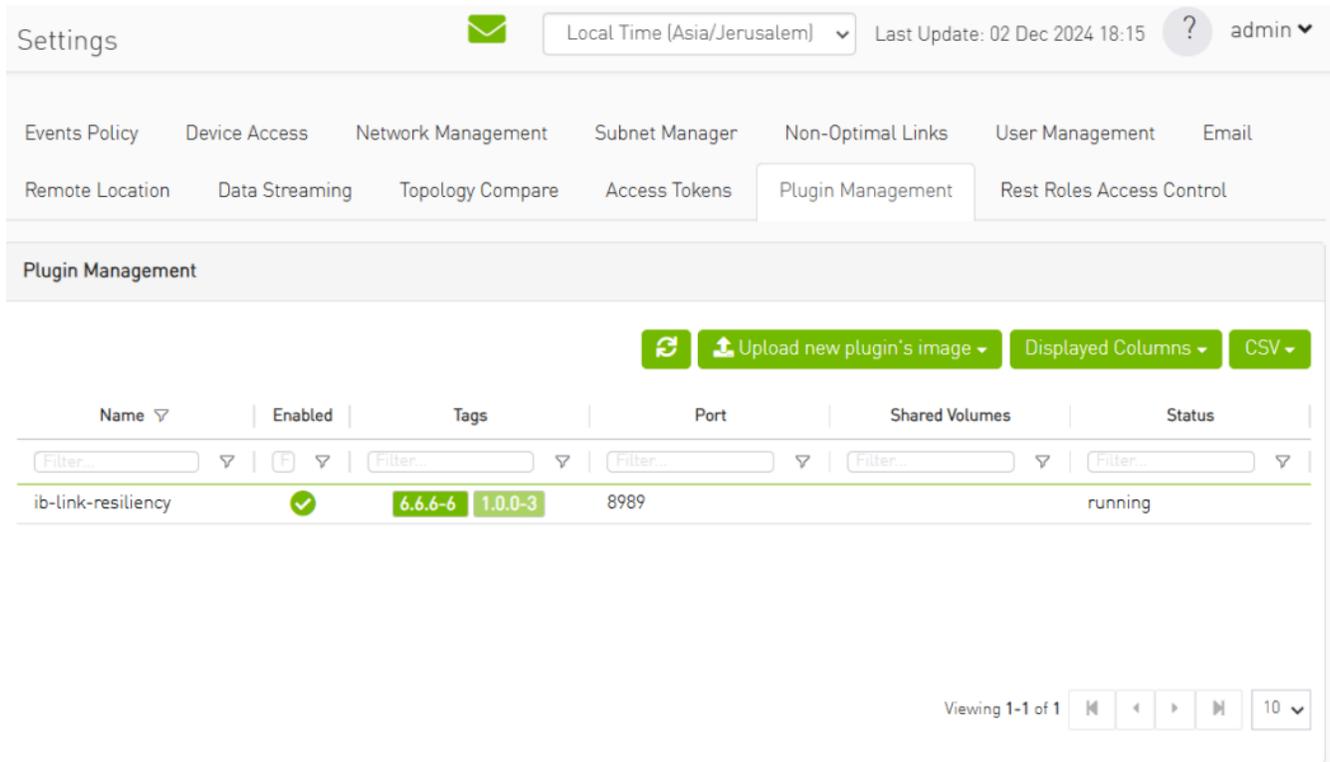
1. Download the `ufm-plugin-ib-link-resiliency-image` from [DockerHub](#).

2. Load the downloaded image onto the UFM server. This can be done either by using the UFM GUI by navigating to the **Settings -> Plugins Management** tab or by loading the image via the following instructions:

1. Log in to the UFM server terminal.
2. Run:

```
docker load -i <path_to_image>
```

3. After successfully loading the plugin image, the plugin should become visible within the plugins management table within the UFM GUI. To initiate the plugin's execution, simply right-click on the respective line in the table.



Settings Local Time (Asia/Jerusalem) Last Update: 02 Dec 2024 18:15 admin

Events Policy Device Access Network Management Subnet Manager Non-Optimal Links User Management Email

Remote Location Data Streaming Topology Compare Access Tokens **Plugin Management** Rest Roles Access Control

**Plugin Management**

Refresh Upload new plugin's image Displayed Columns CSV

| Name               | Enabled                             | Tags            | Port | Shared Volumes | Status  |
|--------------------|-------------------------------------|-----------------|------|----------------|---------|
| ib-link-resiliency | <input checked="" type="checkbox"/> | 6.6.6-6 1.0.0-3 | 8989 |                | running |

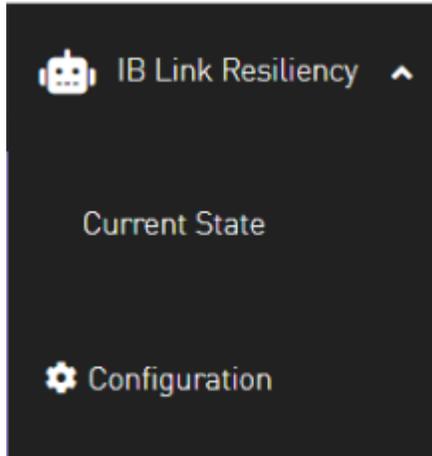
Viewing 1-1 of 1 10

**Note**

**The supported InfiniBand hardware technologies are HDR and NDR.**

# IB Link Resiliency UI

After the successful deployment of the plugin, a new item is shown in the UFM side menu for the IB Link Resiliency plugin:



## Current State

This page displays the `Current State` table presenting the cluster status, outlining the following counts:

1. Number of ports.
2. Number of isolated ports.
3. Number of ports operating in active/shadow mode, per each of the alert engines.
4. Number of predicted failures, reflecting ports which were recently flagged by the ML model as having a high probability of failure.

**Current State**

Please select a value to filter the table below

Displayed Columns ▼ CSV ▼

|                                                                | Switch to Switch | Switch to Host | Total, currently |
|----------------------------------------------------------------|------------------|----------------|------------------|
| Filter...                                                      | Filter...        | Filter...      | Filter...        |
| Number of ports                                                | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of isolated ports                                       | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in active failure prediction mode              | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow failure prediction mode              | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of ports in active operating conditions validation mode | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow operating conditions validation mode | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of ports in active failure detection mode               | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow failure detection mode               | 8(80%)           | 2(20%)         | 10(100%)         |
| Failures prediction                                            | 0(0%)            | 0(0%)          | 0(0%)            |

Viewing 1-9 of 9 ⏪ ⏩ 10 ▼

The **Port Level Status** table is displayed below and shows the status of the cluster ports, as stored in the port state DB.

**Port Level Status**

Displayed Columns ▼ CSV ▼

| Node ID       | Node Name    | Port Number | Failure Pred... | Failure Dete... | Operation C... | Isolation St... | Type          | Last Recom... | Last Recom... | Last Action | Last Action ... | Last Reason |
|---------------|--------------|-------------|-----------------|-----------------|----------------|-----------------|---------------|---------------|---------------|-------------|-----------------|-------------|
| Filter...     | Filter...    | Filter...   | Filter...       | Filter...       | Filter...      | Filter...       | Filter...     | Filter...     | Filter...     | Filter...   | Filter...       | Filter...   |
| 0x248a070...  | AJNA-LEA...  | 9           | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x043f7203... | SwitchIB ... | 3           | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x043f7203... | SwitchIB ... | 5           | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x98039b0...  | SwitchIB ... | 13          | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x1070fd03... | r-ufm116     | 1           | shadow          | shadow          | shadow         | Health          | host_switch   | NA            | N/A           | NA          | N/A             | NA          |
| 0x98039b0...  | SwitchIB ... | 11          | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x043f7203... | SwitchIB ... | 1           | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0x248a070...  | AJNA-LEA...  | 7           | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0xec0d9a0...  | SwitchIB ... | 15          | shadow          | shadow          | shadow         | Health          | switch_swi... | NA            | N/A           | NA          | N/A             | NA          |
| 0xec0d9a0...  | SwitchIB ... | 25          | shadow          | shadow          | shadow         | Health          | switch_host   | NA            | N/A           | NA          | N/A             | NA          |

Viewing 1-10 of 10 ⏪ ⏩ 10 ▼

The user can filter the **Port Level Status** table by clicking on any value in the **Current State** table.

For example, if the user clicks on the number of isolated switch-to-switch ports, the **Port Level Status** table will display only the isolated switch-to-switch ports.

|                                                                | Switch to Switch | Switch to Host | Total, currently |
|----------------------------------------------------------------|------------------|----------------|------------------|
| Number of ports                                                | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of isolated ports                                       | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in active failure prediction mode              | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow failure prediction mode              | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of ports in active operating conditions validation mode | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow operating conditions validation mode | 8(80%)           | 2(20%)         | 10(100%)         |
| Number of ports in active failure detection mode               | 0(0%)            | 0(0%)          | 0(0%)            |
| Number of ports in shadow failure detection mode               | 8(80%)           | 2(20%)         | 10(100%)         |
| Failures prediction                                            | 0(0%)            | 0(0%)          | 0(0%)            |

Viewing 1-9 of 9

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**Port Level Status**

Displayed Columns CSV

| Node ID             | Node Name | Port Number | Failure Pred... | Failure Dete... | Operation C... | Isolation St... | Type | Last Recom... | Last Recom... | Last Action | Last Action ... | Last Reason |
|---------------------|-----------|-------------|-----------------|-----------------|----------------|-----------------|------|---------------|---------------|-------------|-----------------|-------------|
| No items were found |           |             |                 |                 |                |                 |      |               |               |             |                 |             |

## Configuration

This page displays a subset of the aforementioned IBLR configuration parameters.

Below are representative screenshots showing some of the configuration parameters accessible through the UI:

- Action execution configurations:

**General Configurations** ▼

**Max Number of Isolated Ports**

**Max Number of Isolated Per Time Window**

 Hour
 Day
 Week
 Month

**Max Number of De-isolated Per Time Window**

 Hour

**Minimum Time Port Should be Healthy Before De-isolation**

 Minutes

**Minimum Number of Links Between Two Switches**

**Minimum Number of Active Ports Per Switch**

- Failure prediction operating mode configurations:

**Failure Prediction** ▼

**Default Mode**

 Active  Shadow

**Exception List**

 ▼

# ClusterMinder Plugin

**i Note**

This plugin is supported on UFM Enterprise Appliance only.

## Overview

The ClusterMinder plugin collects telemetry data from multiple data sources and aggregates, streams and visualizes the backend data. The plugin can cluster/group aggregated Redfish data from multiple machines that allows operational anomaly and misconfiguration detection. The plugin provides Cluster-wide histograms of hardware telemetry which details compute node configuration and inventory, PCIe bus, hardware information (SN and FW version) and health alerts of all relevant devices on each Redfish category.

The plugin can be deployed as a container and supports multiple data sources, including:

- Redfish on Host
- Redfish on DPU
- MLNX Switch Data
- DOCA Telemetry Service on DPU (BlueField)
- DOCA Telemetry Service on Host
- Unmanaged InfiniBand Switches

## Deployment

The plugin can be deployed using the following methods:

1. On the UFM Appliance
2. On the UFM Software

To deploy the plugin, follow these steps:

- The plugin is included in the default plugin bundle available at [NVIDIA's Licensing Portal](#).
- Load the downloaded image onto the UFM server. This can be done either by using the UFM GUI by navigating to the Settings -> Plugins Management tab or by loading the image via the following instructions:
  - Log in to the UFM server terminal.
  - Run:

```
docker load < <path_to_image>
```

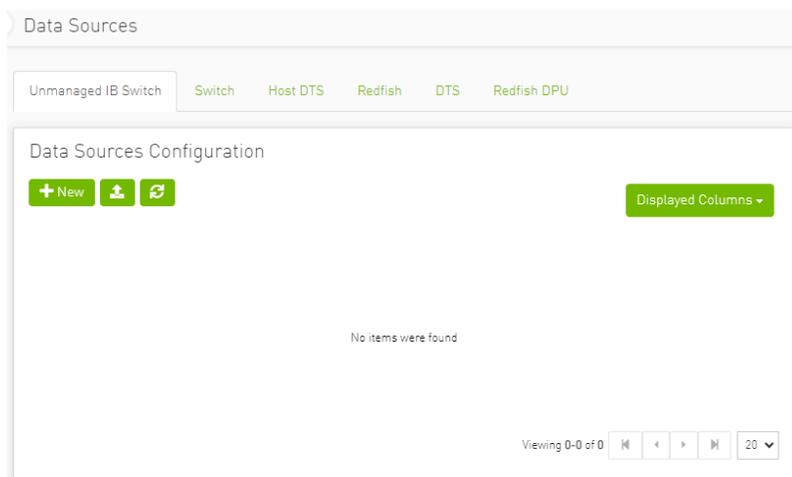
- o After successfully loading the plugin image, the plugin should become visible within the plugins management table within the UFM GUI. To initiate the plugin's execution, simply right-click on the respective in the table.

| Name          | Enabled | Tags  | Port | Shared Volumes | Status  |
|---------------|---------|-------|------|----------------|---------|
| clusterminder | ✓       | 1.1.4 | 8688 |                | running |

## ClusterMinder Plugin UI

After the successful deployment of the plugin, a new item is shown in the UFM side menu for the ClusterMinder plugin:

## Example of Adding Data Source



## Example of Adding the Redfish Host

After inputting the "BMC IP", "Protocol", "Username" and "Password". Pressing the button tests the connection and allows to hosts if successful.

New Source
×

---

BMC IP

Protocol

Username

Password

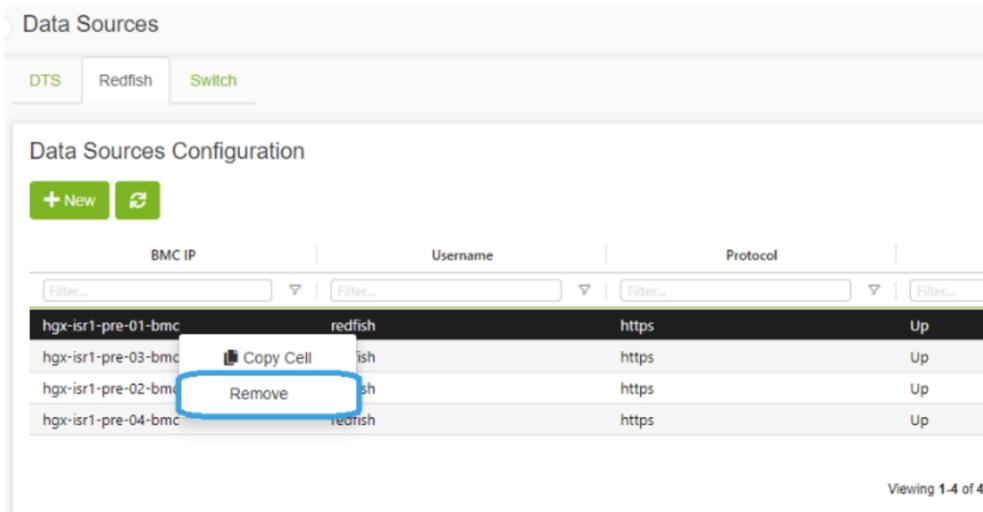
Test Result: ✔

| bmc_ip                                                               | username                                                 | protocol                                               | status |
|----------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|--------|
| <input style="width: 90%;" type="text" value="hgx-isr1-pre-03-bmc"/> | <input style="width: 90%;" type="text" value="redfish"/> | <input style="width: 90%;" type="text" value="https"/> | Up     |
| <input style="width: 90%;" type="text" value="hgx-isr1-pre-02-bmc"/> | <input style="width: 90%;" type="text" value="redfish"/> | <input style="width: 90%;" type="text" value="https"/> | Up     |
| <input style="width: 90%;" type="text" value="hgx-isr1-pre-04-bmc"/> | <input style="width: 90%;" type="text" value="redfish"/> | <input style="width: 90%;" type="text" value="https"/> | Up     |
| <input style="width: 90%;" type="text" value="hgx-isr1-pre-01-bmc"/> | <input style="width: 90%;" type="text" value="redfish"/> | <input style="width: 90%;" type="text" value="https"/> | Up     |

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## Example of Removing Data Source

Removing hosts is done through the "Data Sources" section, Right click any available host and click the remove option.



# Sysinfo Plugin

## Overview

The Sysinfo plugin is a Docker container that is managed by UFM and comes with REST API support. Its purpose is to allow users to run commands and extract information from managed switches. This feature enables users to schedule runs at regular intervals and execute commands on switches directly from UFM.

The plugin takes care of managing sessions to the switches and can extend them if necessary. It also enables users to send both synchronous and asynchronous commands to all the managed switches. Additionally, it can intersect the given switches with the running UFM to ensure that only those switches that are on the UFM are activated.

## Deployment

The following are the possible ways plugin plugin can be deployed:

1. On UFM Appliance
2. On UFM Software.
3. Authentication

Following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

## REST API

The following REST APIs are supported:

- GET /help
- GET /version
- POST /query
- POST /update
- POST /cancel
- POST /delete

## Sysinfo Query Format

The Sysinfo plugin is responsible for extracting basic data needed to create a query. This is done using the following five fields:

1. Switches - An array of switch IP addresses. If this field is left empty, the plugin will gather all switches from the running UFM.
2. Callback - The URL location to which the answers should be sent.
3. Commands - An array of commands that need to be executed.
4. Schedule\_run - An optional field used to set intervals for running the commands. The interval can be specified in seconds and can be set to run until a certain duration or end time. The start time can also be controlled.

There are additional flags for a configurable query:

- `ignore_ufm=True`: Does not check the UFM for switches or intersect it with given switches

- `username`: Overrides the switches' default username
- `password`: Overrides the switches' default password
- `is_async`: Rather than attempting to execute all commands simultaneously at the switch, the commands are executed one after the other in sequence.
- `one_by_one=False`: Instead of sending results from each switch as soon as information is obtained, all data is sent at once to the callback. This change eliminates multiple small sends and replaces them with a single large send.

For detailed information on how to interact with Sysinfo plugin, refer to the [NVIDIA UFM Enterprise > Rest API > Sysinfo Plugin REST API](#).

## SNMP Plugin

The SNMP plugin is a self-contained Docker container that includes REST API support and is managed by UFM. Its primary function is to receive SNMP traps from switches and forward them to UFM as external events. This feature enhances the user experience by providing additional information about switches in the InfiniBand fabric via UFM events and alarms.

### Deployment

There are two potential deployment options for the SNMP plugin:

- On UFM Appliance
- On UFM Software

For detailed instructions on how to deploy the SNMP plugin, refer to [this page](#).

### Authentication

The following authentication types are supported:

- basic (/ufmRest)
- client (/ufmRestV2)
- token (/ufmRestV3)

# REST API

The following REST API are supported:

- GET /switch\_list
- GET /trap\_list
- POST /register
- POST /unregister
- POST /enable\_trap
- POST /disable\_trap
- GET /version

For more information, please refer to [UFM Enterprise Documentation](#) → UFM REST API → SNMP Plugin REST API.

## Usage

By default, upon initialization, the SNMP plugin captures traps from all switches within the fabric. However, this behavior can be modified through configuration settings utilizing the "snmp\_mode" option, with available values of "auto" or "manual".

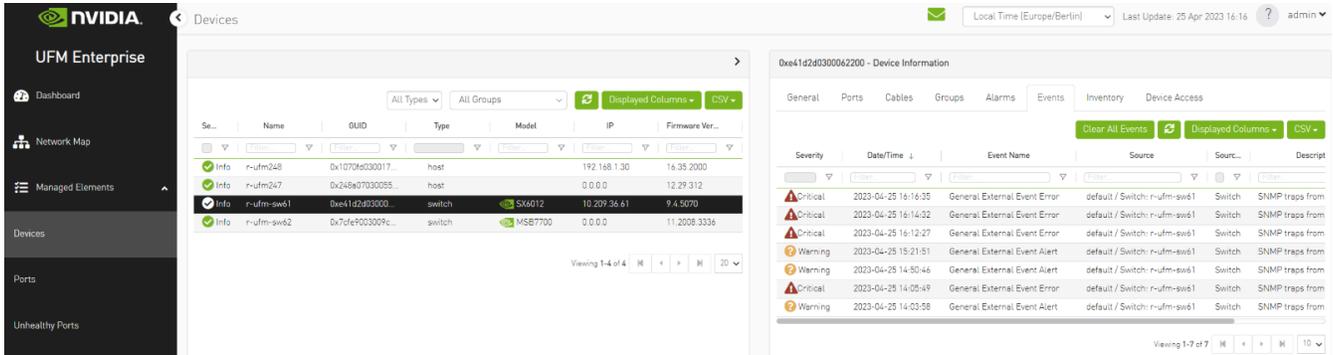
It is important to ensure that the switch is visible to UFM and has a valid IP address. As illustrated in the following example, switch traps will only be received from "r-ufm-sw61".

| Severity | Name       | GUID               | Type   | Model   | IP           | Firmware Version |
|----------|------------|--------------------|--------|---------|--------------|------------------|
| Info     | r-ufm-248  | 0x1070f403001763ec | host   |         | 192.168.1.30 | 16.35.2000       |
| Info     | r-ufm-247  | 0x248a070300554548 | host   |         | 0.0.0.0      | 12.29.312        |
| Info     | r-ufm-sw61 | 0xe41d2803000e2200 | switch | 5K6012  | 10.209.36.61 | 9.4.5070         |
| Info     | r-ufm-sw62 | 0x7cfe9003007cebb0 | switch | MS87700 | 0.0.0.0      | 11.2008.3336     |

The following is an instance of a trap received by the SNMP plugin and displayed as a UFM event:



Additionally, there is an option to verify events/alarms for a particular switch:



The SNMP plugin performs a periodic check of the fabric every 180 seconds, allowing for prompt receipt of traps from new switches or updated IP addresses of existing switches in under 180 seconds. This interval may be adjusted via the "ufm\_switches\_update\_interval" option. To manually register or unregister a switch, please refer to the [UFM Enterprise Documentation](#) → UFM REST API → SNMP Plugin REST API.

The SNMP plugin employs the most up-to-date SNMP v3 protocol, which incorporates advanced security measures such as authentication and encryption. The "snmp\_version" option enables the selection of SNMP versions "1" or "3". It is essential to note that only switch-exposed traps will be transmitted to UFM as events.

| OID                            | Name           | Description                                     | Status  | Severity |
|--------------------------------|----------------|-------------------------------------------------|---------|----------|
| MELLANOX-EFM-MIB::testTrap     | send-test      | A test trap ordered by the system administrator | Enabled | Warning  |
| MELLANOX-EFM-MIB::asicChipDown | asic-chip-down | ASIC (Chip) Down                                | Enabled | Critical |
| MELLANOX-EFM-                  | cpu-util-high  | CPU utilization has risen too high              | Enabled | Warning  |

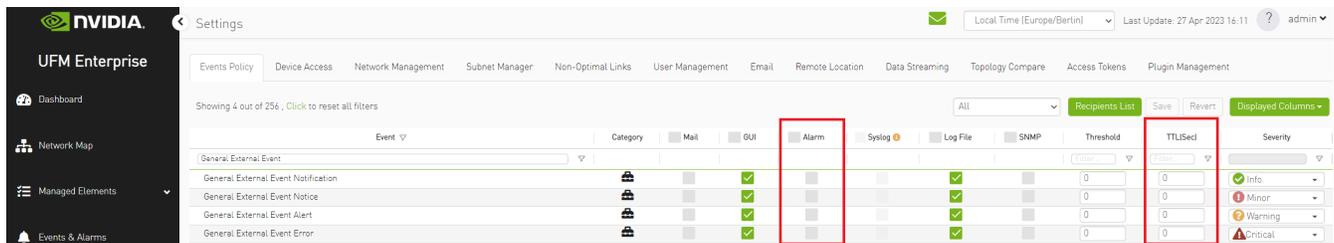
| OID                                       | Name                      | Description                                     | Status  | Severity |
|-------------------------------------------|---------------------------|-------------------------------------------------|---------|----------|
| MIB::cpuUtilHigh                          |                           |                                                 |         |          |
| MELLANOX-EFM-MIB::diskSpaceLow            | disk-space-low            | Filesystem free space has fallen too low        | Enabled | Warning  |
| MELLANOX-EFM-MIB::expectedShutdown        | expected-shutdown         | Expected system shutdown                        | Enabled | Info     |
| MELLANOX-EFM-MIB::systemHealthStatus      | health-module-status      | Health module Status                            | Enabled | Critical |
| MELLANOX-EFM-MIB::insufficientFans        | insufficient-fans         | Insufficient amount of fans in system           | Enabled | Warning  |
| MELLANOX-EFM-MIB::insufficientFansRecover | insufficient-fans-recover | Insufficient amount of fans in system recovered | Enabled | Info     |
| MELLANOX-EFM-MIB::insufficientPower       | insufficient-power        | Insufficient power supply                       | Enabled | Warning  |
| RFC1213::linkdown                         | interface-down            | An interface's link state has changed to down   | Enabled | Minor    |
| RFC1213::linkup                           | interface-up              | An interface's link state has changed to up     | Enabled | Info     |
| MELLANOX-EFM-MIB::unexpectedShutdown      | unexpected-shutdown       | Unexpected system shutdown                      | Enabled | Minor    |
| SNMPv2-MIB::coldStart                     | cold-start                | SNMP entity reinitialized                       | Enabled | Info     |

To learn more about how to enable or disable a specific trap, please refer to the [UFM Enterprise Documentation](#) → UFM REST API → SNMP Plugin REST API.

If some traps are not included in the default list, they may be added using the "snmp\_additional\_traps" option. The SNMP plugin will consider these traps as "enabled" and transmit them to UFM as events with an "Info" severity level.

To ensure the uninterrupted reception of traps from switches within a large fabric, changes must be made to the UFM configuration in the [/opt/ufm/conf/gv.cfg] file's [Events] section. Specifically, the "max\_events" option should be raised from 100 to 1000, while "medium\_rate\_threshold" and "high\_rate\_threshold" should both be set to 500. To implement configuration adjustments, disable and then enable the plugin.

In case of an event storm, it is necessary to adjust the Event Policy settings such that General Events are non-alarmable and the TTL is set to zero, as illustrated in the following screenshot:



## Other

Additional configurations are located in "/opt/ufm/conf/plugins/snmp/snmp.conf". To implement configuration adjustments, disable and then enable the plugin. For instructions on modifying the appliance, please refer to the [UFM-SDN Appliance Command Reference Guide](#).

Logs for the SNMP plugin are stored in "/opt/ufm/logs/snmptrap.log". For guidance on accessing logs on the appliance, please refer to the [UFM-SDN Appliance Command Reference Guide](#).

# Packet Level Monitoring Collector (PMC) Plugin

## Overview

The Packet Monitoring Collector/Controller plugin facilitates the configuration capture and display of a variety of events, enabling users to conduct real-time monitoring of network events. The PMC plugin is included in the plugins bundle, which can be downloaded from [NVIDIA's Licensing Portal](#).

Supported triggers are pFRN, Congestion, Fast Recovery, CQE and PHY Error Links.

Network events are stored as UFM events and are archived in files for later retrieval. Additionally, they can be observed through the PMC user interface. Events can be streamed externally via UFM REST API in the same way that UFM events are streamed. The REST APIs are described in the [UFM Enterprise REST API Guide](#).

## **pFRN**

- pFRN Notifications - Enables/Disables mirroring on pFRN trigger for entire network or list of GUIDs

## **Fast Recovery**

- Fast Recovery Notifications - Enables/Disables mirroring on Fast Recovery trigger for entire network or list of GUIDs
- Notifications Level - Specifies threshold for Fast Recovery mirroring. (Thresholds are configured in SM configuration)

## **PHY Error Links**

- PHY Error Links Notifications - Enables/Disables mirroring on PHY Link Error trigger for entire network or list of GUIDs
- Specifies threshold for PHY Link Error mirroring. (Thresholds are configured in SM configuration)

## **CQE**

- CQE Notifications - Enables/Disables mirroring on CQE Notifications trigger for entire network or list of GUIDs

## Congestion

- Congestion Notifications - Enables/Disables mirroring on Congestion Notifications trigger for entire network or list of GUIDs
  - Mirrored packets (%) - Specifies the percent of congested packets to be mirrored.
  - High threshold - High threshold percentage for InfiniBand switch egress port queue size. Values are in the [1,1023] range.
  - Low threshold - Low threshold percentage for InfiniBand switch egress port queue size. Values are in the [1,1023] range.

### **Note**

When a packet enters an InfiniBand switch, its data is stored at an ingress port buffer. A pointer to the packet's data is inserted into the egress port's queue, from which the packet will be exiting the switch. At that point, the threshold given by this command line argument is compared to the egress queue data size. If the queue data size exceeds the threshold, a congestion event is reported. The threshold is given in percent of the ingress port size.

An egress port queue can point data coming from multiple ingress port buffers, therefore the threshold can be bigger than 100%.

## Deployment

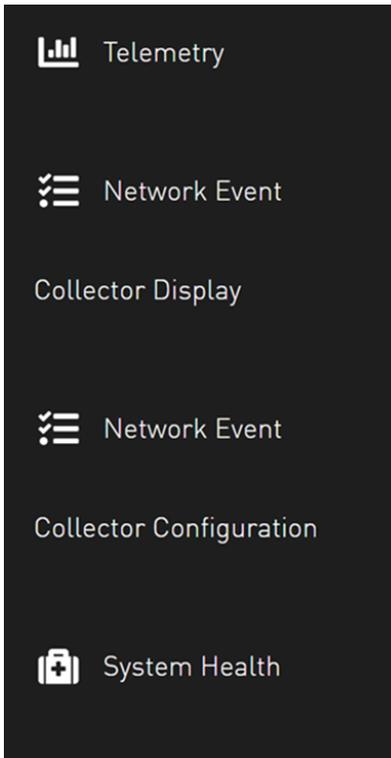
### Installation

Load the image on the UFM server; either using the UFM GUI -> Settings -> Plugins Management tab, or by loading the image via the following command:

1. Login to the UFM server terminal.

## 2. Run

```
docker load -I <path_to_image>
```



Upon completion of the plugin addition and subsequent refresh of the UFM GUI, the left navigation bar will display two new menu items. These two tabs can be observed in the following GUI screenshots

## PMC UI

### Network Event Collector Display

**Network Event Collector Display**

pFRN Events Congestion Events Fast Recovery Events **CQE Events**

Profile **Event summary** Time **Last 24 hours**

Please wait...

Displayed Columns

| timestamp                  | src guid           | src lid | src desc            | local qpn | dst lid | remote qpn | transport | syndrome            |
|----------------------------|--------------------|---------|---------------------|-----------|---------|------------|-----------|---------------------|
| 2024-01-02 11:20:13.607486 | 0x98039b03009fce86 | 1       | smg-lb-svr065 mx5_0 | 72        | 6       | 224        | RC        | Remote Access Error |

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## Network Event Collector Configuration

**Network Event Collector Configuration**

**Collectors**

pFRN Notifications

Fast Recovery Notifications

Notification Level

PHY Error Links Notifications

Notification Level

CQE Notifications

Congestion Notifications

Mirrored packets (%)

High threshold

Low threshold

**General Options**

enable adaptive routing

enable aggregation

enable autostart

## GNMI-Telemetry Plugin

The GNMI Telemetry Plugin is a server that uses the gNMI protocol to stream data from UFM telemetry. Users can select the data to stream, specify intervals, and choose to include only deltas (on-change mode).

The server supports three functions: Capability, Get and Subscribe.

**Data Streaming:** The streamed data is delivered in CSV format. Headers are provided in the first message and included in subsequent messages. Data is presented in hex format to conserve space for unchanged data. Values are displayed as an array of strings, each representing a unique identifier (GUID) and port. Depending on the mode, values may have missing rows if there are no changes in the GUID and port.

**Metadata Streaming:** The plugin can stream UFM's metadata, providing an inventory of it. For convenience, examples use the gNMIc client, but any gNMI client can be used.

**Configuration and Polling Intervals:** The polling intervals for each server cache are configurable with the following defaults:

- Telemetry: every 5 minutes
- Inventory: every minute
- Events: every minute
- Switch rank: every 6 hours

The service supports telemetry from switch-level data (fset) and port-level data (xcset), querying `low_freq_debug xcset` by default. Multiple telemetries can be polled simultaneously.

**Data Sharding:** The service supports sharding the cache data on request, allowing many clients to request the same data while each receiving a different part.

## Deployment

To deploy the plugin with UFM (SA or HA):

1. Install the latest version of UFM.
2. Run UFM with `/etc/init.d/ufmd start`.
3. Pull the plugin image from the Docker Hub.

#### 4. Run

```
/opt/ufm/scripts/manage_ufm_plugins.sh add -p gnmi_telemetry -t <version>
```

to enable the plugin, or use the UFM UI to add the plugin via Setting → Plugin Management → Right Click on GNMI-telemetry → Add → select version → Add.

#### 5. Check that the plugin is running with `docker ps`.

#### 6. If the gNMI default port is unavailable, change the configuration file `gnmi_telemetry.ini` and restart the plugin.

## Configurations

The `/opt/ufm/files/conf/plugins/gnmi_telemetry/gnmi_telemetry.ini` file centralizes the configuration of the GNMI-Telemetry Plugin, allowing users to customize logging, server behavior, telemetry intervals, security settings, and more. Below is an overview of the available configuration parameters, their default values, and their purpose within the plugin.

## Common Configurations

| Parameter                          | Description                                                     | Default Value |
|------------------------------------|-----------------------------------------------------------------|---------------|
| <code>log_level</code>             | Sets the logging level for the plugin (e.g., INFO, DEBUG).      | INFO          |
| <code>log_file_max_size_MB</code>  | Maximum size of the log file before it rotates, measured in MB. | 10            |
| <code>log_file_backup_count</code> | Number of backup log files to retain after rotation.            | 5             |

## GNMI-Server Configurations

| Parameter                                  | Description                                                                                                              | Default Value |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------|
| <code>grpc_port</code>                     | Port on which the gRPC server listens for incoming connections.                                                          | 9339          |
| <code>cpu_list</code>                      | Specifies which CPU cores the server can use (comma-separated for multiple cores, e.g., 3,5,6).                          | 3             |
| <code>include_port_sharding</code>         | Determines whether the port number is included in the sharding algorithm. Ports of the node may not be in the same shard | false         |
| <code>include_oldest_data_on_change</code> | Includes previous data when sending notifications in <code>on_change</code> mode.                                        | true          |
| <code>strict_collected_counters</code>     | Enforces strict rules for collecting counters based on client requests.                                                  | false         |
| <code>disable_events_inventory</code>      | Disables the collection and delivery of events and inventory data.                                                       | false         |

## Time-Intervals Configurations

| Parameter            | Description                                                                             | Default Value |
|----------------------|-----------------------------------------------------------------------------------------|---------------|
| events_interval      | Time interval for collecting events, specified in seconds (e.g., 60s).                  | 60s           |
| inventory_interval   | Time interval for collecting inventory data, specified in seconds (e.g., 60s).          | 60s           |
| minimum_sample_rate  | Minimum sampling interval for telemetry notifications, specified in seconds.            | 10s           |
| timeout_rest_call    | Timeout for REST API calls, specified in seconds.                                       | 30s           |
| switch_rank_interval | Interval for monitoring changes in the switch rank datasource file, specified in hours. | 6h            |

## Telemetry Cluster-Specific Configurations

Each cluster should have its own section named `cluster-config-$cluster_name`. For example, `[cluster-config-low_freq_debug]`. you can add multiple sections in case you need to collect data from multiple clusters/telemetries simultaneously.

By default, the plugin comes with a single cluster to collect data from [http://127.0.0.1:9002/csv/xcset/low\\_freq\\_debug](http://127.0.0.1:9002/csv/xcset/low_freq_debug).

| Parameter              | Description                                                                                                      | Default Value                                                                                               |
|------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| telemetry_endpoint_url | URL for the telemetry endpoint for the cluster.                                                                  | <a href="http://127.0.0.1:9002/csv/xcset/low_freq_debug">http://127.0.0.1:9002/csv/xcset/low_freq_debug</a> |
| default_id_cols        | Default identifier columns applied to all rows (ports) for telemetry data.                                       | Node_GUID,Port_Number                                                                                       |
| id_type_col            | Telemetry column used to determine identification schemes based on its value.                                    | N/A                                                                                                         |
| id_cols_<type>         | Identifier columns for rows where <code>id_type_col</code> has a specific value (e.g., <code>id_cols_1</code> ). | N/A                                                                                                         |

| Parameter                       | Description                                                                             | Default Value |
|---------------------------------|-----------------------------------------------------------------------------------------|---------------|
| <code>per_slvl</code>           | Enables <code>per_slvl</code> counters for telemetry if supported by the configuration. | false         |
| <code>telemetry_interval</code> | Interval for sending telemetry data to the endpoint, specified in seconds.              | 300s          |
| <code>filtered_columns</code>   | Columns to exclude from telemetry data, separated by commas.                            | port_guid     |

## UFM Configurations

| Parameter                                | Description                                                                 | Default Value                                                     |
|------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------|
| <code>default_inventory</code>           | Default inventory values if UFM is unavailable, specified as a JSON string. | <code>{"Servers":8,"Switches":4,"HCAs":4,"ActivePorts":16}</code> |
| <code>ufm_ip</code>                      | IP address of the UFM instance used for inventory data.                     | 127.0.0.1                                                         |
| <code>ufm_access_token</code>            | Access token for authenticating with UFM if running on a different host.    | N/A                                                               |
| <code>switch_rank_datasource_file</code> | File path for the switch rank datasource                                    | <code>/opt/ufm/files/log/opensm-smdb.dump</code>                  |

| Parameter | Description  | Default Value |
|-----------|--------------|---------------|
|           | used by UFM. |               |

## GNMI-Security Configurations

| Parameter                                   | Description                                                                   | Default Value |
|---------------------------------------------|-------------------------------------------------------------------------------|---------------|
| <code>secure_mode_enabled</code>            | Enables secure mode for gNMI.                                                 | true          |
| <code>client_cert_subject_identifier</code> | Specifies the certificate subject identifier (SAN or CN).                     | SAN           |
| <code>initial_check_time</code>             | Time of day for the initial certificate validation check, specified as HH:mm. | 01:30         |
| <code>check_interval</code>                 | Interval for periodic certificate validation checks, specified in hours.      | 12h           |

## XDR Configurations

| Parameter             | Description            | Default Value |
|-----------------------|------------------------|---------------|
| <code>xdr_mode</code> | Enables XDR Mode Setup | false         |

|                               |                                                                                                           |                                                          |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| <pre>xdr_ port s_ty pes</pre> | <p>Types of XDR ports to collect, separated by commas (e.g., <code>legacy, aggregated, plane</code>).</p> | <pre>l e g a c y , a g g r e g a t e d , p l a n e</pre> |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|

## Authentication

The server's authentication is determined by the gNMI protocol. Two configurable items require authentication: the UFM Telemetry URL and the UFM inventory IP.

- Authentication is not necessary for the UFM telemetry URL. Therefore, only the telemetry URL is required.
- The inventory is sourced from the UFM of the local host, but can be changed to a different machine in the config file. To do so, token access to that machine is necessary.

## Secure Server using mTLS and Certificate Subject Identifier

The server can be secured using certificates. To secure the server, set the "`secure_mode_enabled`" flag to "true" in the configuration (default is true).

The certificate must be placed under the `/opt/ufm/conf/webclient` folder and can be changed by modifying the shared volume. The gNMI server periodically checks its certificates for updates, ensuring they remain up-to-date. The client certification naming convention must align with the DNS name (SAN) as the UFM.

The gNMI plugin supports certificate subject identifier (the default value is SAN). Configure the certificate subject identifier under the gNMI-security section to be SAN or CN (Common Name). For example: `client_cert_subject_identifier=CN.`

## Supported API Requests

The service supports the following requests:

- **Capability:** Describes the YANG files the service supports (UFM telemetry).
- **Get:** Requires legal paths; receives the cache data from the service.
- **Subscribe:** Requires legal paths and an interval; receives cache data at the specified interval. The first message contains headers extracted from the path, and subsequent messages include only the headersID. In on-change subscribe mode, a heartbeat interval is provided instead of an interval. During the heartbeat interval, if no data changes, no notification is sent; A full notification message, similar to the first message, is sent. If some data changes a notification of the change is sent; No heart message is send.

## Capability Request

The capability request provides information about the YANG files that the server supports, including their versions. This request can be fulfilled without requiring a connection to the telemetry or inventory.

### Request Example:

```
gnmic -a localhost:9339 capability
```

### Response Example:

```
gNMI version: 1.3.0-2
```

supported models:

- nvidia-ib-amber, Nvidia IB, 1.0.0
- nvidia-ib-amber-ext, Nvidia IB, 1.0.0
- nvidia-ib-amber-inventory-counters, Nvidia IB, 1.0.0
- nvidia-ib-amber-port-counters, Nvidia IB, 1.0.0

supported encodings:

- JSON
- JSON\_IETF

## Supported Paths

### Telemetry Request Path Construction

To construct a path for a telemetry request, follow these steps:

1. Begin with "nvidia/ib".
2. Specify sharding if desired. For example, to partition the data into 10 pieces and take the second partition, use 2/10.
3. Specify the `node_guid` to select, using an asterisk (\*) to select all nodes.
4. Specify the desired ports for the selected nodes, using an asterisk (\*) to select all ports.
5. Select "amber" for amBER telemetry.
6. Specify the desired counters group. If unknown, this step can be skipped.
7. Specify the counter, using an asterisk (\*) to select all the counters in the cache. If a counters group is used, it will return all counters in the specified group.

### Other Information Requests (Events, Inventory)

1. Begin with "nvidia/ib".

2. Specify `inventory` or `events`.

## Switch Rank Information Path Construction

To construct a path for switch rank information, follow these steps:

1. Begin with `"nvidia/ib"`.
2. Specify the `node_guid` to select, using an asterisk (\*) to select all nodes.
3. Select `"amber"` for amBER telemetry.
4. Use `Switch_rank` as the counter name.

## Telemetry Messages - Data Format

Telemetry messages consist of two key components: Headers and Values, both representing telemetry data in a CSV format.

- **Headers:** Initially provided in a full mode, but transition to a string hash format after the second message when using a subscribe request to reduce message size.
- **Values:** Each value begins with a timestamp, followed by the `node_guid` and port number, and then the counter value in the same order as the headers. If a counter is not present for a node, it will be empty in the message.

In on-change subscribe messages, only nodes with changes and their corresponding modified values are included. All other counters for that node will remain empty.

### Request Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/port_counters/his
--path
```

```
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/port_counters/his
-i 30s
```

### Response Example:

```
[
 {
 "source": "localhost:9339",
 "subscription-name": "default-1690282472",
 "timestamp": 1690282475124352000,
 "time": "2023-07-25T13:54:35.124352063+03:00",
 "updates": [
 {
 "Path": "nvidia/ib/amber/reply/sample",
 "values": {
 "nvidia/ib/amber/reply/sample": {
 "Headers": "timestamp,guid,port,hist0,hist1",
 "HeaderID": "5246201354",
 "Values": [
 "240771222771818,0x8168793592c6a790,1,,2",
 "240771222771818,0x47a67159c915493f,1,1,2",
 "240771222771818,0x667203ac69f3f2bf,1,2,",
 "240771222771818,0x113cd807bfed3853,1,0,"
]
 }
 }
 }
]
 }
]
```

The second message on the headers will be set to hash values.

# GET Request

The Get request retrieves data at a specified path. If the telemetry is devoid of information, the server will respond with an empty response. Otherwise, it will respond with counters it can locate.

## Example:

```
gnmic -a localhost:9339 --insecure get --path
nvidia/ib/guid[guid=0x5255456]/port[port_number=2]/amber/port_count
```

The request retrieves data from node\_guid `0x5255456`, specifically in port number 2, with the request counter set to hist0.

## Example 2:

```
gnmic -a localhost:9339 --insecure get --path
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/port_counters/his
```

The request retrieves the data from all the ports and the node\_guids, with the request counter set to hist0.

## Example 3:

```
gnmic -a localhost:9339 --insecure get --path
nvidia/ib/guid[guid=0x5255456]/port[port_number=2]/amber/*
```

The request retrieves the data from node\_guid `0x5255456`, port 2, with the request counters set to "all".

## Example for multi path:

```

gnmic -a localhost:9339 --insecure get
nvidia/ib/guid[guid=*/port[port_number=*/amber/CableInfo.transmitter_technology
--path
nvidia/ib/guid[guid=*/port[port_number=*/amber/sel_gctrln_en_5_lane0
--path
nvidia/ib/guid[guid=*/port[port_number=*/amber/num_pll5_7nm --
path
nvidia/ib/guid[guid=*/port[port_number=*/amber/rcal_fsm_done --
path
nvidia/ib/guid[guid=*/port[port_number=*/amber/LinkErrorRecoveryControl
--path
nvidia/ib/guid[guid=*/port[port_number=*/amber/sel_enc2_ib0_lane0
--path
nvidia/ib/guid[guid=*/port[port_number=*/amber/lockdet_err_cnt_upper

```

### Response Example:

```

[
 {
 "source": "localhost:9339",
 "timestamp": 1719232374915165200,
 "time": "2024-06-24T15:32:54.915165166+03:00",
 "updates": [
 {
 "Path": "nvidia/ib/amber/reply",
 "values": {
 "nvidia/ib/amber/reply": {
 "Headers": [
 "timestamp",
 "Node_GUID",
 "Port_Number",
 "CableInfo.transmitter_technology",
 "sel_gctrln_en_5_lane0",

```

```

 "num_plls_7nm",
 "rcal_fsm_done",
 "LinkErrorRecoveryCounterExtended",
 "sel_enc2_ib0_lane2",
 "lockdet_err_cnt_unlocked_sticky"
],
 "Values" : [

"1719232345757948,0x91f87bf42deb3e03,1,5091,7826,6290,8615,4247,8586,6214" ,

"1719232345757948,0x7b8c2e08907250ce,1,2891,3293,5774,4398,3681,3548,7408" ,

"1719232345757948,0x48b60e6f3670eaca,1,9477,3847,1184,5527,4783,2102,8192" ,

"1719232345757948,0xabccdad7f8a3eda6,1,7976,6143,8257,3770,6166,6690,2835" ,

"1719232345757948,0x6d9ec4bb5fa45736,1,9051,2982,7145,3604,9256,1061,2638" ,

"1719232345757948,0x028cf9e0f9ed7c32,1,5623,7483,2263,2265,6890,4875,5564" ,

"1719232345757948,0x92a984c1a491b72a,1,6732,7795,6411,8569,3370,705,5536" ,

"1719232345757948,0x8b4b404acd2f34da,1,7610,7128,10064,1880,4834,3411,6724" ,

"1719232345757948,0x20f92ed58991d56c,1,6805,1632,5407,2038,1865,7279,8350" ,

"1719232345757948,0x1dac004a426bb5f5,1,8351,5757,7925,6181,3260,3081,1554"

]
 }
}
]

```

## Subscribe Stream Request

The Subscribe request, similar to the get request, provides data from the specified path. When the telemetry is empty, the server responds with an empty result. If data is available, the server responds with the retrieved counters. The stream delivers information at the specified interval. If no interval is specified, the server transmits the information at the default server rate, which is configurable and defaults to 10s.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=0x5255456]/port[port_number=2]/amber/port_count
-i 30s
```

This request retrieves data from the node\_guid `0x5255456`, port 2, where the request counter is hist0, and the interval is configured for 30 seconds. If the user wishes to test the stream, the stream mode can be configured to "once," and following a single response, the stream will be stopped.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=0x5255456]/port[port_number=2]/amber/port_count
-i 30s --mode once
```

This request retrieves the data from node\_guid `0x5255456`, port 2, where the request counter is hist0. The stream shuts down after one response, similar to a Get request.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/* -i 10s
```

The server responds for the first two notifications, as follows:

```

{
 "source": "localhost:9339",
 "subscription-name": "default-1719233128",
 "timestamp": 1719233128171946500,
 "time": "2024-06-24T15:45:28.171946518+03:00",
 "updates": [
 {
 "Path": "nvidia/ib/amber/reply/sample",
 "values": {
 "nvidia/ib/amber/reply/sample": {
 "HeaderID": "970426048",
 "Headers": [
 "timestamp",
 "Node_GUID",
 "Port_Number",
 "Counter1",
 "Counter2",
 "Counter3",
 "Counter4",
 "Counter5",
 "Counter6",
 "Counter7"
],
 "Values": [
 "1719232345757948,0x91f87bf42deb3e03,1,5091,7826,6290,8615,4247,8586,6214" ,
 "1719232345757948,0x7b8c2e08907250ce,1,2891,3293,5774,4398,3681,3548,7408" ,
 "1719232345757948,0x1dac004a426bb5f5,1,8351,5757,7925,6181,3260,3081,1554" ,
 "1719232345757948,0x48b60e6f3670eaca,1,9477,3847,1184,5527,4783,2102,8192" ,
 "1719232345757948,0xabccdad7f8a3eda6,1,7976,6143,8257,3770,6166,6690,2835" ,
 "1719232345757948,0x6d9ec4bb5fa45736,1,9051,2982,7145,3604,9256,1061,2638" ,
 "1719232345757948,0x028cf9e0f9ed7c32,1,5623,7483,2263,2265,6890,4875,5564" ,
 "1719232345757948,0x92a984c1a491b72a,1,6732,7795,6411,8569,3370,705,5536" ,

"1719232345757948,0x8b4b404acd2f34da,1,7610,7128,10064,1880,4834,3411,6724" ,
 "1719232345757948,0x20f92ed58991d56c,1,6805,1632,5407,2038,1865,7279,8350"
]
 }
 }
]
 }

```

```

]
 }
}
]
}
{
 "source" : "localhost:9339",
 "subscription-name" : "default-1719233128",
 "timestamp" : 1719233138173907700,
 "time" : "2024-06-24T15:45:38.173907825+03:00",
 "updates" : [
 {
 "Path" : "nvidia/ib/amber/reply/sample",
 "values" : {
 "nvidia/ib/amber/reply/sample" : {
 "HeaderID" : "970426048",
 "Values" : [
 "1719232345757948,0x20f92ed58991d56c,1,6805,1632,5407,2038,1865,7279,8350" ,
 "1719232345757948,0x1dac004a426bb5f5,1,8351,5757,7925,6181,3260,3081,1554" ,
 "1719232345757948,0x48b60e6f3670eaca,1,9477,3847,1184,5527,4783,2102,8192" ,
 "1719232345757948,0xabccdad7f8a3eda6,1,7976,6143,8257,3770,6166,6690,2835" ,
 "1719232345757948,0x6d9ec4bb5fa45736,1,9051,2982,7145,3604,9256,1061,2638" ,
 "1719232345757948,0x028cf9e0f9ed7c32,1,5623,7483,2263,2265,6890,4875,5564" ,
 "1719232345757948,0x92a984c1a491b72a,1,6732,7795,6411,8569,3370,705,5536" ,

"1719232345757948,0x8b4b404acd2f34da,1,7610,7128,10064,1880,4834,3411,6724" ,
 "1719232345757948,0x91f87bf42deb3e03,1,5091,7826,6290,8615,4247,8586,6214" ,
 "1719232345757948,0x7b8c2e08907250ce,1,2891,3293,5774,4398,3681,3548,7408"

]
 }
 }
 }
]
}

```

## Subscribe On-Change Request

The subscribe on-change request, similar to the standard subscribe request, provides data from the specified path. If the telemetry lacks data, the server responds with an empty result. When data is available, the server responds with the located counters. The stream delivers information at the specified interval, but only if there is new information to transmit. Otherwise, it waits for the next interval to check for updates. The path construction follows the same pattern as the get request and includes inventory and event paths.

Only updated data will be included in the response, with all other parts remaining empty but retaining the specified format. Similarly, only the nodes that have been updated will be included in the response.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=0x5255456]/port[port_number=2]/amber/port_counters
--stream-mode on-change --heartbeat-interval 1m
```

This request retrieves data from node\_guid `0x5255456`, port 2, with the request counters set to hist0. It periodically checks for changes every minute, and when changes are detected, it promptly sends the updated values.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/port_counters/*
--stream-mode on-change --heartbeat-interval 1m
```

This request involves all nodes and ports, aiming to retrieve all counters from the telemetry. It periodically checks for changes every minute, and when changes are detected, it promptly sends the updated values.

The below is an example of the response to a particular GUID, which represents an on-change request for a few counters. However, only specific counters have been updated, those who have not updated have a value of 0. Because the flag `include_old_data_on_change` default is true

```
1706532307824, 0x0002c903007e5220, 1, 0, 0, 0, 41447490564, 617155163, 41423305825, 617155163
```

The same example with the flag set to true will give this:

```
1706532307824, 0x0002c903007e5220, 1, , , , 41447490564, 617155163, 41423305825, 617155163, 2
```

Only the values that have changed return while the others are empty values. To get this format of data, one need to change the `include_old_data_on_change` in the config file to false.

### Example:

```
gnmic -a localhost:9339 --insecure sub --path
nvidia/ib/guid[guid=*]/port[port_number=*]/amber/* --stream-mode
on-change --heartbeat-interval 24h
```

The server responds for the first 2 notifications are the following (where `include_old_data_on_change` is true), one can see the last two columns have not changed but still return the data before, the second message was send due to some rows have changed, those rows

```
{
 "source": "localhost:9339",
 "subscription-name": "default-1719236764",
 "timestamp": 1719236764654659600,
 "time": "2024-06-24T16:46:04.654659517+03:00",
 "updates": [
```

```

{
 "Path": "nvidia/ib/amber/reply/onchange",
 "values": {
 "nvidia/ib/amber/reply/onchange": {
 "HeaderID": "912200528",
 "Headers": [
 "timestamp",
 "Node_GUID",
 "Port_Number",
 "Counter1",
 "Counter2",
 "Counter3",
 "Counter4",
 "Counter5",
 "Counter6",
 "Counter7"
],
 "Values": [
"1719236753818594,0x7e680fb8f81a1950,1,100531,107250,100999,107455,109258,3716,5329" ,
"1719236753818594,0x0176438fe4ee507c,1,104269,108884,104887,108502,105366,4540,6673" ,
"1719236753818594,0x2e36224302959e79,1,101228,100555,105616,102767,108899,87,9953" ,
"1719236753818594,0x8e62a55d7571a9b8,1,100684,108124,106670,102400,106689,2910,4203" ,
"1719236753818594,0x0be75a9e97016f5e,1,102227,102735,108903,103547,108705,2629,1830" ,
"1719236753818594,0x8307bfad0672adbd,1,106033,103906,106185,107450,105736,2567,6914" ,
"1719236753818594,0x2cbe66ec0b1af84c,1,105958,106959,100349,107704,105073,8330,4962" ,
"1719236753818594,0x6b6da39a9ec4bbfc,1,104340,106752,109134,103796,103500,7136,3493" ,
"1719236753818594,0x6d122dbdd99cfb60,1,104941,107630,104190,105392,109582,5480,7934" ,

```

```

"1719236753818594,0xeed4bd9cd3b7f325,1,102416,100164,106731,102033,103807,3048,6316"
]
 }
}
]
}
{
 "source" : "localhost:9339",
 "subscription-name" : "default-1719236764",
 "timestamp" : 1719237054620929500,
 "time" : "2024-06-24T16:50:54.620929561+03:00",
 "updates" : [
 {
 "Path" : "nvidia/ib/amber/reply/onchange",
 "values" : {
 "nvidia/ib/amber/reply/onchange" : {
 "HeaderID" : "912200528",
 "Values" : [

"1719237054172043,0xeed4bd9cd3b7f325,1,117416,115164,121731,117033,118807,3048,6316" ,

"1719237054172043,0x2e36224302959e79,1,116228,115555,120616,117767,123899,87,9953" ,

"1719237054172043,0x8e62a55d7571a9b8,1,115684,123124,121670,117400,121689,2910,4203" ,

"1719237054172043,0x7e680fb8f81a1950,1,115531,122250,115999,122455,124258,3716,5329" ,

"1719237054172043,0x0176438fe4ee507c,1,119269,123884,119887,123502,120366,4540,6673"
]
 }
 }
 }
]
}

```

## Inventory Requests

Inventory messages are conveyed in separate updates, presenting the inventory details of the UFM associated with the provided IP. These messages display comprehensive information, including the total count of various components within the UFM, such as switches, routers, servers, and more, along with details about active ports and the total number of ports, including disabled ones. Moreover, inventory requests include the size of the telemetry, which is not always the same as the active ports. In cases where the plugin is unable to establish contact with the UFM, it will revert to using default values defined in the configuration file. It is worth noting that the path for inventory requests differs from the conventional path structure, as they do not rely on specific nodes or ports.

Consequently, inventory requests are initiated after "`nvidia/ib`".

### Example:

```
gnmic -a localhost:9339 --insecure get -path
nvidia/ib/inventory/*
```

Response:

```
[
 {
 "source": "localhost:9339",
 "timestamp": 1698824237536878000,
 "time": "2023-11-01T09:37:17.536878067+02:00",
 "updates": [
 {
 "Path": "nvidia/ib/inventory",
 "values": {
 "nvidia/ib/inventory": {
 "ActivePorts": 4,
 "Cables": 2,
 "Gateways": 0,

```

```

 "HCAs": 2,
 "Routers": 0,
 "Servers": 2,
 "Switches": 1,
 "TotalPorts": 38,
 "TelemetrySize": 4,
 "timestamp": 1698824211535069000
 }
}
]
}
]

```

## Events Requests

Events messages are provided in separate updates, offering insights into the events occurring within the UFM associated with the specified IP. Given that the event metadata remains consistent, even when numerous events are part of a request, the message format adopts a CSV-like structure. The Headers section contains essential metadata regarding UFM events, while the Values section contains the raw event data. Users can subscribe to these events with the on-change feature enabled, receiving only the events triggered within the subscription interval. Notably, the path structure for event requests differs from the typical node or port-based structure and is requested after "`nvidia/ib`".

### Example:

```
gnmic -a localhost:9339 --insecure get -path nvidia/ib/events/*
```

### Response:

```
[
 {
```

```

"source": "localhost:9339",
"timestamp": 1698824809647515600,
"time": "2023-11-01T09:46:49.647515575+02:00",
"updates": [
 {
 "Path": "nvidia/ib/events",
 "values": {
 "nvidia/ib/events": {
 "Headers": [
 "id",
 "object_name",
 "write_to_syslog",
 "description",
 "type",
 "event_type",
 "severity",
 "timestamp",
 "counter",
 "category",
 "object_path",
 "name"
],
 "Values": [
 "7718,Grid,false,Disk space usage in /opt/ufm/files/log is above the threshold of 90.0%.,Grid,525,Critical,2023-11-01 07:25:54,N/A,Maintenance,Grid,Disk utilization threshold reached" ,
 "7717,Grid,false,Disk space usage in /opt/ufm/files/log is above the threshold of 90.0%.,Grid,525,Critical,2023-11-01 07:24:54,N/A,Maintenance,Grid,Disk utilization threshold reached" ,
 "7716,Grid,false,Disk space usage in /opt/ufm/files/log is above the threshold of 90.0%.,Grid,525,Critical,2023-11-01 07:23:54,N/A,Maintenance,Grid,Disk utilization threshold reached" ,
 "7491,ec0d9a0300d42e54,false,Mcast group is deleted: ff12601bffff0000,00000002,Computer,67,Info,2023-10-31 06:39:21,N/A,Fabric Notification,default / Computer: r-ufm59,Mcast Group Deleted"
]
 }
 }
 }
]

```

```
]
}
]
```

## Switch Rank Requests

Switch rank updates are conveyed in separate messages, presenting the rank of the switches in the UFM. This data is derived from a file in the UFM and is updated by the server every 6 hours by default. The `switch_rank` counter is associated only with switch-level data, so there is no need to specify a port in the path. However, this counter is not connected to the telemetry cache of switch-level data. **Note that if the `ufm_ip` is changed, the `switch_rank` information will not be available.**

### Example:

```
gnmic -a localhost:9339 --insecure get --path
nvidia/ib/guid[guid=*]/amber/switch_rank
```

### Response:

```
{
 "source": "localhost:9339",
 "timestamp": 1719296207323383300,
 "time": "2024-06-25T09:16:47.323383222+03:00",
 "updates": [
 {
 "Path": "nvidia/ib/guid[guid=*]/amber/amber/switch_rank",
 "values": {
 "nvidia/ib/guid/amber/amber/switch_rank": {
 "Headers": "Timestamp,Node_GUID,switch_rank",
 "Values": [
 "1719296205612,0x0002c903007e5220,0"
]
 }
 }
 }
]
}
```

```
}
 }
 }
]
}
```

# UFM Telemetry Manager (UTM) Plugin

## Overview

Managed telemetry is a mode of high availability and improved performance of UFM Telemetry processes.

Governed by UFM Telemetry Manager (UTM) several UFM Telemetry Instances (TIs) run on one or more machines, each collecting a subset of the cluster fabric.

UTM manages the following aspects:

- monitoring of TI states: down, initializing, running, paused
- TI management commands: add, remove, pause, start, restart
- partitioning of fabric based on TIs health and fabric changes
- assigning fabric segments to TIs
- telemetry coverage check of a cluster

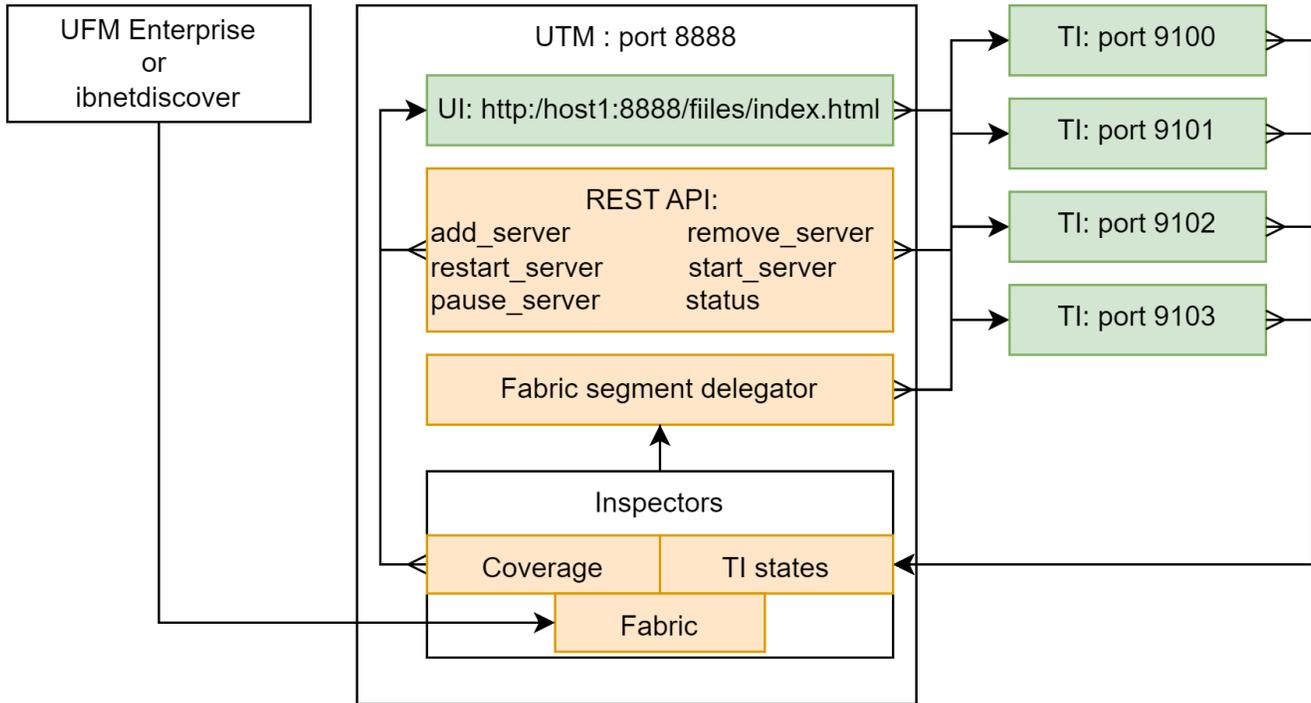
The UFM Telemetry Manager (UTM) Plugin facilitates managed telemetry in high availability mode, enhancing the performance of UFM Telemetry operations.

Under the governance of UFM Telemetry Manager (UTM), multiple UFM Telemetry Instances (TIs) are executed on one or more machines, with each TI responsible for collecting a specific portion of the cluster fabric.

Key functionalities managed by UTM include:

- Monitoring TI statuses: down, initializing, running, paused

- Execution of TI management commands: add, remove, pause, start, restart
- Fabric partitioning based on TI health and fabric changes
- Assigning fabric segments to TIs
- Verification of telemetry coverage across the cluster



## Deployment

The UTM plugin is designed to operate either as a UFM plugin or in standalone mode.

UTM plugin mode is deployed via UFM UI. Telemetry instances might be deployed by UFM or manually by deployment scripts.

Standalone mode deploys the whole setup (UTM, host TI list, switch telemetry image) with the deployment scripts.

As a first step, get the UTM image. If it runs in UFM mode, upload it to the UFM machine.

```
docker pull mellanox/ufm-plugin-utm
```

# UFM Plugin Mode

The UTM plugin can be added either via the Command Line Interface or Web-UI.

## CLI Deployment

To add the plugin, run:

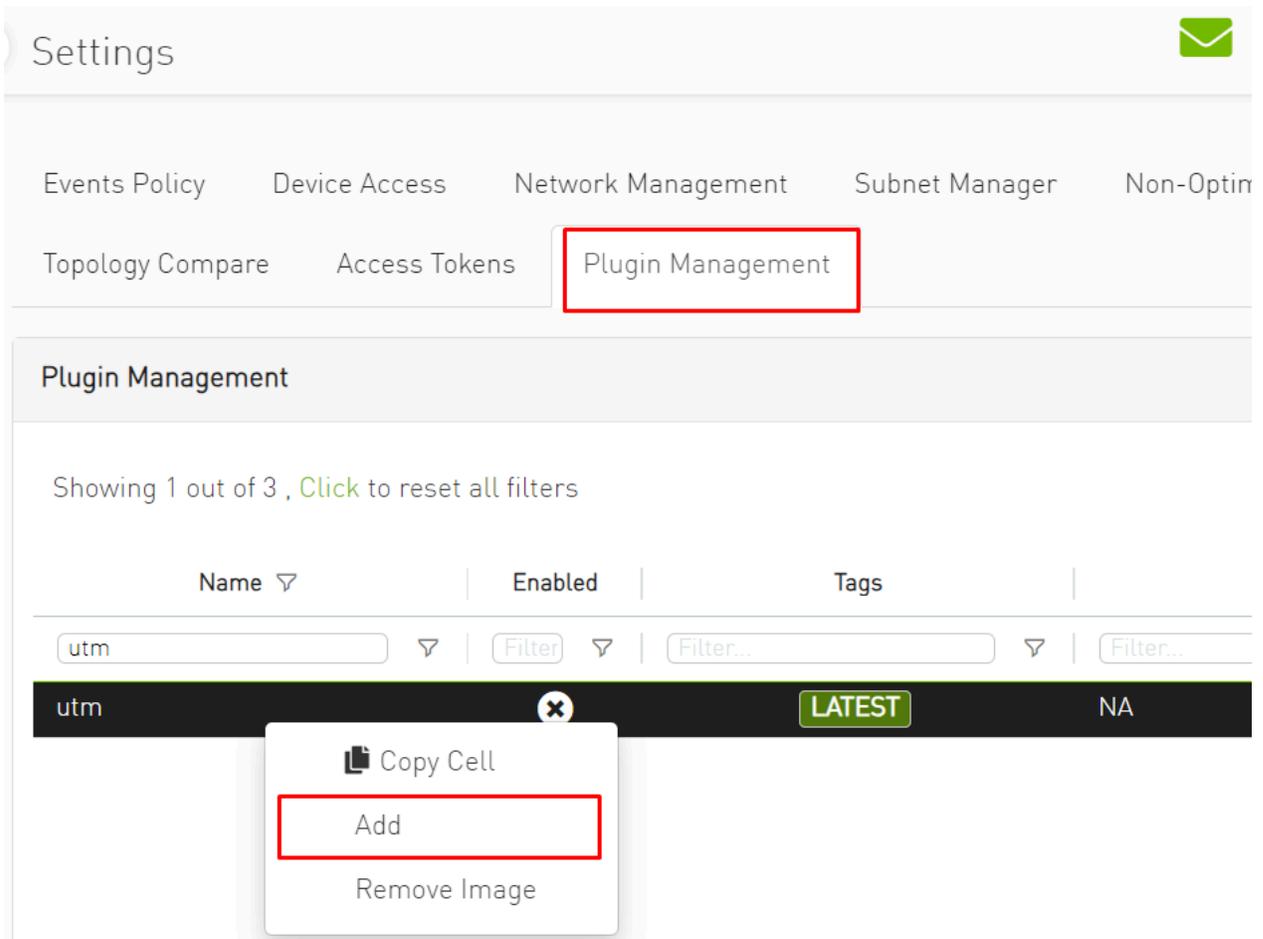
```
/opt/ufm/scripts/manage_ufm_plugins.sh add -p utm
```

To remove the plugin, run:

```
/opt/ufm/scripts/manage_ufm_plugins.sh remove -p utm
```

## Web-UI Deployment

1. Navigate to the UFM web UI and click on **Settings** in the left panel.
2. Go to the "Plugin Management" tab.
3. Right-click on the UTM plugin row and select "Add."



4. Go to the option on the left called "Telemetry Status" to see the UTM UI page.

5. Operate with several options:

1. The default UFM TIs. Depending on UFM configuration, TIs might run in legacy mode or within UTM.
2. Start telemetry instances manually using UTM deployment scripts. See section "Manual Deployment".

To stop the UTM plugin, go to "Plugin Management", right-click on the UTM plugin line and click on `disable`.

**Note**

If non-default UFM credentials are used, UTM may fail to access the UFM REST API. To resolve this, configure the `ufm` section of the

`utm_config.ini` file with `ufm_user=` and `ufm_pass=` to restore the connection between UTM and UFM.

## Default UFM Telemetry Monitoring in Legacy Mode

UFM Telemetry has high and low-frequency (Primary and Secondary, respectively) TIs that are running by default.

To enable meaningful monitoring:

1. Set `plugin_env_CLX_EXPORT_API_SHOW_STATISTICS=1` in the config files:

```
/opt/ufm/files/conf/telemetry_defaults/launch_ibdiagnet_config
/opt/ufm/files/conf/secondary_telemetry_defaults/launch_ibdiag
```

2. Restart telemetry instances with the new config. If UFM Enterprise runs as a docker container, this command should be executed inside the container.

```
/etc/init.d/ufmd ufm_telemetry_restart
```

3. Give TIs some time to update performance metrics. The time depends on the update interval of default TIs.

## Default UFM Telemetry instances in UTM

If legacy mode is disabled in UFM configuration, UTM will run Primary and Secondary telemetries automatically.

## Manual Deployment

Additional telemetry instances for UFM plugin mode or the whole standalone setup (UTM and TIs) are deployed using UTM Deployment scripts.

## UTM Deployment Scripts

Get deployment scripts and examples by mounting the local folder

`UTM_DEPLOYMENT_SCRIPTS` (`/tmp/utm_deployment_scripts` in this example) and running `get_deployment_scripts.sh`:

```
$ export UTM_DEPLOYMENT_SCRIPTS=/tmp/utm_deployment_scripts
$ docker run -v "$UTM_DEPLOYMENT_SCRIPTS:/deployment_scripts" --rm --name utm-
deployment-scripts -ti mellanox/ufm-plugin-utm:latest /bin/sh
/get_deployment_scripts.sh
```

The content of the script folder consists of:

- `Examples` - Contains run/stop scripts for both standalone and UFM plugin modes. Each example script is an example of actual deployment script usage.
- `hostlist.txt` - Specifies the hosts, ports, and HCAs for TIs to be deployed
- `Scripts` - Contains actual deployment scripts. Entry-point script `deploy_managed_telemetry.sh` triggers the rest two scripts, depending on input arguments.

```
$ cd $UTM_DEPLOYMENT_SCRIPTS
$ tree
.
 examples
 run_standalone.sh
 run_with_plugin.sh
 stop_standalone.sh
 stop_with_plugin.sh
 hostlist.txt
 README.md
```

```
scripts
 deploy_bringup.sh
 deploy_managed_telemetry.sh
 deploy_ufm_telemetry.sh
```

### **(i) Note**

All example/deployment scripts should run from the `UTM_DEPLOYMENT_SCRIPTS` folder.

## **Hostlist File**

Please note the following:

- The `hostlist.txt` file should be set before running any script.
- The hostname and port will be used for communication and HCA for telemetry collection.
- UTM only supports a single fabric for managed TIs, even if different HCAs on the same machine are connected to different fabrics.
- Both local and remote hosts are supported for TI deployments.

```
$ cat hostlist.txt

List lines in the following format:
host:port:hca
#
where:
- host is IP or hostname. Use localhost or 127.0.0.1 for local
 deployment
```

```
- port to run telemetry on.
- hca is the target host device from which telemetry collects.
Run `ssh $host ibstat`
to find the active device on the target host.

localhost:8123:mlx5_0
localhost:8124:mlx5_0
```

## Main Deployment Script

For a more customizable setup beyond what the example scripts offer, users have the option to manually run `./scripts/deploy_managed_telemetry.sh`. This primary deployment script can deploy multiple TIs and optionally UTM as well.

Use `deploy_managed_telemetry.sh --help` to get help.

```
./deploy_managed_telemetry.sh --help
./deploy_managed_telemetry.sh options: mandatory:

mandatory:
 --hostlist-file= Path to a file that lists
hostname:port:hca lines
mandatory run options (use only one at the same time):
 -r, --run Deploy and run managed telemetry
setup
 -s, --stop Stop all processes and cleanup
mandatory telemetry deployment options (use only one at the
same time):
 -t=, --ufmt-image= UFM telemetry docker image or
tgz/tar.gz-image
or:
 --bringup-package= Bringup tar.gz package
optional:
```

```
-m, --utm-image= UTM docker image or tgz/tar.gz-
image. Runs UTM only if it is set. Configures UTM according
hostlist file
--utm-as-plugin= if UTM runs as a plugin, set this
flag
-d, --data-root= Root directory for run data |
Default: '/tmp/managed_telemetry/'
--switch-telem-image= Switch telemetry image (tar.gz-file
or docker image). UTM will be able to deploy it to managed
switches if set
--common-data-dir= Common data folder for TIs
-h, --help Print this message
```

## Start TIs for UFM Plugin Mode:

1. Prepare TI setup using `utm_deployment_scripts` example scripts:
2. Change directory:

```
cd $UTM_DEPLOYMENT_SCRIPTS
```

3. Open and configure `hostlist.txt`
4. Deploy and run TIs according to `hostlist.txt` and set these TIs to be monitored by UTM:

```
sudo ./examples/run_with_plugin.sh
```

5. To stop and cleanup TIs setup and unset TIs to be monitored by UTM:

```
sudo ./examples/stop_with_plugin.sh
```

### **Note**

This script does not stop UTM plugin!

## Standalone Mode

In standalone mode, UTM periodically tracks fabric changes by itself and does not require UFM Enterprise.

Deploy via example scripts:

1. Change directory

```
cd $UTM_DEPLOYMENT_SCRIPTS
```

2. Open and configure `hostlist.txt`
3. Deploy and run TIs according to `hostlist.txt` and run UTM:

```
sudo ./examples/run_standalone.sh
```

4. To stop and cleanup TIs setup and UTM, run:

```
sudo ./examples/stop_standalone.sh
```

## Deployment without Scripts

This section provides detailed instructions for manually deploying UTM and managed TIs to ensure coverage of all potential corner cases where the convenience script may not be effective.

### UTM Deployment

UTM can be started with two docker run commands.

1. Set `utm_config`, `utm_data`, `utm_log`, and `utm_image` variables.
2. Initialize UTM config:

```
docker run -v $utm_config:/config \
 -v $utm_data:/data \
 --rm --name utm-init \
 --device=/dev/infiniband/ \
 $utm_image /init.sh
```

3. Run UTM

```
docker run -d --net=host \
 --security-opt seccomp=unconfined --cap- \
 add=SYS_ADMIN \
 --device=/dev/infiniband/ \
 -v $utm_config:/config \
 -v $utm_data:/data \
 -v $utm_log:/log \
 --rm --name utm $utm_image
```

## Managed/Standalone TIs Manual Deployment

TI can be represented either as a UFM Telemetry docker container or as a UFM Telemetry bring-up package.

To run the docker container in managed mode, `launch_ibdiagnet_config.ini` should have the following flags enabled:

```
plugin_env_CLX_EXPORT_API_SHOW_STATISTICS=1
plugin_env_UFM_TELEMETRY_MANAGED_MODE=1
```

To run UFM Telemetry with Distributed Telemetry, enable its receiver and specify `HCA` to work on:

```
plugin_env_CLX_EXPORT_API_RUN_DT_RECEIVER=1
plugin_env_CLX_EXPORT_API_DT_RECEIVER_HCA=$HCA
```

To run bringup in managed mode, create `enable_managed.ini` file with the same flags and use `custom_config` option of `collection_start`:

```
collection_start custom_config=./enable_managed.ini
```

## UTM Configuration File

The UTM configuration file `utm_config.ini` is placed under the configuration folder (which is referred to as `UTM_CONFIG` later on this document).

In the case of UFM plugin mode, `UTM_CONFIG`  
`= /opt/ufm/files/conf/plugins/utm/.`

In the case of standalone mode, the default value is

`UTM_CONFIG = /tmp/managed_telemetry/utm/config` and can be changed via `--data-root` argument of deployment script.

When changes are made to the configuration file, UTM initiates a restart of its main process to apply the updated configuration.

Users may wish to adjust timeout and update rate configurations based on their specific setups. However, it is important to note that the remaining configurations are tailored to enable UTM to function as a UFM plugin and should not be modified.

## Distributed Telemetry

To enable distributed telemetry set `dt_enable=1` in the corresponding section.

### Note

Distributed Telemetry requires Switch Telemetry docker image tagged as `switch-telemetry:{version}` and placed under `UTM_CONFIG/telem_files/` as `switch-telemetry_{version}.tar.gz`

UTM scans this file at its start.

Example deployment scripts handle it for both UFM plugin and standalone modes.

For more details refer to [NVIDIA UFM Telemetry Documentation](#) → Distributed Telemetry - Switch Telemetry Agent

## GUI

To access the GUI within the UFM web UI, navigate to the Telemetry status section in the left panel.

The UI is accessible whether it is running as a part of UFM Enterprise or standalone via the endpoint: `http://127.0.0.1:8888/files/index.html`.

The GUI comprises several zones:

- The top pane displays general information and provides options to add a server name/IP and port for monitoring. Users can set the GUI refresh interval in the top right corner.
- The middle panes showcase TI groups, with the default group being basic. Unmanaged (standalone) TIs can be monitored and are placed in the "Unmanaged" group.
- Each group pane presents monitoring information for each TI.
- The bottom pane exhibits system events. Utilize the bottom right menu to navigate through the events history.

The screenshot displays the 'Telemetry Status' interface. At the top, it shows 'UFM Telemetry Manager Up Time: 2 mins, 4 secs' and 'Fabric Source: http://127.0.0.1:8000'. A 'Refresh interval' dropdown is set to '1 second'. Below this is an 'Add Server' button.

The first table shows the 'unmanaged' group with two entries:

| URL                   | Mode            | DT receiver | Status  | Uptime                             | Collected host/switch ports | Configured host/switch ports | Enabled/Discovered ports | Iteration time [sec] | Export time [sec] | Port counters time [sec] | Ports/sec |
|-----------------------|-----------------|-------------|---------|------------------------------------|-----------------------------|------------------------------|--------------------------|----------------------|-------------------|--------------------------|-----------|
| http://127.0.0.1:9001 | standalone/host | 0           | Running | 2 hours, 28 mins, 21 secs          | 0+35/-                      |                              | 30/173                   | 0.000723             | 1e-05             | 0.000391                 |           |
| http://127.0.0.1:9002 | standalone/host | 0           | Running | 2 days, 21 hours, 11 mins, 45 secs | 173/-                       |                              | 30/173                   | 0.38699              | 0.001255          | 0.037979                 | 4555.15   |

The second table shows the 'default' group with two entries:

| URL                   | Mode         | DT receiver | Status  | Uptime  | Collected host/switch ports | Configured host/switch ports | Enabled/Discovered ports | Iteration time [sec] | Export time [sec] | Port counters time [sec] | Ports/sec |
|-----------------------|--------------|-------------|---------|---------|-----------------------------|------------------------------|--------------------------|----------------------|-------------------|--------------------------|-----------|
| http://localhost:8123 | managed/host | 1           | Running | 50 secs | 9/-                         | 9/-                          | 30/173                   | 0.003565             | 8.2e-05           | 0.002276                 | 3954.31   |
| http://localhost:8124 | managed/host | 1           | Running | 50 secs | 20/-                        | 20/-                         | 30/173                   | 0.005695             | 9.7e-05           | 0.004665                 | 4287.25   |

The 'Events' section shows a log of system events:

| Severity | Time                       | Source                | Group   | Description                                                                                                           |
|----------|----------------------------|-----------------------|---------|-----------------------------------------------------------------------------------------------------------------------|
| info     | 2024-05-05 11:33:18.655627 | http://localhost:8124 | default | Updated Telemetry Instance with 20 ports                                                                              |
| info     | 2024-05-05 11:33:18.652747 | http://localhost:8123 | default | Updated Telemetry Instance with 9 ports                                                                               |
| info     | 2024-05-05 11:33:18.257047 | http://localhost:8124 | default | Host TI config updated. New config_hash=1dc7e0a8aedf520c0940219c445200549c30b6dbd690856b12a9e5aa8fed0788              |
| info     | 2024-05-05 11:33:18.256252 | http://localhost:8124 | default | Host TI qp updated. New qp_info={qp_lid: 7, qp_port: 1, qp_num: 5776-5777, total_ops: 2, timestamp: 1714908793139835} |
| info     | 2024-05-05 11:33:18.249813 | http://localhost:8123 | default | Host TI config updated. New config_hash=8723213085d6a6e1b9f3b798471eb1e6ae5863bb69e905b8fda33f0fb147e952              |

## TI Management

In managed mode, UTM can dispatch commands to TIs. By right-clicking on the TI line, users can:

- Pause a currently running TI. This action redistributes fabric sharding among the active TIs.

- Resume a paused TI.
- Exclude a TI from monitoring. Although the TI remains on the machine, it enters a paused state and is removed from its group. It's important to note that empty TI groups are automatically removed.

## Telemetry Status Fields

The table below lists each column of a Telemetry Group panel:

| Field Name                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| URL                          | TI URL in format<br><code>http://{hostname}:{port}</code> or<br><code>http://{IP}:{port}</code>                                                                                                                                                                                                                                                                                                                                                              |
| Mode                         | standalone or managed / platform                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DT receiver                  | With or without a Distributed Telemetry receiver. If 0, cannot receive DT data from a switch TI                                                                                                                                                                                                                                                                                                                                                              |
| Status                       | Down, Running, Initializing, Paused, or Restarting                                                                                                                                                                                                                                                                                                                                                                                                           |
| Uptime                       | TI uptime in human-readable format                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Collected host/switch ports  | Ports collected from the host/switch. By default data that did not change from the last sample is not being re-exported. Such data is shown in the host part as <code>+num_old_ports</code> .<br>In the screenshot above, first TI of the "unmanaged" group sampled 0 new data samples and found 35 old ones. Nothing is being sampled from Distributed Telemetry, because this TI runs without DT receiver. The resulting format is:<br><code>0+35/-</code> |
| Configured host/switch ports | Ports configured to be sampled from a host and corresponding switches in total. For more details refer to Distributed Telemetry documentation.                                                                                                                                                                                                                                                                                                               |

| Field Name               | Description                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------------------|
| Enabled/discovered ports | Enabled and discovered ports of the Fabric.                                                                 |
| Iteration time           | Total iteration time of UFM Telemetry data collection                                                       |
| Export time              | Export time in the last iteration of UFM Telemetry data collection. Included to <code>Iteration time</code> |
| Port counters time       | Time spent only on port counters telemetry collection. Included to <code>Iteration time</code>              |
| Ports/sec                | Speed of new port counters data collection during the last iteration of UFM Telemetry.                      |

## REST API

All the GUI features including TI management and monitoring can be accessed via REST API.

## Accessing UTM API Commands Based on Operating Mode

The method to access UTM API commands varies depending on the mode:

- **In UFM Plugin Mode:** Use the UFM REST API proxy:

```
curl -s -k https://{UFM_HOST_IP}/ufmRest/plugin/utm/{COMMAND} -u {user}:{pass}
```

- **In Standalone Mode:** Access the UTM HTTPS endpoint on the default port `8888`:

```
curl -s -k https://{UTM_HOST_API}:8888/{COMMAND}
```

## Command List

For simplicity, the following commands are provided for standalone mode.

- Get the list of supported user endpoints:

```
curl -s -k https://127.0.0.1:8888/help
```

- Get the status of the monitored TIs in JSON format:

```
curl -k https://127.0.0.1:8888/status
```

- Add TI <http://127.0.0.1:8123> to the `my_group` monitoring group:

```
curl -k 'https://127.0.0.1:8888/add_server?url=http://127.0.0.1:8123&group=my_group'
```

- Add TI <http://127.0.0.1:8123> to `default` monitoring group:

```
curl -k https://127.0.0.1:8888/add_server?
url=http://127.0.0.1:8123
```

- Remove TI from monitoring (running TI will be paused):

```
curl -k https://127.0.0.1:8888/remove_server?
url=http://127.0.0.1:8123
```

- Pause running TI:

```
curl -k https://127.0.0.1:8888/pause_server?
url=http://127.0.0.1:8123
```

- Resume paused TI:

```
curl -k https://127.0.0.1:8888/start_server?
url=http://127.0.0.1:8123
```

## Overview

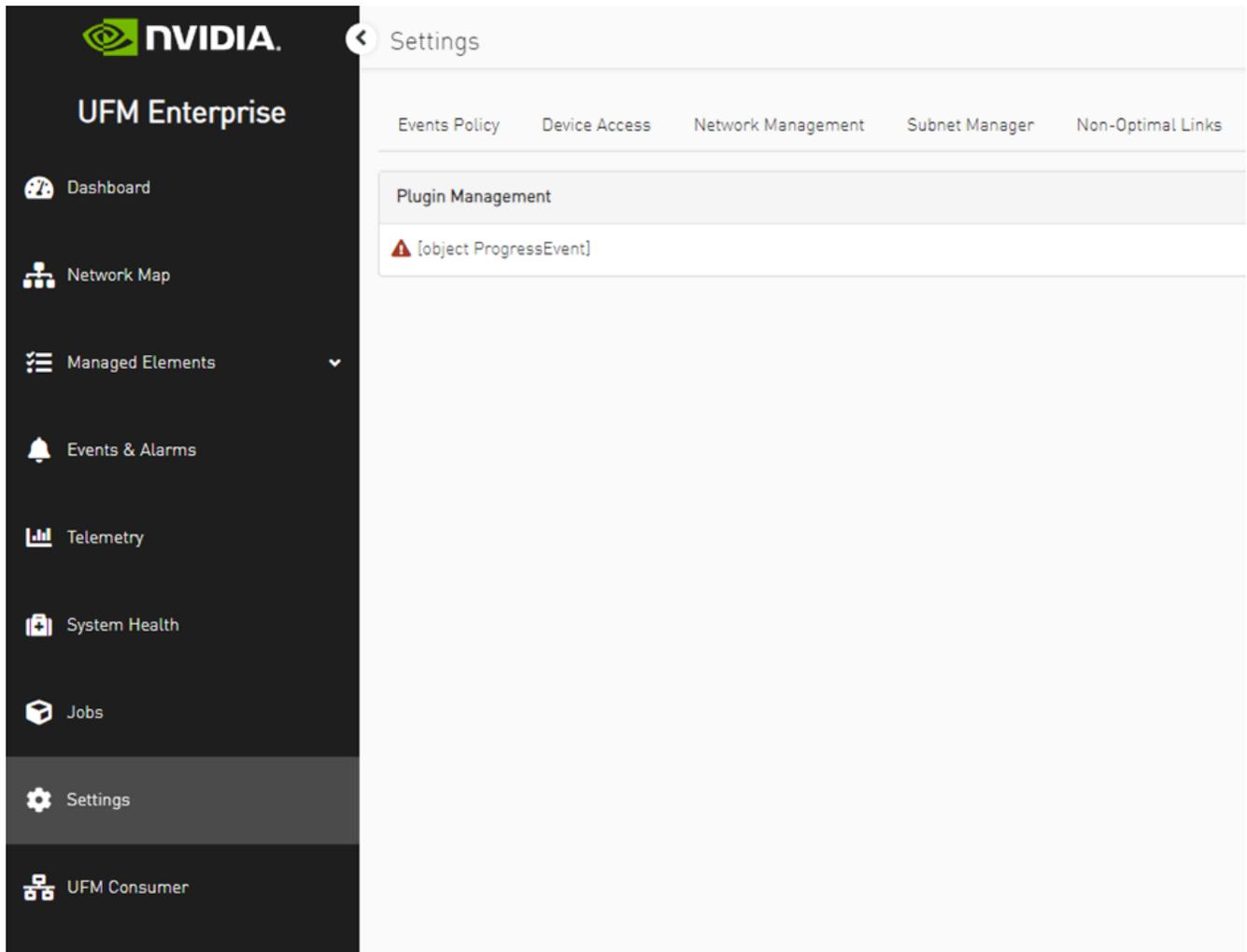
The UFM consumer plugin is a self-contained Docker container with REST API support, under UFM management. It serves as a Multi-Subnet consumer within UFM, offering all the functionalities available for Multi-Subnet UFM.

The Multi-Subnet UFM feature allows the management of large fabrics spanning multiple sites within a single product, specifically Multi-Subnet UFM.

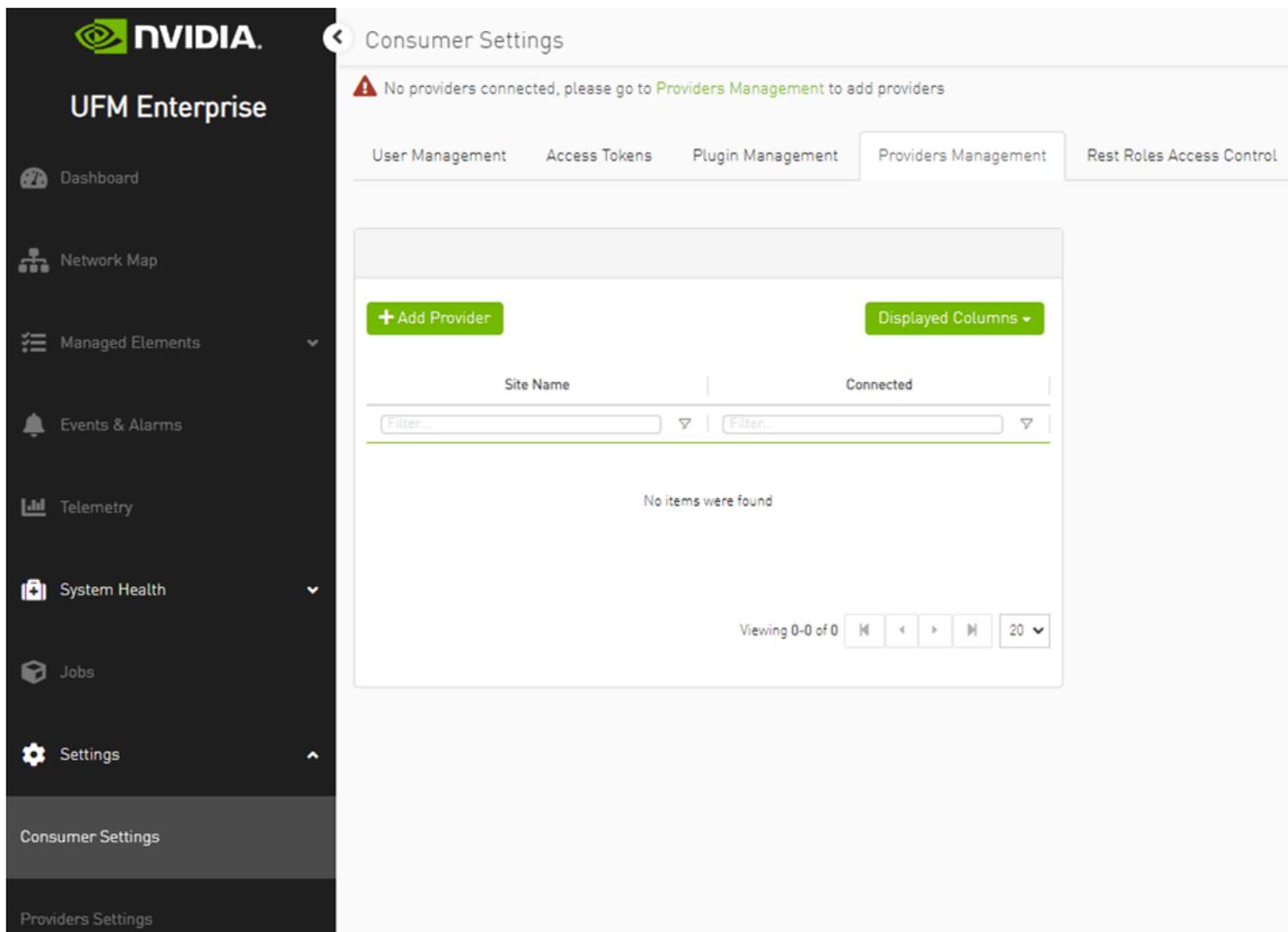
This feature comprises two layers: UFM Multi-Subnet Provider and UFM Multi-Subnet Consumer (UFM consumer plugin).

The UFM Provider acts as a Multi-Subnet Provider, exposing all local InfiniBand fabric information to the UFM consumer plugin. On the other hand, the UFM consumer plugin functions as a Multi-Subnet Consumer, gathering and consolidating data from configured UFM Providers. This enables users to manage multiple sites conveniently in one location. While the UFM Consumer offers similar functionality to regular UFM, there are behavioral differences concerning aggregation.

Upon deployment of the UFM consumer plugin, an additional tab is incorporated into the UFM interface.



After clicking on UFM consumer plugin UI, a new browser tab with UFM Multi-Subnet consumer functionality options is presented. Upon the initial launch of the UFM consumer plugin UI and in case there are no configured providers, a screen for adding providers (Provider Management) will be displayed.



The functionality of the UFM consumer plugin is similar to that of Multi-Subnet UFM. For further details, refer to [Multi-Subnet UFM](#).

## Fast-API Plugin

### Overview

The Fast-API plugin is a new component that runs in parallel to the UFM model and provides a more scalable and efficient way to manage the inventory and topology of the fabric. It uses a Redis database to store the data it receives from the SM client consumer and the ibdiagnet collector. It also exposes REST APIs for querying the ports, systems, links, switches, and sharp reservations. The Fast-API plugin also supports persistent inventory, which means it keeps track of all the devices, ports, and links the UFM ever encountered, even if they are disabled or removed. The Fast-API plugin is designed to be backward compatible with the UFM model, except for some minor differences in the API parameters and the handling of generic node names.

## Deployment

- As a first step, get the Fast API image:

```
docker pull mellanox/ufm-plugin-fast_api
```

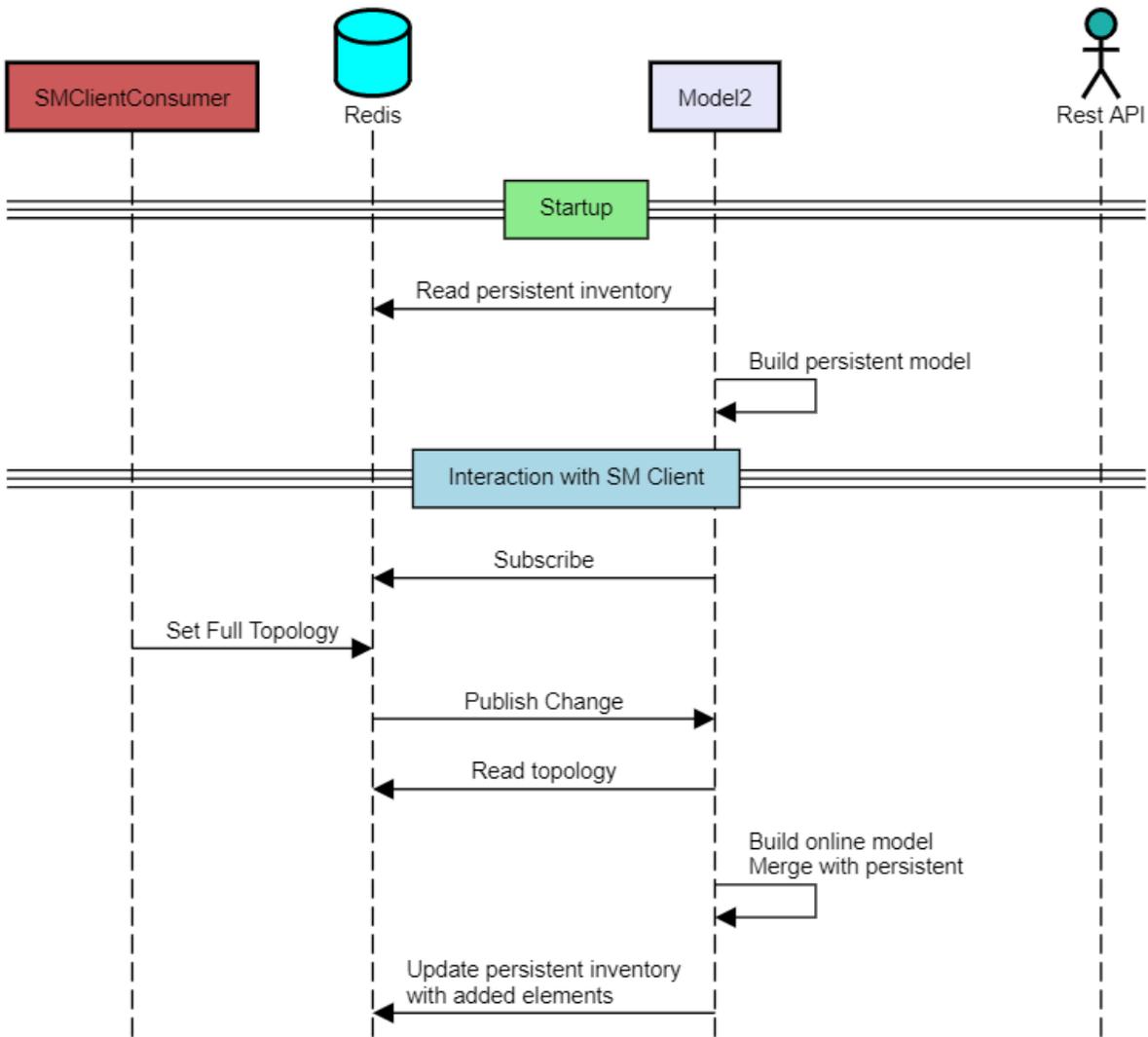
- Load the downloaded image onto the UFM server. This can be done either by using the UFM GUI by navigating to the Settings -> Plugins Management tab or by loading the image via the following instructions:

1. Log in to the UFM server terminal.
2. Run:

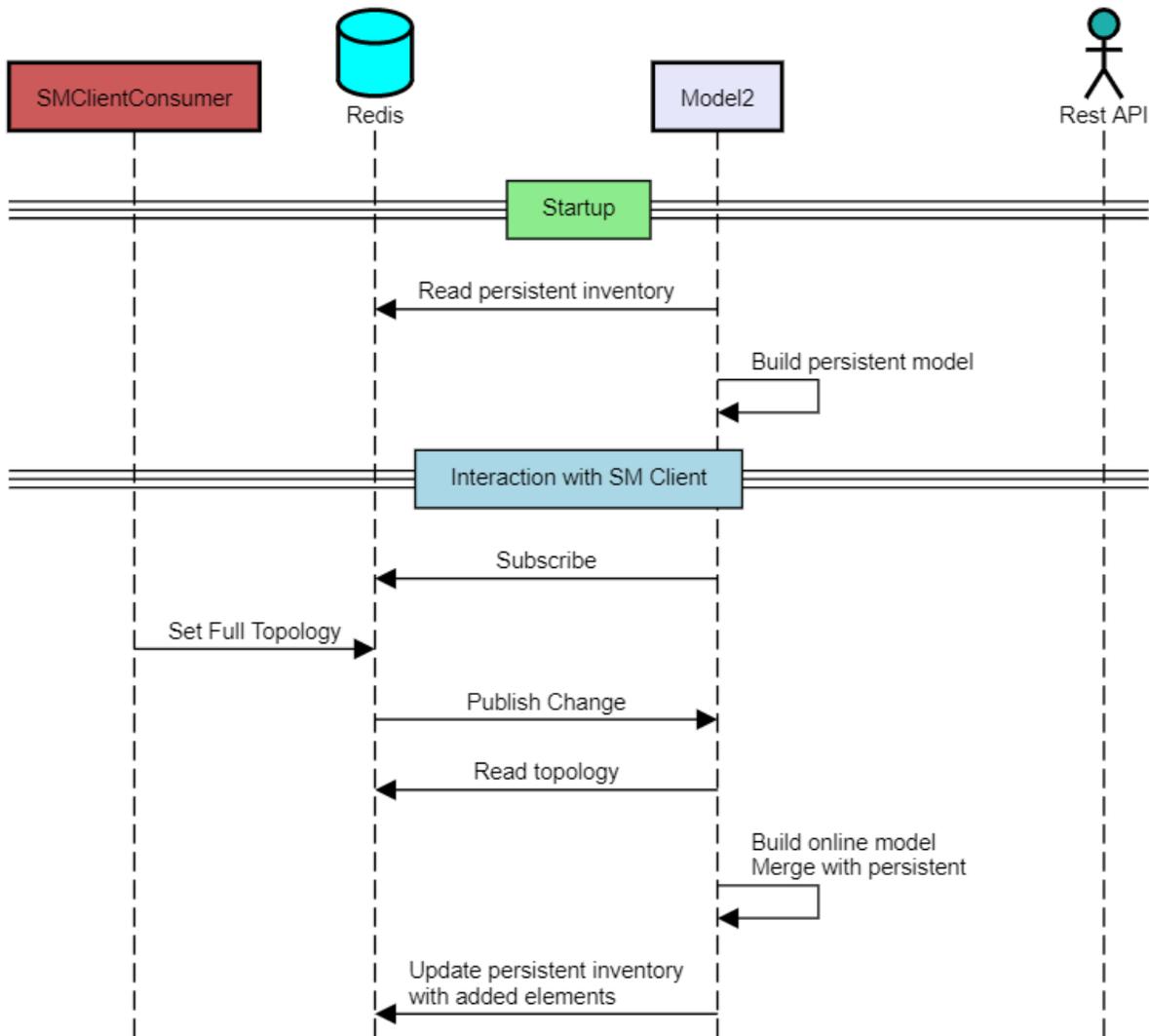
```
docker load -I <path_to_image>
```

- After successfully loading the plugin image, the plugin should become visible in the plugin management table within the UFM GUI. To initiate the plugin's execution, simply right-click on the respective in the table.

## SequencDiagrm



## Sequence Diagram



## Supported APIs

The following APIs are supported:

Ports API - Retrieve all the ports in the cluster or filter by the system name. The following attributes are retrieved:

- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/ports](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/ports)
- GET /resources/ports/ - deviceId referred as sys\_guid for switches and hostname for hosts
  - `name`: The name of the port.
  - `lid`: The local ID of the port.

- `logical_state`: The logical state of the port.
- `physical_state`: The physical state of the port.
- `number`: The number of the port.
- `decimal_guid`: The decimal GUID of the port.
- `mtu`: The maximum transmission unit of the port.
- `active_speed`: The active speed of the port.
- `active_width`: The active width of the port.
- `peer_address`: The peer address of the port.
- `peer_port`: The peer port of the port.
- `tier`: The tier of the port.
- `label`: The label of the port.

This API retrieves all the ports in the cluster, including cable information. The following attributes are supported for cable information:

- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/ports/?cable\\_info=true](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/ports/?cable_info=true)
  - `part_number`: The part number of the cable.
  - `serial_number`: The serial number of the cable.
  - `revision`: The revision of the cable.
  - `identifier`: The identifier of the cable.
  - `length`: The length of the cable.
  - `technology`: The technology of the cable.
  - `fw_version`: The firmware version of the cable.

Links API - Retrieve all the links in the cluster. The following attributes are retrieved:

- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/links](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/links)
  - `source_guid`: The GUID of the source port.
  - `source_port`: The source port.
  - `destination_guid`: The GUID of the destination port.
  - `destination_port`: The destination port.
  - `source_port_dname`: The display name of the source port.
  - `source_port_name`: The name of the source port.
  - `destination_port_dname`: The display name of the destination port.
  - `destination_port_name`: The name of the destination port.
  - `width`: The width of the link.
  - `severity`: The severity of the link.
  - `source_port_node_description`: The description of the node connected to the source port.
  - `destination_port_node_description`: The description of the node connected to the destination port.
  - `name`: The name of the link.
  - `active`: The status of the link.

This API retrieves information about the systems in the cluster. It can retrieve all the systems or filter by the system name. The following attributes are retrieved:

- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/systems](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/systems)
- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/systems/<system\\_name>](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/systems/<system_name>)

- GET [https://<UFM\\_IP>/ufmRestV2/plugin/fast\\_api/resources/switches](https://<UFM_IP>/ufmRestV2/plugin/fast_api/resources/switches)
  - `name`: The display name of the system.
  - `system_name`: The name of the system.
  - `guid`: The GUID of the system.
  - `sys_guid`: The system GUID.
  - `ports`: A list of ports associated with the system.
  - `hostname`: The hostname of the system.
  - `vendor`: The vendor of the system.
  - `temperature`: The temperature of the system.
  - `fw_version`: The firmware version of the system.
  - `technology`: The technology used by the system.
  - `level`: The level of the system.
  - `uptime`: The uptime of the system.
  - `sw_version`: The software version of the system.
  - `system_type`: The type of the system.
  - `description`: The description of the system.
  - `psid`: The PSID of the system.
  - `active`: The status of the system.
  - `state`: The state of the system.
  - `is_managed`: Indicates whether the system is managed.

# UFM Light Plugin

## Overview

UFM Light is a C++ UFM plugin designed to create a reduced UFM model and deliver a high-performance REST API. While it builds a model similar to the legacy UFM, there are notable differences:

- The model in UFM Light is streamlined to meet the specific requirements of the UFM Light REST API functionality.
- UFM Light builds its model more quickly.

UFM Light offers the same REST API as the legacy UFM, but with enhanced performance.

## Deployment

### Prerequisites

1. UFM is running
2. Fast-API plugin is running

UFM Light builds its model from the Redis and requires the Fast-API plugin as Redis provider. Writing to Redis must be enabled in UFM.

## Installation

1. Get UFM Light image:

```
docker pull mellanox/ufm-plugin-ufm-light
```

2. Load UFM Light plugin:

```
sudo /opt/ufm/scripts/manage_ufm_plugins.sh add -p ufm-light
-t <version>
```

3. Configure the UFM Light plugin if needed (see "Configuration" section).

**Note:** it is recommended to configure parameter `--http.threads` to "4" for 16-Core systems, "16" for 64-Core systems.

## Configuration

UFM Light runs with its default configuration. To update the configuration, edit:

```
sudo vim /opt/ufm/files/conf/plugins/ufm-light/ufm-light.cfg
```

If `ufm-light.cfg` is updated, the UFM Light plugin must be stopped and started again manually to apply the changes:

```
sudo /opt/ufm/scripts/manage_ufm_plugins.sh stop -p ufm-light
sudo /opt/ufm/scripts/manage_ufm_plugins.sh start -p ufm-light
```

## Configuration Options:

|                                                |                       |
|------------------------------------------------|-----------------------|
| <code>--model.srcmode arg (=redis:full)</code> | base source of model: |
| <code>redis:full, redis:invnt, grpc</code>     |                       |
| <code>--model.period arg (=30)</code>          | set farbric request   |
| period in seconds                              |                       |
| <code>--redis.address arg (=localhost)</code>  | set Redis address     |

```

--redis.port arg (=6379) set Redis port
--grpc.address arg (=localhost) set gRPC address
--grpc.port arg (=2510) set gRPC port
--telemetry.address arg (=localhost) set Telemetry address
--telemetry.port arg (=9001) set Telemetry port
--telemetry.url arg (=csv/cset/converted_enterprise) set
Telemetry url
--http.address arg (=127.0.0.1) set http address
--http.port arg (=8950) set http port
--http.threads arg (=4) set number of http server
threads, min 1
--logging.level arg (=INFO) set logging level:
CRITICAL, ERROR, WARNING, INFO, DEBUG, TRACE
--logging.log_dir arg (=log) set logging directory
--logging.file.max_size_MB arg (=10) set MAX log file size
limit in MBs, min 1
--logging.file.backups arg (=10) set number of log file
backups

```

For normal operation, keep the parameter `model.srcmode = redis:full` at its default value. Other values (`redis:invnt`, `grpc`) can be set, but it is not guaranteed that the model will be built correctly. Parameters `grpc.address` and `grpc.port` will have no effect.

**Note:** it is recommended to configure parameter `--http.threads` to “4” for 16-Core systems, “16” for 64-Core systems.

## Supported REST API

Telemetry API:

- GET monitoring/session/0/data

### Access methods:

-

- **Direct access:**

```
curl http://127.0.0.1:8950/monitoring/session/0/data
```

- **Over plugins API:**

```
curl -k https://<lab_ip>/ufmRest/plugin/ufm-light/monitoring/session/0/data -u <user>:<password>
```

Topology API:

- GET resources/systems

**Access methods:**

- 

- **Direct access:**

```
curl http://127.0.0.1:8950/resources/systems
```

- **Over plugins API:**

```
curl -k https://<lab_ip>/ufmRest/plugin/ufm-light/resources/systems -u <user>:<password>
```

- GET resources/ports

**Access methods:**

- 

- **Direct access:**

```
curl http://127.0.0.1:8950/resources/ports
```

- **Over plugins API:**

```
curl -k https://<lab_ip>/ufmRest/plugin/ufm-light/resources/ports -u <user>:
<password>
```

- GET resources/modules?type=hca

**Access methods:**

- 

- **Direct access:**

```
curl http://127.0.0.1:8950/resources/modules?type=hca
```

- **Over plugins API:**

```
curl -k https://<lab_ip>/ufmRest/plugin/ufm-light/resources/modules?type=hca -u
<user>:<password>
```

## Troubleshooting

If the response to `GET monitoring/session/0/data` contains an empty dictionary, ensure that the Fast-API plugin is running.

UFM Light logs are located in:

```
/opt/ufm/files/log/plugins/ufm-light/
```

The default log level is `INFO`. To change the log level to `DEBUG`, edit:

```
sudo vim /opt/ufm/files/conf/plugins/ufm-light/ufm-light.cfg

logging.level = DEBUG
```

After config update, ufm-light plugin must be stopped and started again manually in order to obtain config changes.

## Key Performance Indexes (KPI) Plugin

The KPI plugin periodically collects telemetry metrics and topology data from one or multiple UFM Telemetry and UFM clusters to calculate high-level Key Performance Indicators (KPIs). It can operate as a standalone Docker container or as a UFM plugin.

The calculated KPIs and collected telemetry metrics are stored in a Prometheus time-series database using the remote-write Prometheus protocol.

### KPIs

#### NICs Connectivity

- **Name:** `connected_endpoints`
- **Description:** This KPI shows the percentage of NICs connectivity, namely, from all NICs available, how many are connected. The desired value is 100%, meaning all NICs are connected.

The default threshold for "bad" values is  $\leq 95\%$ .

 **Note**

The complete list of NICs includes all those detected at least once since the plugin is started.

## Topology Correctness

- **Name:** `topology_correctness`
- **Description:** This KPI reports the number of wrongly connected links. The ability to spread traffic over multiple minimal-distance paths is critical in utilizing the bandwidth provided by the network.

Therefore, a pass/fail criteria for the topology not being broken by miss-connections is key for the network to provide reasonable bandwidth to running applications. The threshold for failure is  $> 0$ .

## Link Stability

- **Name:** `stability`
- **Description:** For each UID (Unique Identifier), the KPI checks for changes in the link down counter. A change may indicate a link recovery, suggesting there was a period with no link. The statistics are tracked per UID, and the ideal value for link down errors is 0, indicating no problematic links.

## Overheated Components

- **Name:** `operating_conditions`
- **Description:** This KPI displays the total number of elements (ports and devices) experiencing operating condition violations. Each hardware element has a predefined normal operating temperature range, with a common default threshold set at 70°C (158°F) or higher.

## Bandwidth Loss due to Congestion

- **Name:** `bw_loss_by_congestion`

- **Description:** An Infiniband (IB) network is lossless and can therefore experience loss congestion spread. Features like congestion control aim to minimize this issue. This KPI reports the percentage of bandwidth loss due to congestion for each layer and direction, as measured by the `port-xmit-wait` counter.

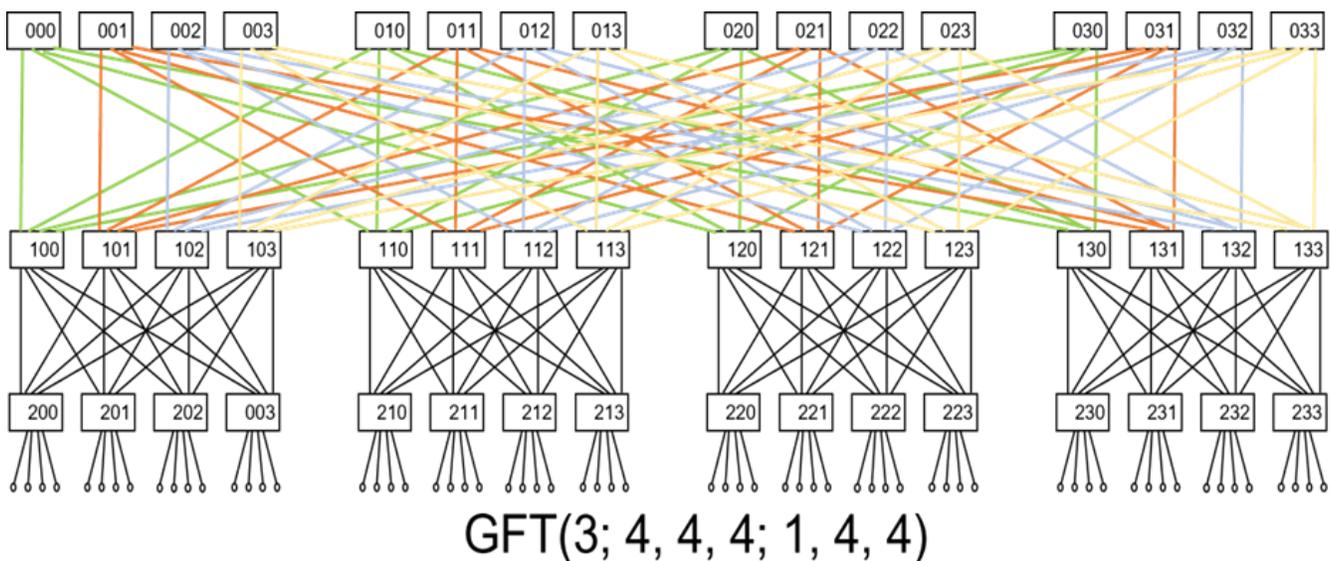
The reported percentage is calculated by averaging the `xmit-wait` equivalent time with the time between samples across all links in the specified layer-direction group.

## Fat Tree (Single Root) to Tree Conversion

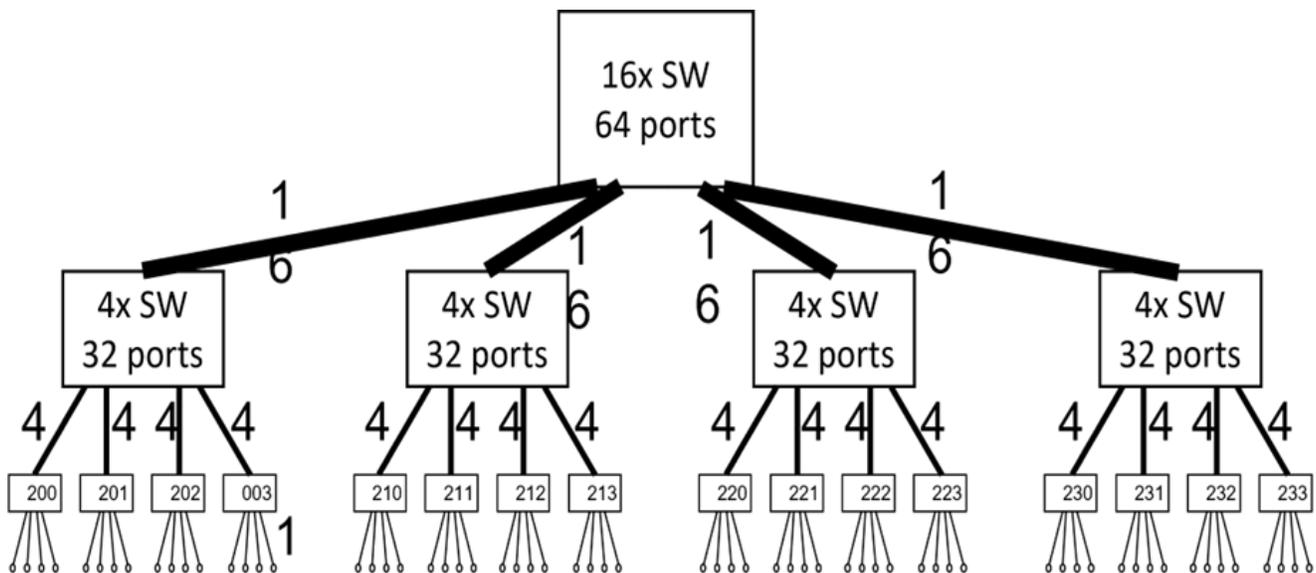
- **Name:** `tree_over_subscription`

- **Description:** Fat Trees were constructed by Leiserson in order to enable building a tree structure using fixed radix  $K$  and capacity switches  $T$ . Consider a regular  $K-1$  tree (each switch has one parent and  $K-1$  children), which have a single root switch service and after  $H-1$  levels  $(K-1)^{(H-1)}$  leaf switches connecting  $(K-1)^H$  hosts each with bandwidth  $B$ . Consider the worst case traffic pattern where each leaf switch send traffic to other leaf switches that must cross the top. The connection from each leaf switch up should carry  $B(K-1)$  traffic and the capacity of that switch is bi-directional  $B(K-1)$  too. One level up the capacity and up link capacity required is  $B(K-1)^2$ , etc. But that requires exponentially growing capacity from links and switches.

For example, the below diagram is of a three level fat tree:



## The Single Root Tree:



The solution to that problem was to split each single switch in the original Single Root Tree (SRT) into Multi Rooted Tree - which is a Fat Tree. In each level there are exactly same number of switches connected up and down except for the top level which carry half the number of switches - connecting only down.

The Fat Tree formulations define which switches connect to which other switches but it does not break the basic concept that a Fat Tree can be collapsed back into a simple tree by merging switches into much larger ones. A pair of leaf switches can still be classified by their distance - or the level of their common parents - just like in the original SRT.

When we want to evaluate the damage to the perfect tree structure due to link faults, it is very hard to get an exact maximum flow bandwidth without lengthy  $N^2$  complex algorithm. However, if we examine the SRT obtained by collapsing the Fat Tree back into a tree, we can get an upper bound to the available bandwidth between different branches of the SRT.

This metric evaluates Fat Tree clusters topology and extracts their original Tree structure. Then it evaluates the over-subscription of each sub-tree. This way, the impact of the exact set of missing links can be evaluated in terms of the bandwidth taken out between sub-trees of the topology.

## Top-of-rack (ToR) to ToR Max Flow (Bandwidth) Matrix

- **Name:** `tor_to_tor_bw`

- **Description:** This KPI provides a simple metric for the impact of link failures. One such network property is the available bandwidth for pairs of ToRs. This provides a meaningful yet traffic independent metric. So no prior knowledge of the exact set of instantaneous traffic patterns is required.

It is most important to look at the TOR up-ports since on Fat Trees the number of possible paths grows exponentially when going up the topology towards the roots. So the impact of link faults is decaying exponentially with their level towards the roots.

It would have been nice if we could just count the number of missing up links on each of the TORs in the pair and claim that TOR X lost x uplinks and TOR Y lost y uplinks, the lost bandwidth is  $\text{linkBW} \cdot \min(x,y)$ . But in reality the worst case lost bandwidth is  $\text{linkBW} \cdot (x+y)$ . This is an artifact of the specific links lost and the network structure.

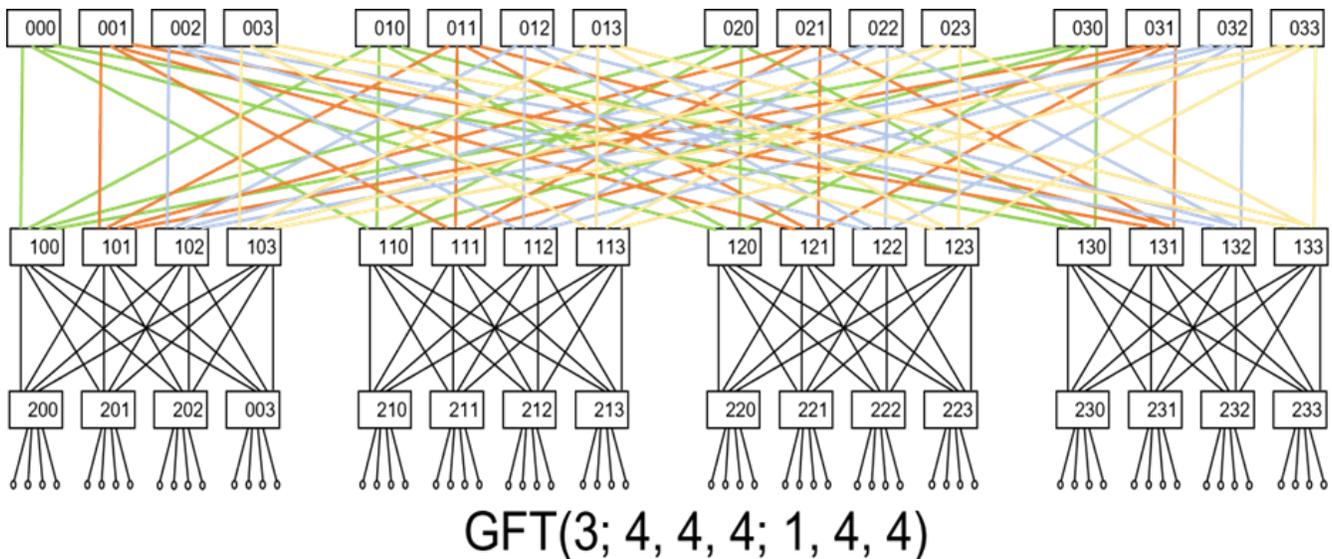
The code we provide performs a Fat Tree specific computation of the exact available bandwidth for each TOR's pair.

The algorithm provides unique identifiers for sub-trees and consider the subtree each link of the TORs connect to. Then it sums the min number of links connected from each of the TORs to each of the subtrees.

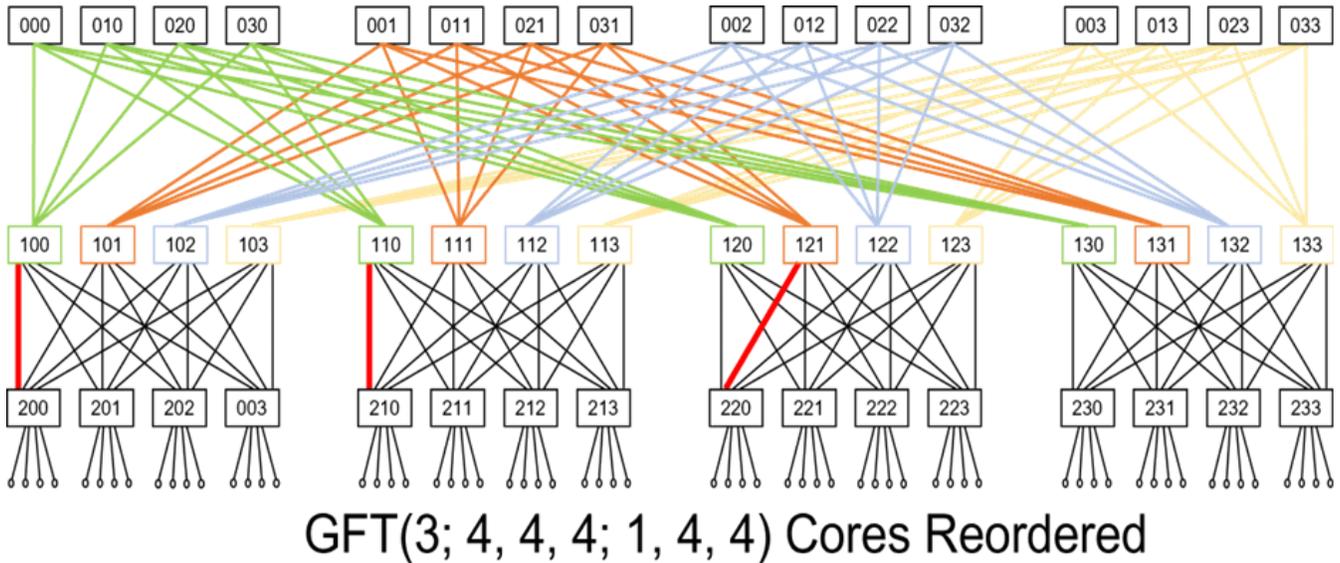
A more straight forward approach utilizing networkx or direct implementation of Dinic's max-flow algorithm yielded much higher runtime, yielding this metric impractical to use.

**We use an example to demonstrate these concepts:**

Consider the Fat Tree  $\text{GFT}(3;4,4,4;1,4,4)$  depicted in the diagram below:



We re-arrange the top row of switches (cores) such that the full-bipartites between switch levels 2 and 3 are close together:



The re-ordered picture highlights that if we imagine the red links as missing links, then:

1. TORs 200 and 210 missing links are connected to the same bipartite and thus they only lose 1 out of the 4 paths between them.
2. However, TORs 200 and 220, missing links connect to 2 different L2-L3 bipartites and thus 2 different paths out of the 4 possible are lost.

The resulting TOR to TOR max-flow matrix, providing the maximal bandwidth between each pair, in units of single link bandwidth is provided below:

|     | 00 | 01 | 02 | 03 | 10 | 11 | 12 | 13 | 20 | 21 | 22 | 23 | 30 | 31 | 32 | 33 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 100 |    | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 2  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
| 101 | 3  |    | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 102 | 3  | 4  |    | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 103 | 3  | 4  | 4  |    | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 110 | 3  | 3  | 3  | 3  |    | 3  | 3  | 3  | 2  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
| 111 | 3  | 4  | 4  | 4  | 3  |    | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 112 | 3  | 4  | 4  | 4  | 3  | 4  |    | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 113 | 3  | 4  | 4  | 4  | 3  | 4  | 4  |    | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 120 | 2  | 3  | 3  | 3  | 2  | 3  | 3  | 3  |    | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
| 121 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  |    | 4  | 4  | 4  | 4  | 4  | 4  |
| 122 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  |    | 4  | 4  | 4  | 4  | 4  |
| 123 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  |    | 4  | 4  | 4  | 4  |
| 130 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  |    | 4  | 4  | 4  |
| 131 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  |    | 4  | 4  |
| 132 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  |    | 4  |
| 133 | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  |    |

## **The Algorithm**

The following steps are conducted in order to provide that table:

1. DFS from top to bottom collecting the list of parents for each switch. We require all TORs be accessed so we try all top level switches until we find one that is connected to all TORs. After we are done we can ask for every TORs pair what is the level of the lowest common parent. This is required since routing will only use shortest paths, and thus go up to that level only.
2. Establish for each TOR and up the unique bottom-up subtree it is part of. The same sub-tree number should be used for all parents of each switch that are on the same level. Since the topology may be missing some links, it is not simple to check if there was previous allocation of such number, so first all parents are scanned, and then a consolidation step decides which levels are missing a number. If any needs to be set then another step applies the consolidated value.
3. For TOR switch, we sum the total number of links that connect to switches with same bottom-up tree (recognized by their assigned number). We do that for every parent level.
4. Now that we have that data for every TOR, we compute the TOR to TOR max-flow by first looking up the level of their common parent and then computing the the minimal number of flows they connect to each bottom-up tree they connect to.

## **Deployment**

The plugin could be deployed as a standalone application or as a UFM plugin.

### **Deploy the KPI as a UFM plugin**

1. Pull/load the latest image of the plugin:

```
docker pull mellanox/ufm-plugin-kpi
```

2. Pull/load the latest image of the plugin:

```
/opt/ufm/scripts/manage_ufm_plugins.sh add -p kpi -t <TAG>
```

## Deploy the KPI as a Standalone application

1. Pull/load the latest image of the plugin:

```
docker pull mellanox/ufm-plugin-kpi
```

2. Pull/load the latest image of the plugin:

```
docker run --network host -v
/opt/ufm/files/conf/plugins/kpi:/config -v
/opt/ufm/files/logs/plugins/kpi:/logs --rm -dit $IMAGE
```

## Configurations

The configurations can be managed through a configuration file.

- **Within the container**, the configurations file can be found under `/config/kpi_plugin.conf`
- **On the host**, the shared volume location of the `/config` is `/opt/ufm/files/conf/plugins/kpi/kpi_plugin.conf`

## Clusters Configurations

The default KPI configurations KPI include one default cluster called `unknown`, once the plugin starts, the default cluster is configured to collect the secondary telemetry endpoint <http://localhost:9002/csv/metrics> and the local UFM topology data.

To change the parameters of the default cluster, or to add additional clusters, please refer to the following configuration under the `kpi_plugin.conf`:

```
Set name to "cluster-config-$cluster_name". Add section per each cluster
[cluster-config-unknown]

uncomment and set 2 following options:
#host_list = host_name[1-1024],another_host_name[1-100]
threshold to distinguish between hosts and switches
(inclusive)
#host_max_ports = 4

OR

If hostlist format is not possible, another option is per-
level regular expressions
That is a list of regular expressions to detect nodes level
in topology (0 is lowest - hosts)
Key structure is 'level.<level number>.<per-level running index>'
#level.0.0=some-host-pattern-\d+
#level.0.1=another-host-pattern-\d+
#level.1.0=leaf-pattern-l\d+
#level.2.0=spine-pattern-s\d+
#level.3.0=core-pattern-c\d+

If running as standalone app please uncomment and set next 3
lines
#ufm_ip=0.0.0.0
#ufm_access_token=1234567890abcdefghijklmnopqrst
#telemetry_url=http://0.0.0.0:9100

If running as UFM plugin and UFM port has changed
```

#ufm\_port=1234

| Property                                               | Description                                                                                                                                | Default Value                                                 |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <code>cluster.host_list</code>                         | Set of hosts in <a href="#">hostlist format</a> . Used to detect the topology leafs.                                                       | None                                                          |
| <code>cluster.host_max_ports</code>                    | The maximal number of ports in a server. Used as threshold to classify a node as server / switch.                                          | 4                                                             |
| <code>cluster.level.X.Y</code>                         | Regular Expression to capture topology levels. The first index (X) is the level and the following index (Y) is a running index for level X | None                                                          |
| <code>cluster.ufm_ip</code>                            | UFM IP that used to collect the topology data                                                                                              | '127.0.0.1'                                                   |
| <code>cluster.ufm_port</code>                          | UFM port that used to collect the topology data in case the cluster is local                                                               | '8000'                                                        |
| <code>cluster.ufm_access_token</code>                  | The UFM access token that should be provided in case the cluster is collecting data from a remote UFM                                      | None                                                          |
| <code>cluster.telemetry_url</code>                     | UFM telemetry endpoint URL that used to collect the telemetry metrics.                                                                     | ' <a href="http://127.0.0.1:9002">http://127.0.0.1:9002</a> ' |
| <code>cluster.telemetry_metrics_push_delta_only</code> | If True, only changed telemetry metrics are pushed to Prometheus after each pulling interval, with a fallback to push unchanged            | True                                                          |

| Property | Description                                                                                                                                 | Default Value |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|          | metrics if they remain static for over an hour. Otherwise, all fetched metrics will be pushed to the Prometheus after each pulling interval |               |

## KPI Configurations

The configurations are related to the KPI plugin itself. please refer to the below configuration section in order to manage the KPI generic configurations:

```
[kpi-config]
Optional Comma separated list that contains list of the
disabled KPIs that we don't want to store them in Prometheus DB
Available KPIs:
###
connected_endpoints, topology_correctness, stability, operating_conditions
disabled_kpis=telemetry_metrics
```

| Property      | Description                                                                                                                                                                                                                                                                                                          | Default Value     |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| disabled_kpis | Optional Comma-separated list that contains the list of the disabled KPIs that we don't want to store in Prometheus DB. The available KPIs are: connected_endpoints, topology_correctness, stability, operating_conditions, bw_loss_by_congestion, tree_over_subscription, tor_to_tor_bw, general, telemetry_metrics | telemetry_metrics |

## Prometheus Configurations

The plugin includes a local Prometheus server instance that is used by default, the following parameters are used to manage the Prometheus configurations:

```
[prometheus-config]
prometheus_ip=0.0.0.0
prometheus_port=9090
prometheus_db_data_retention_size=120GB
prometheus_db_data_retention_time=15d
```

| Property                          | Description                                                               | Default Value |
|-----------------------------------|---------------------------------------------------------------------------|---------------|
| prometheus_ip                     | IP of Prometheus server                                                   | 0.0.0.0       |
| prometheus_port                   | Port of Prometheus server                                                 | 9090          |
| prometheus_db_data_retention_size | Data retention policy by size (used only for the local Prometheus server) | 120GB         |
| prometheus_db_data_retention_time | Data retention policy by time (used only for the local Prometheus server) | 15d           |

The data storage path of the local Prometheus DB is under `/opt/ufm/files/conf/plugins/kpi/prometheus_data`.

## Global Time Interval Configurations

The following is used by all clusters globally, each property could be overridden by adding it under the cluster's section.

```
[time-interval-config]
telemetry_interval=300
ufm_interval=60
```

| Property           | Description                                                   | Default Value |
|--------------------|---------------------------------------------------------------|---------------|
| telemetry_interval | Polling interval for the telemetry metrics data in seconds    | 300           |
| ufm_interval       | Polling interval for the UFM APIs in seconds                  | 60            |
| disabled_kpis      | Polling interval for the connected_endpoints KPI specifically | 60            |

## Logs Configurations

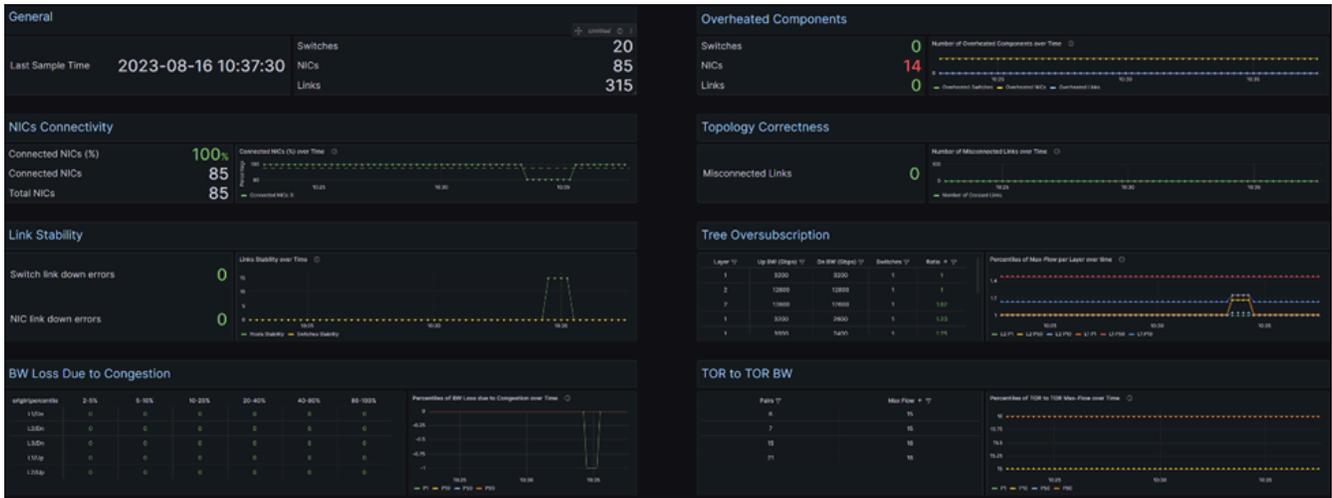
The below configurations are to manage the `kpi_plugin.log` file

```
[logs-config]
logs_level = INFO
logs_file_name = /log/kpi_plugin.log
log_file_max_size = 10485760
log_file_backup_count = 5
```

## Grafana Dashboard Templates

The KPI plugin provides several Grafana dashboard templates that the Grafana users can import, these dashboards display the KPIs panels and graphs. The main dashboard is a cluster view that shows the cluster's KPIs. The dashboard should be connected to the KPI Prometheus server.

The dashboard JSON template can be found under `/opt/ufm/files/conf/plugins/kpi/grafana/`:



## Logs

The following logs are exposed under `/opt/ufm/files/logs/plugins/kpi/` in case of UFM plugin mode, and under `/log` inside the container in case of Standalone mode.

- `kpi_plugin.log` - The application logs.
- `kpi_plugin_stderr/stdout` - The application service logs
- `prometheus.log` - The local Prometheus logs.

## REST APIs

### Get List of Configured Clusters

- URL:
  - UFM Plugin: `https://<IP>/ufmRest/plugin/kpi/api/cluster/__names__`
  - Standalone: `http://<IP>:8686/api/cluster/__names__`
- Method: GET
- Response: List of cluster names strings

## Get KPIs Information

- URL:
  - UFM Plugin: `https://<IP>/ufmRest/plugin/kpi/files/kpi_info`
  - Standalone: `http://<IP>:8686/files/kpi_info`
- Method: GET
- Response: List of KPI names and HTML descriptions.

## Get KPIs Values

- URL:
  - UFM Plugin: `https://<IP>/ufmRest/plugin/kpi/api/cluster/<cluster_name>`
  - Standalone: `http://<IP>:8686/api/cluster/<cluster_name>`
- Method: GET

Response: A list of KPIs with the relative calculates graph values to be used in the UI. Generally, 2 main components are expected: the table data (key “2d\_matrix\_data”) and the graph data (key “graph\_data”). Each value corresponds to rules expected by the UI:

- `display_name` – KPI display name
- `2d_matrix_data` – Latest data in a table-like format. Every list item is a dict that makes a table row - corresponding to the columns of that row.
  - `data` – List of dict, each dict is a column in the row. May contain:
    - `percentage` – Value in percentage.
    - `value` – Raw value.
    - `name` – Column header
  - `direction` – For arrows icon (up / down)

- `name` – Row header
- `graph_data` – dictionary with the following items:
  - `multi_line_graph` – time series graph for one or more series.
    - `title` – Graph title.
    - `x_label` – X axis label.
    - `x_values` – X axis values.
    - `y_labels` – Y axis labels.
    - `y_values` – Y axis values.
  - `info` – string with information of the graph data.

## Get KPI Plugin Overview

- URL:
  - UFM Plugin: [https://<IP>/ufmRest/plugin/kpi/overview?time\\_window=<value>](https://<IP>/ufmRest/plugin/kpi/overview?time_window=<value>) (in hours)
  - Standalone: [http://<IP>:8686/overview?time\\_window=<value>](http://<IP>:8686/overview?time_window=<value>) (in hours)
- Method: GET

Response:

```
{
 "clusters_telemetry_info": [
 {
 "cluster_name": "unknown",
 "interval": 60,
 "url": "http://pjazz:9002/csv/metrics"
```

```

 }
],
 "prometheus_info": {
 "db_statistics": {
 "appended_samples_rate_per_sec": 11.46,
 "bytes_rate_per_sample": 9.227,
 "total_compressed_blocks_size_bytes": 272329313.0,
 "total_head_chunks_size_bytes": 1937238.0,
 "total_wal_size_bytes": 2989807.0
 },
 "url": "http://pjazz:9191"
 }
}

```

Where:

`clusters_telemetry_info`: contains a list of the configured clusters' information, each cluster has the following properties:

| Property                  | Description                               | Default Value                                                                 |
|---------------------------|-------------------------------------------|-------------------------------------------------------------------------------|
| <code>cluster_name</code> | Cluster's name                            | One cluster with name 'unknown'                                               |
| <code>interval</code>     | Cluster's telemetry pulling time interval | 60                                                                            |
| <code>url</code>          | The cluster's URL telemetry               | <a href="http://0.0.0.0:9002/csv/metrics">http://0.0.0.0:9002/csv/metrics</a> |

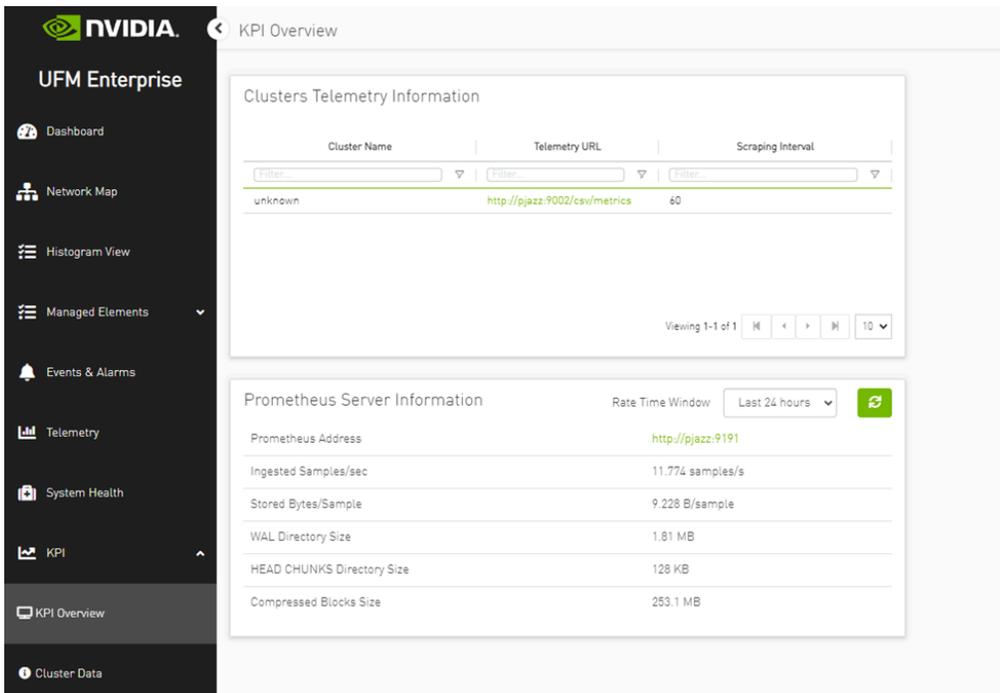
**prometheus\_info**: Contains the general Prometheus configurations (e.g. the URL) and statistics about the collected samples (for the local Prometheus mode)

| Property                                                 | Description                                                                                                                                                                                          |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>db_statistics.appended_samples_rate_per_sec</code> | Prometheus rate of the total appended samples per second, calculated by the following Prometheus expression:<br><b><i>rate(prometheus_tsdb_head_samples_appended_total[{rate_window_time}h])</i></b> |

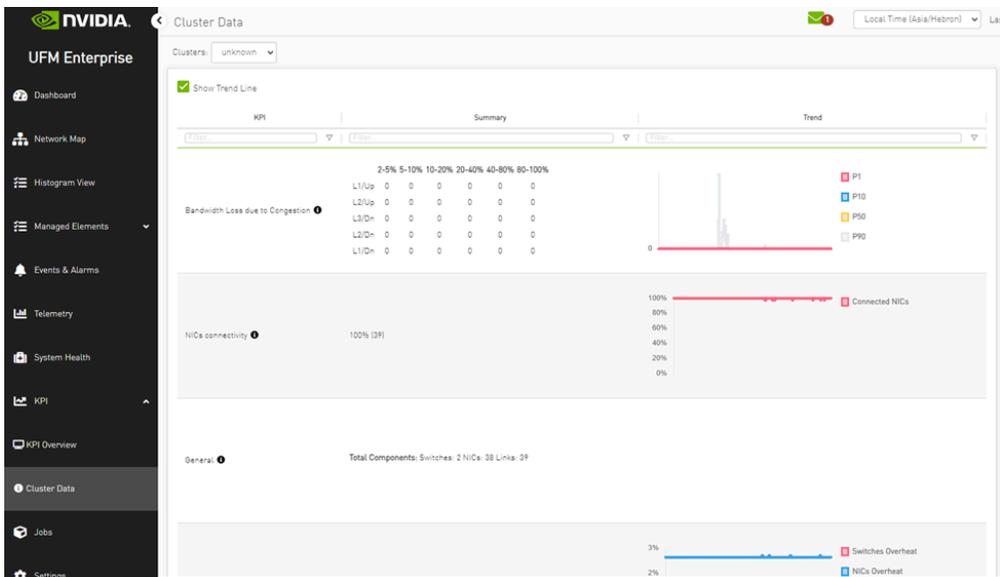
|                                                             |                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>db_statistics.bytes_rate_per_sample</pre>              | <p>Prometheus rate of ingested bytes per sample, calculated by the following Prometheus expression:</p> <p><b><i>rate(prometheus_tsdb_compaction_chunk_size_bytes_sum[{rate_window_time}h]) / rate(prometheus_tsdb_compaction_chunk_samples_sum[{rate_window_time}h])</i></b></p> |
| <pre>db_statistics.total_compressed_blocks_size_bytes</pre> | <p>Total compressed blocks size in bytes that the Prometheus was stored, calculating by the following Prometheus expression:</p> <p><b><i>prometheus_tsdb_storage_blocks_bytes</i></b></p>                                                                                        |
| <pre>db_statistics.total_head_chunks_size_bytes</pre>       | <p>Total HEAD chunks blocks size in bytes that the Prometheus was stored, calculating by the following Prometheus expression:</p> <p><b><i>prometheus_tsdb_head_chunks_storage_size_bytes</i></b></p>                                                                             |
| <pre>db_statistics.total_wal_size_bytes</pre>               | <p>Total WAL size bytes, calculating by the following Prometheus expression:</p> <p><b><i>prometheus_tsdb_wal_storage_size_bytes</i></b></p>                                                                                                                                      |
| <pre>prometheus_info.url</pre>                              | <p>The prometheus's URL telemetry</p>                                                                                                                                                                                                                                             |

## UI Views

## KPI Overview



## Cluster KPIs Data



# UFM Events Grafana Dashboard Plugin

# Overview

This plugin monitors and parses UFM events from the `event.log` file using `Fluentd`. It pushes the logs to a Loki server and visualizes them through Grafana dashboards.

## Installation

1. **Install Plugin** on UFM.
2. **Access Grafana Dashboard** at: `http://<IP>:3002` (default credentials: `admin/admin`).

## Components

- **Fluentd:** Parses `event.log` file, extracts relevant fields, and pushes logs to Loki.
- **Loki:** Aggregates and stores logs.
- **Grafana:** Visualizes logs with predefined panels (e.g., Events Stats, Topology Changes, Hardware Events).

## Configuration Files

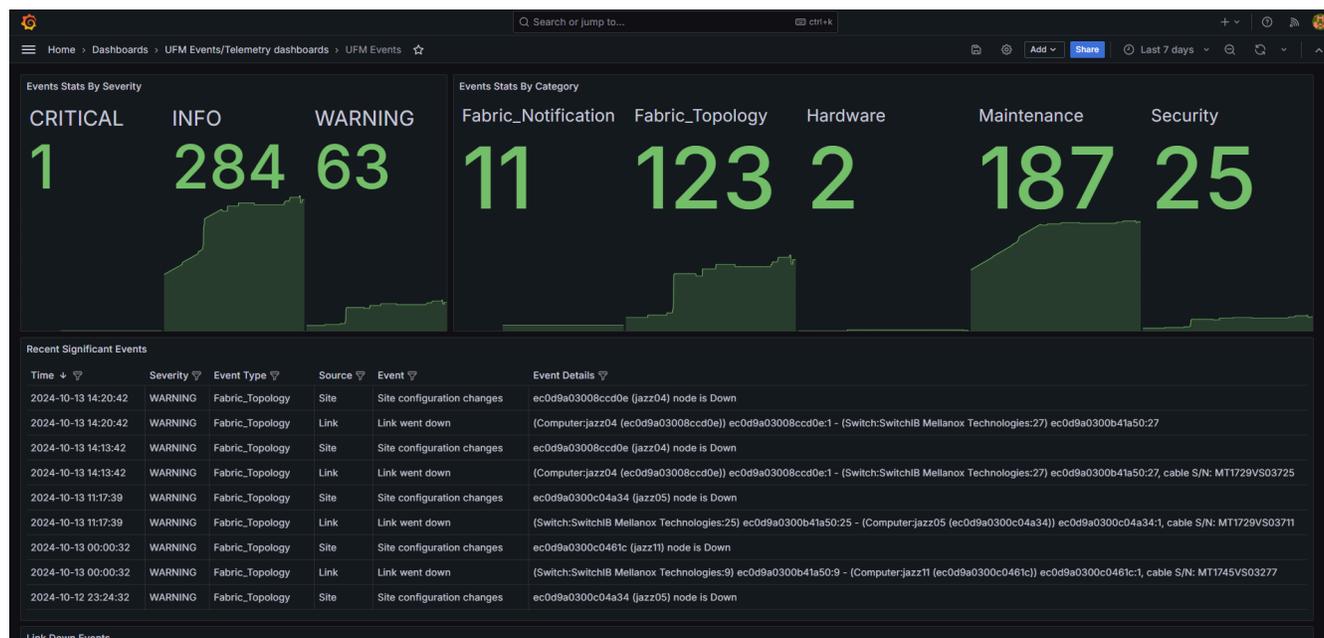
- Fluentd:  
`/opt/ufm/files/conf/plugins/ufm_events_grafana_dashboard/fluentd/`
- Loki:  
`/opt/ufm/files/conf/plugins/ufm_events_grafana_dashboard/loki/loki-local-config.yaml`
- Grafana:  
`/opt/ufm/files/conf/plugins/ufm_events_grafana_dashboard/grafana/`

## Logs

Plugin logs are stored in `/opt/ufm/files/log/plugins/ufm_events_grafana_dashboard/`.

## Usage

Navigate to Grafana -> Dashboards -> UFM Events to view predefined panels or create custom queries under the Explore section.



---

# Troubleshooting

## Split-Brain Recovery in HA Installation

The split-brain problem is a DRBD synchronization issue (HA status shows `DUnknown` in the DRBD disk state), which occurs when both HA nodes are rebooted. For example, in cases of electricity shut-down. To recover, please follow the below steps:

- **Step 1:** Manually choose a node where data modifications will be discarded.

It is called the split-brain victim. Choose wisely; all modifications will be lost! When in doubt, run a backup of the victim's data before you continue.

When running a Pacemaker cluster, you can enable maintenance mode. If the split-brain victim is in the Primary role, bring down all applications using this resource. Now switch the victim to the Secondary role:

```
victim# drbdadm secondary ha_data
```

- **Step 2:** Disconnect the resource if it's in connection state **WFConnection**:

```
victim# drbdadm disconnect ha_data
```

- **Step 3:** Force discard of all modifications on the split-brain victim:

```
victim# drbdadm -- --discard-my-data connect ha_data
```

For DRBD 8.4.x:

```
victim# drbdadm connect --discard-my-data ha_data
```

- **Step 4:** Resync starts automatically if the survivor is in a WFConnection network state. If the split-brain survivor is still in a Standalone connection state, reconnect it:

```
survivor# drbdadm connect ha_data
```

Now the resynchronization from the survivor (SyncSource) to the victim (SyncTarget) starts immediately. There is no full sync initiated, but all modifications on the victim will be overwritten by the survivor's data, and modifications on the survivor will be applied to the victim.

## Performing Failover on Non-Master Node

The `ufm_ha_cluster` failover action fails with the following error: "Cannot perform failover on non-master node". To fix, follow the below action:

- **Step 1:** Verify that `/etc/hosts` file on both the master and standby UFM hosts contains the correct host names and IP addresses mapping.
- **Step 2:** If necessary, fix the mapping and retry the failover command.

## Restoring UFM Data Upon In-Service Upgrade Failure

### Note

These instructions apply in high availability scenario only.

In the event of an in-service upgrade failure, the previous version of UFM's data will be safeguarded as a backup in the `/opt/ufm/BACKUP` directory, formatted as `ufm_upgrade_backup_<prev_version>-<new_version<_<date>.zip`.

To restore the data on the unupgraded node, follow these steps:

1. Copy the backup file from the upgraded node to the unupgraded node using the following command:

```
scp /opt/ufm/BACKUP/ufm_upgrade_backup_<prev_version>-
<new_version<_<date>.zip
root@<unupgraded_node_ip>:/opt/ufm/BACKUP/
```

2. Perform a failover of UFM to the master node, which is mandatory for data mount migration (including '/opt/ufm/files') to the master node: On the Master node, execute:

```
ufm_ha_cluster takeover
```

3. Stop UFM on the unupgraded node:

```
ufm_ha_cluster stop
```

4. Restore UFM configuration files from the backup:

```
/opt/ufm/scripts/ufm_restore.sh -f
/opt/ufm/BACKUP/ufm_upgrade_backup_<prev_version>-
<new_version<_<date>.zip
```

5. Start UFM on the unupgraded node (Note: Only the upgraded node can function until the upgrade issue is resolved, and failovers will not work).

Now, the issue that caused the upgrade failure can be addressed. If the problem is resolved, you can attempt the in-service upgrade again by failing UFM over to the upgraded node.

Alternatively, if needed, you can revert the changes made by reinstalling the old UFM version on the upgraded node.

## High-Availability Monitoring and Troubleshooting

Refer to the [NVIDIA UFM High-Availability User Guide](#) for HA monitoring and troubleshooting.

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# Appendixes

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- [Appendix – Used Ports](#)
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## SM Configurations

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## Appendix – SM Default Files

The SM default files are located under the following paths:

- Default SM configuration file – /opt/ufm/files/conf/opensm/opensm.conf
- Default node name map file – /opt/ufm/files/conf/opensm/ib-node-name-map
- Default partition configuration file – /opt/ufm/files/conf/opensm/partitions.conf
- Default QOS policy configuration file – /opt/ufm/files/conf/opensm/qos-policy.conf
- Default prefix routes file – /opt/ufm/files/conf/opensm/prefix-routes.conf

## Appendix – UFM Subnet Manager Default Properties

The following table provides a comprehensive list of UFM SM default properties.

| Category       | Property      | Config File Attribute | Default            | Mode/<br>Field | Description                                         |
|----------------|---------------|-----------------------|--------------------|----------------|-----------------------------------------------------|
| <b>Generic</b> | Subnet Prefix | subnet_prefix         | 0xfe80000000000000 | RW             | Subnet prefix used on the subnet 0xfe80000000000000 |
|                | LMC           | lmc                   | 0                  | RW             | The LMC value used on the subnet: 0-7               |

| Category      | Property | Config File Attribute | Default                  | Mode/<br>Field | Description                                                                                                           |
|---------------|----------|-----------------------|--------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------|
|               |          |                       |                          |                | Changes to the LMC parameter require a UFM restart.                                                                   |
|               | SM LID   | master_sm_lid         | 0                        |                | Force specific LID for local SM when in MASTER state. Selected LID must match configured LMC. 0 disables the feature. |
| Security Keys | M_Key    | m_key                 | 0x0000000000000000<br>00 | RW             | M_Key value sent to all ports - used to qualify the set(PortInfo). <b>Not recommended</b>                             |

| Category | Property | Config File Attribute | Default                  | Mode/<br>Field | Description                                                                           |
|----------|----------|-----------------------|--------------------------|----------------|---------------------------------------------------------------------------------------|
|          |          | m_key_per_port        | FALSE                    | RW             | When enabled, OSM will generate unique M_Key for each HCA/RT R port and Switch port0. |
|          |          | m_key_lease_period    | 60                       | RW             | The lease period used for the M_Key on the subnet in [sec]                            |
|          |          | m_key_lookup          | TRUE                     | RW             | If FALSE, SM will not try to determine the m_key of unknown ports.                    |
|          | SM_Key   | sm_key                | 0x0000000000000000<br>01 | RO             | SM_Key value of the SM used                                                           |

| Category | Property    | Config File Attribute | Default                  | Mode/<br>Field | Description                                                                                                                                                      |
|----------|-------------|-----------------------|--------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |             |                       |                          |                | for SM authentication                                                                                                                                            |
|          | SA_Key      | sa_key                | 0x0000000000000000<br>01 | RO             | SM_Key value to qualify incoming SA queries as 'trusted'                                                                                                         |
|          | Key manager | key_mgr_seed          | 0x0000000000000000<br>00 | RW             | Parameter used by key manager for CC/VS key configuration. if 0, uses mkey as a key for CC and VS Classes. Otherwise, use this parameter as a seed for CC/VS key |

| Category | Property                         | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                               |
|----------|----------------------------------|-----------------------|---------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                                  |                       |         |                | generation.                                                                                                                                                                               |
|          | Congestion control security keys | cc_key_lease_period   | 60      | RW             | The lease period used for CC Keys in [sec]                                                                                                                                                |
|          |                                  | cc_key_protect_bit    | 1       | RW             | The protection level used for CC Keys. Supported values: 0: Protection is provided. However, CC managers are allowed to read the key by KeyInfo GET. 1: Protect subnet ports with CC key. |
|          | Vendor specific                  | vs_key_enable         | 0       | RW             | Enable Vendor                                                                                                                                                                             |

| Category | Property           | Config File Attribute  | Default | Mode/<br>Field | Description                                                                                                                                                                         |
|----------|--------------------|------------------------|---------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | MADs security keys |                        |         |                | Specific Key Configuration. If enabled, VS keys are configured using a seed indicated by key_mgr_seed. Supported values:<br>0: Ignore VSKey<br>1: Disable VSKey<br>2: Enable VSKey# |
|          |                    | vs_key_lease_period    | 60      | RW             | The lease period used for VS keys in [sec]                                                                                                                                          |
|          |                    | vs_key_ci_protect_bits | 1       | RW             | The protection level used for VS                                                                                                                                                    |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                      |
|----------|----------|-----------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | <p>Keys. A mode defined by protect bit and protection scope. Supported values:</p> <p>0: Protection is provided. However, VS managers are allowed to read the key by KeyInfo GET.</p> <p>1: Protect subnet ports with VS key for both Informational and Configurational MADs</p> |

| Category | Property              | Config File Attribute | Default                                                 | Mode/<br>Field | Description                                                                                                                                                                  |
|----------|-----------------------|-----------------------|---------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | Partition enforcement | part_enforce          | both (default-outbound and inbound enforcement enabled) | RO             | Partition enforcement type (for switch ports)                                                                                                                                |
| Limits   | Packet Life Time      | packet_life_time      | 0x12                                                    | RW             | The maximum lifetime of a packet in a switch. The actual time is $4.096 \mu\text{s} * 2^{\langle \text{packet\_life\_time} \rangle}$ . The value 0x14 disables the mechanism |
|          | VL Stall Count        | vl_stall_count        | 0x07                                                    | RO             | The number of sequential packets dropped that cause the                                                                                                                      |

| Category | Property            | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                              |
|----------|---------------------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                     |                       |         |                | port to enter the VL Stalled state. The result of setting the count to zero is undefined.                                                                                |
|          | Leaf VL Stall Count | leaf_vl_stall_count   | 0x07    | RO             | The number of sequential packets dropped that causes the port to enter the leaf VL Stalled state. The count is for switch ports driving a CA or gateway port. The result |

| Category | Property                     | Config File Attribute       | Default | Mode/<br>Field | Description                                                                                                                                                                                            |
|----------|------------------------------|-----------------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                              |                             |         |                | of setting the count to zero is undefined.                                                                                                                                                             |
|          | Head Of Queue Life time      | head_of_queue_lifetime      | 0x12    | RW             | The maximum time a packet can wait at the head of the transmission queue. The actual time is $4.096\mu s \times 2^{\langle head\_of\_queue\_lifetime \rangle}$ . The value 0x14 disables the mechanism |
|          | Leaf Head Of Queue Life time | leaf_head_of_queue_lifetime | 0x10    | RW             | The maximum time a                                                                                                                                                                                     |

| Category | Property                  | Config File Attribute      | Default       | Mode/<br>Field | Description                                                                              |
|----------|---------------------------|----------------------------|---------------|----------------|------------------------------------------------------------------------------------------|
|          |                           |                            |               |                | packet can wait at the head of queue on a switch port connected to a CA or gateway port. |
|          | Local PHY Error Threshold | local_phy_errors_threshold | 0x08          | RW             | Threshold of local phy errors for sending Trap 129                                       |
|          | Overrun Errors Threshold  | overrun_errors_threshold   | 0x08          | RW             | Threshold of credit overrun errors for sending Trap 130                                  |
|          | Subnet Timeout            | subnet_timeout             | 18 (1 second) | RW             | The Infiniband subnet_timeout that will be set for                                       |

| Category   | Property            | Config File Attribute   | Default               | Mode/<br>Field | Description                                                                                                             |
|------------|---------------------|-------------------------|-----------------------|----------------|-------------------------------------------------------------------------------------------------------------------------|
|            |                     |                         |                       |                | all the ports. The actual timeout is $4.096 \mu\text{s} \times 2^{\text{subnet\_timeout}}$                              |
|            | VS MADs on the wire | vs_max_outstanding_mads | 500                   | RW             | Maximum number of vendor-specific mads in the network at once                                                           |
| Link Speed | Force Link Speed    | force_link_speed        | 15<br>(Do NOT change) | RW             | Force PortInfo: LinkSpeedEnabled on switch ports. If 0, do not modify. Values are:<br>1: 2.5 Gbps<br>3: 2.5 or 5.0 Gbps |

| Category | Property         | Config File Attribute | Default               | Mode/<br>Field | Description                                                                                                                 |
|----------|------------------|-----------------------|-----------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------|
|          |                  |                       |                       |                | 5: 2.5 or 10.0 Gbps<br>7: 2.5 or 5.0 or 10.0 Gbps<br>2,4,6,8-14 Reserved<br>15: set to PortInfo: LinkSpeedSupported         |
|          | Force Link Speed | force_link_speed_ext  | 31<br>(Do NOT change) | RW             | 1: 14.0625 Gbps<br>2: 25.78125 Gbps<br>3: 14.0625 Gbps or 25.78125 Gbps<br>4: 53.125 Gbps<br>5: 14.0625 Gbps or 53.125 Gbps |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                                                                                                               |
|----------|----------|-----------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | 6:<br>25.781<br>25<br>Gbps or<br>53.125<br>Gbps<br>7:<br>14.062<br>5 Gbps,<br>25.781<br>25<br>Gbps or<br>53.125<br>Gbps<br>8:<br>106.25<br>Gbps<br>9:<br>14.062<br>5 Gbps<br>or<br>106.25<br>Gbps<br>10:<br>106.25<br>Gbps or<br>25.781<br>25<br>Gbps or<br>106.25<br>Gbps<br>11:<br>14.062<br>5 Gbps<br>or<br>25.781<br>25<br>Gbps or<br>106.25<br>Gbps<br>12:<br>53.125 |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                                                                                                                                |
|----------|----------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | Gbps or<br>106.25<br>Gbps<br>13:<br>14.062<br>5 Gbps<br>or<br>53.125<br>Gbps or<br>106.25<br>Gbps<br>14:<br>25.781<br>25<br>Gbps or<br>53.125<br>Gbps or<br>106.25<br>Gbps<br>15:<br>14.062<br>5 Gbps,<br>25.781<br>25<br>Gbps or<br>53.125<br>Gbps or<br>106.25<br>Gbps<br>30:<br>Disable<br>extend<br>ed link<br>speeds<br>#<br>Default<br>31: set<br>to<br>PortIn<br>fo:LinkS<br>peedEx |

| Category     | Property                      | Config File Attribute | Default              | Mode/<br>Field | Description                                                                         |
|--------------|-------------------------------|-----------------------|----------------------|----------------|-------------------------------------------------------------------------------------|
|              |                               |                       |                      |                | tSupported                                                                          |
|              | Force Link Speed              | force_link_speed_ext2 | 7<br>(Do NOT change) | RW             | 1:<br>212.50<br>Gbps<br>Default<br>7: set<br>to<br>PortInfo:LinkSpeedExtSupported2  |
| SM Threading | SMP<br>MAD/Trap<br>processing | smp_threads           | 0                    | RW             | Number of threads to be used for processing SMPs, 0 stands for all available cores. |
|              | SA/GMP<br>MAD<br>processing   | gmp_threads           | 0                    | RW             | Number of threads to be used for processing GMPs, 0 stands for all available cores. |

| Category | Property                 | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                        |
|----------|--------------------------|-----------------------|---------|----------------|------------------------------------------------------------------------------------------------------------------------------------|
|          | SA/GMP Trap processing   | gmp_traps_threads_num | 1       | RW             | Number of threads to be used for processing key violation trap made by VS and CC managers                                          |
|          | Routing Threads          | routing_threads_num   | 0       | RW             | Number of threads to be used for parallel minhop/updn calculations. If 0, number of threads will be equal to number of processors. |
|          | Routing Threads Per Core | max_threads_per_core  | 0       | RW             | Max number of threads                                                                                                              |

| Category | Property       | Config File Attribute | Default          | Mode/<br>Field | Description                                                                                                                                                     |
|----------|----------------|-----------------------|------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                |                       |                  |                | that are allowed to run on the same process or during parallel computing. If 0, threads assignment per process or is up to operating system initial assignment. |
| Sweep    | Sweep Interval | sweep_interval        | 10               | RW             | The time in seconds between subnet sweeps (Disabled if 0)                                                                                                       |
|          | Reassign Lids  | reassign_lids         | FALSE (disabled) | RW             | If TRUE (enabled), all LIDs are                                                                                                                                 |

| Category | Property                      | Config File Attribute    | Default        | Mode/<br>Field | Description                                                                                                        |
|----------|-------------------------------|--------------------------|----------------|----------------|--------------------------------------------------------------------------------------------------------------------|
|          |                               |                          |                |                | reassigned For debug only.                                                                                         |
|          | Force Heavy Sweep             | force_heavy_sweep_window | -1             | RW             | Forces heavy sweep after number of light sweeps (-1 disables this option and 0 will cause every sweep to be heavy) |
|          | Sweep On trap                 | sweep_on_trap            | TRUE (enabled) | RW             | If TRUE every trap 128 and 144 will cause a heavy sweep                                                            |
|          | Alternative Route Calculation | max_alt_dr_path_retries  | 0              | RW             | Maximum number of attempts to find an alternative                                                                  |

| Category | Property                    | Config File Attribute      | Default | Mode/<br>Field | Description                                                                  |
|----------|-----------------------------|----------------------------|---------|----------------|------------------------------------------------------------------------------|
|          |                             |                            |         |                | direct route towards unresponsive ports                                      |
|          | Fabric Rediscovery          | max_seq_redisc             | 2       | RW             | Max Failed Sequential Discovery Loops                                        |
|          | Offsweep Rebalancing Enable | offsweep_balancing_enabled | FALSE   | RW             | Enable/Disable idle time routing rebalancing (deprecated)                    |
|          | Offsweep Rebalancing Window | offsweep_balancing_window  | 180     | RW             | Set the time window in seconds after sweep to start rebalancing (deprecated) |
| Handover | SM Priority                 | sm_priority                | 15      | RO             | SM (enabled). The priority used                                              |

| Category | Property         | Config File Attribute  | Default          | Mode/<br>Field | Description                                                                    |
|----------|------------------|------------------------|------------------|----------------|--------------------------------------------------------------------------------|
|          |                  |                        |                  |                | for deciding which is the master. Range is 0 (lowest priority) to 15 (highest) |
|          | Ignore Other SMs | ignore_other_sm        | FALSE (disabled) | RO             | If TRUE other SMs on the subnet should be ignored                              |
|          | Polling Timeout  | sminfo_polling_timeout | 10               | RO             | Timeout in seconds between two active master SM polls                          |
|          | Polling Retries  | polling_retry_number   | 4                | RO             | Number of failing remote SM polls that declares it non-                        |

| Category | Property               | Config File Attribute | Default              | Mode/<br>Field | Description                                                                                                                            |
|----------|------------------------|-----------------------|----------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
|          |                        |                       |                      |                | operational                                                                                                                            |
|          | Honor GUID-to-LID File | honor_guid2lid_file   | FALSE<br>(disabled)  | RO             | If TRUE, honor the guid2lid file when coming out of standby state, if the guid2lid file exists and is valid (not applicable to UFM SM) |
|          | Allowed SM GUID list   | allowed_sm_guids      | (null)<br>(disabled) | RW             | Comma-separated list of Host GUIDs where SM is allowed to run when specified. OpenSM ignores SM running                                |

| Category     | Property      | Config File Attribute | Default | Mode/<br>Field | Description                                                                                            |
|--------------|---------------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------|
|              |               |                       |         |                | on port that is not in this list. If 0, does not allow any other SM. If null, the feature is disabled. |
| MAD handling | Max Wire SMPs | max_wire_smps         | 32      | RW             | Maximum number of SMPs sent in parallel                                                                |
|              |               | max_wire_smps2        | 32      | RW             | Maximum number of timeout-based SMPs allowed to be outstanding. A value less than or equal to max_wi   |

| Category | Property | Config File Attribute    | Default | Mode/<br>Field | Description                                                                                                                                                                                         |
|----------|----------|--------------------------|---------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                          |         |                | re_smps disables this mechanism                                                                                                                                                                     |
|          |          | max_wire_smps_per_device | 2       | RW             | Maximum number of SMPs sent in parallel to the same port. Currently, the supported MADs are: portInfo/Extended portInfo, LFTs, AR LFTs, AR group table, AR copy group table, RN subgroup direction, |

| Category | Property            | Config File Attribute    | Default | Mode/<br>Field | Description                                                                                                                       |
|----------|---------------------|--------------------------|---------|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
|          |                     |                          |         |                | SLVL table, VL Arbitration                                                                                                        |
|          | Transaction Timeout | transaction_timeout      | 200     | RO             | The maximum time in [msec] allowed for a SMP Get/Set MAD sending transaction to complete                                          |
|          | Transaction Timeout | long_transaction_timeout | 1000    | RO             | The maximum time in [msec] allowed for a "long" transaction to complete. Currently, long transactions are only used for optimized |

| Category | Property                 | Config File Attribute | Default | Mode/<br>Field | Description                                                                                 |
|----------|--------------------------|-----------------------|---------|----------------|---------------------------------------------------------------------------------------------|
|          |                          |                       |         |                | SL2VL Mapping Table and PortInfo for port 0 MADs                                            |
|          | Transaction Retries      | transaction_retries   | 3       | RO             | The maximum number of retries allowed for a SMP Get/Set MAD sending transaction to complete |
|          | Max Message FIFO Timeout | max_msg_fifo_timeout  | 10000   | RW             | Maximum time in [msec] a message can stay in the incoming message queue                     |
|          | Max Message FIFO Length  | max_msg_fifo_len      | 20000   | RW             | Maximum number of                                                                           |

| Category | Property        | Config File Attribute | Default                       | Mode/<br>Field | Description                                                                                                |
|----------|-----------------|-----------------------|-------------------------------|----------------|------------------------------------------------------------------------------------------------------------|
|          |                 |                       |                               |                | messages that can reside in the incoming message queue, before dropping SubnAdmGet/SubnAdmGetTbl requests. |
| Logging  | Log File        | log_file              | /opt/ufm/files/log/opensm.log | RO             | Path of Log file to be used                                                                                |
|          | Log Flags       | log_flags             | Error and Info<br>0x03        | RW             | The log flags, or debug level being used.                                                                  |
|          | Force Log Flush | force_log_flush       | FALSE<br>(disabled)           | RO             | Force flush of the log file after each log message                                                         |

| Category | Property             | Config File Attribute | Default            | Mode/<br>Field | Description                                                                                                      |
|----------|----------------------|-----------------------|--------------------|----------------|------------------------------------------------------------------------------------------------------------------|
|          | Log Max Size         | log_max_size          | 4096               | RW             | Limit the size of the log file in MB. If overrun, log is restarted                                               |
|          | Accumulate Log File  | accum_log_file        | TRUE (enabled)     | RO             | If TRUE, will accumulate the log over multiple OpenSM sessions                                                   |
|          | Dump Files Directory | dump_files_dir        | /opt/ufm/files/log | RO             | The directory to hold the file SM dumps (for multicast forwarding tables for example). The file is used collects |

| Category | Property              | Config File Attribute | Default          | Mode/<br>Field | Description                                                            |
|----------|-----------------------|-----------------------|------------------|----------------|------------------------------------------------------------------------|
|          |                       |                       |                  |                | information.                                                           |
|          | Syslog log            | syslog_log            | 0x0              | RW             | Sets a verbosity of messages to be printed in syslog                   |
|          | Dump tables           | dump_ar               | FALSE            |                | Enable adaptive routing data dump to file.                             |
| Misc     | Node Names Map File   | node_name_map_name    | (null)           | RW             | Node name map for mapping node's to more descriptive node descriptions |
|          | SA database File      | sa_db_file            | (null)           | RO             | SA database file name                                                  |
|          | Client Reregistration | no_clients_rereg      | FALSE (disabled) | RO             | If TRUE, disables client reregistration                                |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                 |
|----------|----------|-----------------------|---------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | (Depreciated)                                                                                                                                                                                                                                               |
|          |          | client_rereg_mode     | 2       | RO             | Control parameter for sending client reregistration options. 0 - Sending client reregistration disabled. This option is kept for backward compatibility. Not recommended for use. 1 - Send client reregistration during LID assignment. This option is kept |

| Category | Property                    | Config File Attribute | Default        | Mode/<br>Field | Description                                                                                                    |
|----------|-----------------------------|-----------------------|----------------|----------------|----------------------------------------------------------------------------------------------------------------|
|          |                             |                       |                |                | for backward compatibility. Not recommended for use.<br>2 - Send Client reregistration during link activation. |
|          | Exit On Fatal Event         | exit_on_fatal         | TRUE (enabled) | RO             | If TRUE (enabled), the SM exits for fatal initialization issues                                                |
|          | Enable NVIDIA SHARP support | sharp_enabled         | 2              | RW             | SHArP support<br>0: Ignore SHArP - No SHArP support<br>1: Disable SHArP - Disable                              |

| Category  | Property                   | Config File Attribute | Default          | Mode/<br>Field | Description                                                                                   |
|-----------|----------------------------|-----------------------|------------------|----------------|-----------------------------------------------------------------------------------------------|
|           |                            |                       |                  |                | SHArP on all supporting switches<br>2: Enable SHArP - Enable SHArP on all supporting switches |
| Multicast | Disable Multicast          | disable_multicast     | FALSE (disabled) | RO             | If TRUE, OpenS M should disable multicast support and no multicast routing is performed       |
|           | Multicast Group Parameters | default_mcg_mtu       | 0                | RW             | Default MC group MTU for dynamic group creation. 0 disable                                    |

| Category | Property                            | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                |
|----------|-------------------------------------|-----------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------|
|          |                                     |                       |         |                | s this feature, otherwise, the value is a valid IB encoded MTU                                                             |
|          | Multicast Group Parameters          | default_mcg_rate      | 0       | RW             | Default MC group rate for dynamic group creation. 0 disables this feature, otherwise, the value is a valid IB encoded rate |
|          | MC root file                        | mc_roots_file         | (null)  | RW             | Specify predefined MC groups root guides                                                                                   |
|          | Incremental Multicast Routing (IMR) | enable_inc_mc_routing | TRUE    | RW             | If TRUE, MC nodes will be added to the MC tree                                                                             |

| Category | Property | Config File Attribute                                                                                                                                                                                                                                                                                                                                             | Default | Mode/<br>Field | Description                                                                                                       |
|----------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------|-------------------------------------------------------------------------------------------------------------------|
|          |          |                                                                                                                                                                                                                                                                                                                                                                   |         |                | incrementally. When set to FALSE, the tree will be recalculated per each change.                                  |
| QoS      | Settings | qos                                                                                                                                                                                                                                                                                                                                                               | TRUE    | RW             | If TRUE (enabled), SM will apply QoS settings                                                                     |
|          | Settings | # QoS default options<br>qos_max_vls 4<br>qos_high_limit 0<br>qos_vlarb_high 0:0<br>qos_vlarb_low 0:160,1:112<br>qos_sl2vl 0,1,1,1,1,1,1,1,15,15,15,15,15,15,15<br># QoS CA options<br>qos_ca_max_vls 0<br>qos_ca_high_limit -1<br>qos_ca_vlarb_high (null)<br>qos_ca_vlarb_low (null)<br>qos_ca_sl2vl (null)<br># QoS Switch Port 0 options<br>qos_sw0_max_vls 0 |         | RW             | Recommended SL2VL and VL arbitration settings when qos flag is set to TRUE. No UFM restart is needed upon update. |

| Category | Property | Config File Attribute                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Default | Mode/<br>Field | Description |
|----------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------|-------------|
|          |          | qos_sw0_high_limit<br>-1<br>qos_sw0_vlarb_high<br>(null)<br>qos_sw0_vlarb_low<br>(null)<br>qos_sw0_sl2vl (null)<br># QoS Switch<br>external ports<br>options<br>qos_swe_max_vls 0<br>qos_swe_high_limit<br>-1<br>qos_swe_vlarb_high<br>(null)<br>qos_swe_vlarb_low<br>(null)<br>qos_swe_sl2vl (null)<br># QoS Switch-to-<br>switch external port<br>options<br>qos_sw2sw_max_vls<br>0<br>qos_sw2sw_high_li<br>mit -1<br>qos_sw2sw_vlarb_hi<br>gh (null)<br>qos_sw2sw_vlarb_lo<br>w (null)<br>qos_sw2sw_sl2vl<br>(null)<br># QoS Router ports<br>options<br>qos_rtr_max_vls 0<br>qos_rtr_high_limit<br>-1<br>qos_rtr_vlarb_high<br>(null)<br>qos_rtr_vlarb_low<br>(null)<br>qos_rtr_sl2vl (null) |         |                |             |

| Category        | Property                 | Config File Attribute       | Default                                    | Mode/<br>Field | Description                                                                                                                           |
|-----------------|--------------------------|-----------------------------|--------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                 | Maximal Operational VL   | max_op_vls                  | 2                                          | RW             | Limit of the maximum operational VLs<br><b>Note, SM will flap all fabric links to deploy the configuration upon parameter change.</b> |
|                 | QoS Policy               | qos_policy_file             | /opt/ufm/files/conf/opensm/qos-policy.conf | RW             | QoS policy file to be used                                                                                                            |
| Unhealthy Ports | Enabling Unhealthy Ports | hm_unhealthy_ports_checks   | TRUE                                       | RW             | Enables Unhealthy Ports configuration                                                                                                 |
|                 | Configuration file       | hm_ports_health_policy_file | (null)                                     | RW             | Specifies configuration file for health policy                                                                                        |
|                 | Unhealthy actions        | hm_sw_manual_action         | no_discover                                | RW             | Specifies what to do                                                                                                                  |

| Category | Property               | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                 |
|----------|------------------------|-----------------------|---------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                        |                       |         |                | with switch ports which were manually added to health policy file                                                                                                           |
|          | MADs validation        | validate_smp          | TRUE    | RW             | If set to TRUE, opens m will ignore nodes sending non-spec compliant MADs. When set to FALSE, opens m will log the warning in the opens m log file about non-compliant node |
| Routing  | Unicast Routing Engine | routing_engine        | ar_updn | RW             | By default, ar_updn                                                                                                                                                         |

| Category | Property        | Config File Attribute | Default                                   | Mode/<br>Field | Description                                                                                                                                                                |
|----------|-----------------|-----------------------|-------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                 |                       |                                           |                | n routing engine is used by the SM. Supported routing engines are minhop, updn, dnup, ftree, dor, torus-2QoS, kdor-hc, kdor-ghc , dfp, dfp2, ar_updn, ar_ftree and ar_dor. |
|          | Root GUIDs file | root_guid_file        | /opt/ufm/files/conf/opensm/root_guid.conf | RW             | The file holds the root node GUIDs of the topology. Single GUID or port group                                                                                              |

| Category | Property                | Config File Attribute | Default | Mode/<br>Field | Description                                                                                 |
|----------|-------------------------|-----------------------|---------|----------------|---------------------------------------------------------------------------------------------|
|          |                         |                       |         |                | in each line. Feature supported by updn, ar_updn, ftree, ar_ftree and dfp2 routing engines. |
|          | Unicast Routing Caching | use_ucast_cache       | TRUE    | RW             | Use unicast routing cache for routing computation time improvement                          |
|          | Adaptive routing        | ar_sl_mask            | 0xFFFF  | RW             | AR SL mask - 16-bit bitmask indicating which SLs should be configured for AR                |

| Category | Property | Config File Attribute   | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                     |
|----------|----------|-------------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          | enable_ar_by_device_cap | TRUE    | RO             | Enable adaptive routing only to devices that support packet reordering. When enabled, state in ARLFT entries for devices which do not support packet reordering is set to static. When disabled, ARLFT entries remain as determined by the routing engine. Changing the default |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                      |
|----------|----------|-----------------------|---------|----------------|------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | value is not recommended.                                                                                        |
|          |          | enable_ar_group_copy  | TRUE    | RO             | Enable adaptive routing group copy optimization. Changing the default value is not recommended.                  |
|          |          | ar_mode               | 3       | RO             | Adaptive routing mode Supported values: 0 - Adaptive routing disabled. 1 - Enable local adaptive routing (switch |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                            |
|----------|----------|-----------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | <p>es select exit port based on local buffer utilization).</p> <p>2 - Enable adaptive routing with notifications (deprecated).</p> <p>3 - Auto mode in which adaptive routing is determined by the routing engine. (default)</p> <p>Changing the default value is not recommended.</p> |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                     |
|----------|----------|-----------------------|---------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          | ar_transport_mask     | 0x000A  | RW             | AR Transport mask - indicates which transport types are enabled for AR. Bit 0 = UD, Bit 1 = RC, Bit 2 = UC, Bit 3 = DCT, Bits 4-7 are reserved. |
|          |          | cache_ar_group_id     | TRUE    | RW             | Load GUID to AR group ID from cache file. When enabled, it can reduce AR group configuration changes after restart.                             |

| Category | Property                                       | Config File Attribute             | Default | Mode/<br>Field | Description                                                                                                                                                                                                |
|----------|------------------------------------------------|-----------------------------------|---------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | Adaptive Routing in Asymmetric Tree topologies | ar_tree_asymmetric_flow           | 1       | RW             | AR Asymmetric trees max flow algorithm Supported values: 0 - Disable the algorithm. 1 - Enable with 1 subgroup support. 2 - Enable with 2 subgroups on leaf switches. 3 - Enable asymmetric tree algorithm |
|          |                                                | ar_tree_asymmetric_flow_threshold | 0       | RW             | In use if ar_tree_asym                                                                                                                                                                                     |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                          |
|----------|----------|-----------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | <p>metric_flow is set to 3. Threshold (percent) of BW drop between spine and core links before excluding spines. If a spine's spine to core BW percent drops below the threshold due to link failures that spine will be eligible for removal from the AR group.</p> |

| Category | Property | Config File Attribute             | Default | Mode/<br>Field | Description                                                                                                                                                                                       |
|----------|----------|-----------------------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                                   |         |                | <p>Example:<br/> ar_tree_asymmetric_flow_threshold 34<br/> If spine has 32 links toward the core, then it would need to have 11 links removed before excluding the switch (34% of 32 = 10.88)</p> |
|          |          | ar_tree_asymmetric_flow_threshold | 2       | RW             | <p>Threshold limit of nodes to exclude<br/> If the number of eligible spines to be excluded, (as</p>                                                                                              |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                         |
|----------|----------|-----------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | determined by the ar_tree_asymmetric_flow_threshold parameter) is higher than this limit, no spines will be removed. Changing the default value is not recommended. |
|          |          | routing_flags         | 0x0     | RO             | Bit mask of flags to control various options and behavior of routing engines.<br>Supported values:                                                                  |

| Category | Property    | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                  |
|----------|-------------|-----------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |             |                       |         |                | 0x1 - Enable switch rank adjustments for tree based routing engines .                                                                                                                        |
|          | SHIELD/PFRN | shield_mode           | 3       | RO             | Advanced routing - Fast link fault recovery feature<br>The feature is required for traffic resiliency upon switch-to-switch link failures. Supported values:<br>0 - Fast link fault recovery |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                                                  |
|----------|----------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | <p>disabled.</p> <p>1 - Enable local fast link fault recovery only.</p> <p>2 - Enable legacy fast link fault recovery with notifications (deprecated)</p> <p>3 - Auto mode in which enhanced fast link fault recovery support is determined by the routing engine. (default)</p> <p>ar_updn,<br/>ar_ftre</p> |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                     |
|----------|----------|-----------------------|---------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | <p>e and dfp2 will enable enhanced fast link fault recovery in the switches. Otherwise, local fast link fault recovery only will be enabled in the switches. Changing the default value is not recommended.</p> |
|          |          | pfrn_sl               | 4       | RW             | <p>SL for pFRN communication between switches.<br/><b>Make sure pfrn_sl</b></p>                                                                                                                                 |

| Category | Property | Config File Attribute         | Default | Mode/<br>Field | Description                                                                                                                                  |
|----------|----------|-------------------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                               |         |                | <b>is properly mapped in sl2vl qos settings</b>                                                                                              |
|          |          | pfrn_mask_clear_timeout       | 180     | RW             | Time (in seconds) since last pFRN for a specific subgroup was received, after which the entire mask must be cleared. Multiple of 60 seconds. |
|          |          | pfrn_mask_force_clear_timeout | 720     | RW             | Maximal time (in seconds) since last mask clear, after which                                                                                 |

| Category | Property           | Config File Attribute    | Default | Mode/<br>Field | Description                                                                                                                                                  |
|----------|--------------------|--------------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                    |                          |         |                | mask must be cleared. Multiple of 240 seconds                                                                                                                |
|          |                    | pfrn_over_router_enabled | 2       | RW             | Enable pFRN over routers 0: Ignore - Do not change pFRN configuration on routers 1: Disable - Disable pFRN over routers 2: Enable - Enable pFRN over routers |
|          | Held back switches | held_back_sw_file        | (null)  | RW             | The file holding the node GUIDs list to                                                                                                                      |

| Category | Property                     | Config File Attribute   | Default                                   | Mode/<br>Field | Description                                                                    |
|----------|------------------------------|-------------------------|-------------------------------------------|----------------|--------------------------------------------------------------------------------|
|          |                              |                         |                                           |                | held back from routing                                                         |
|          | GUID Ordering During Routing | guid_routing_order_file | (null)                                    | RW             | The file holding guid routing order of particular guides (for MinHop, Up/Down) |
|          | Torus Routing                | torus_config            | /opt/ufm/files/conf/opensm/torus-2QoS.con | RW             | Torus-2QoS configuration file name                                             |
|          | Routing Chains               | pgrp_policy_file        | (null)                                    | RW             | The file holding the port groups policy                                        |
|          |                              | topo_policy_file        | (null)                                    | RW             | The file holding the topology policy                                           |
|          |                              | rch_policy_file         | (null)                                    | RW             | The file holding the routing                                                   |

| Category | Property              | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                              |
|----------|-----------------------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------|
|          |                       |                       |         |                | chains policy                                                                                                            |
|          |                       | max_topologies_per_sw | 4       | RO             | Defines maximum number of topologies to which a single switch may be assigned during routing engine chain configuration. |
|          | Hash based Forwarding | hbf_sl_mask           | 0xFFFF  | RW             | HBF (Hash-Based Forwarding) SL mask - 16-bit bitmask indicating which SLs should be configured for HBF                   |

| Category | Property | Config File Attribute | Default    | Mode/<br>Field | Description                                                                                                        |
|----------|----------|-----------------------|------------|----------------|--------------------------------------------------------------------------------------------------------------------|
|          |          | hbf_hash_type         | 0          | RW             | HBF (Hash-Based Forwarding) hash type: 0 - CRC, 1 - XOR<br>Changing the value is not recommended.                  |
|          |          | hbf_seed_typ          | 0          | RW             | HBF (Hash-Based Forwarding) hash seed type: 0 - Configurable, 1 - Random<br>Changing the value is not recommended. |
|          |          | hbf_seed              | 0xFFFFFFFF | RW             | HBF (Hash-Based Forwarding)                                                                                        |

| Category | Property | Config File Attribute | Default                | Mode/<br>Field | Description                                                                                                                                                                                                                                 |
|----------|----------|-----------------------|------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |                        |                | ding)<br>hash<br>seed.<br>Values<br>0 -<br>0xFFFF<br>FFFF<br>0xFFFF<br>FFFF<br>stands<br>for<br>taking<br>the 32<br>LSB of<br>the<br>node<br>GUID as<br>HBF<br>hash<br>seed.<br>Changi<br>ng the<br>value is<br>not<br>recom<br>mende<br>d. |
|          |          | hbf_hash_fields       | 0x0000000040F00C<br>0F | RW             | HBF<br>(Hash-<br>Based<br>Forward<br>ing)<br>hash<br>fields -<br>64-bit<br>bitmas<br>k<br>indicati<br>ng<br>the<br>fields<br>that                                                                                                           |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                                                                                               |
|----------|----------|-----------------------|---------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | affect hash calculation.<br>Bit 1: DLID<br>Bit 2: SL<br>Bit 3: VL<br>Bit 4: LRH<br>LNH<br>GRH fields:<br>Bit 10: SGID<br>Bit 11: DGID<br>Layer4 fields:<br>Bit 20: BTH destination QP<br>Bit 21: DETH source QP<br>Bit 22: DCETH V1 source QP<br>Bit 23: DCETH V1 ISID<br>Bit 30: Input port Changing the |

| Category | Property | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                                                                    |
|----------|----------|-----------------------|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |          |                       |         |                | value is not recommended.                                                                                                                                                                                                      |
|          |          | hbf_weights           | auto    | RW             | Weighted Hash-Based Forwarding (WHBF) configures the ratio between three subgroups of the Adaptive Routing (AR) Group. format is a tuple of three integers in a range 0 to 0xffff: <subgroup 0 weight >, <subgroup 1 weight >. |

| Category | Property      | Config File Attribute | Default | Mode/<br>Field | Description                                                                                                                                                                              |
|----------|---------------|-----------------------|---------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |               |                       |         |                | <subgroup 2 weight ><br>Changing the value is not recommended.                                                                                                                           |
|          | Randomization | scatter_ports         | 8       | RW             | Assigns ports in a random order instead of round-robin. If 0, the feature is disabled, otherwise use the value as a random seed. Applicable to the AR_MIN_HOP/AR_UPDN routing algorithms |

| Category | Property                    | Config File Attribute         | Default | Mode/<br>Field | Description                                                                                  |
|----------|-----------------------------|-------------------------------|---------|----------------|----------------------------------------------------------------------------------------------|
|          |                             | guid_routing_order_no_scatter | TRUE    | RO             | Do not use scatter for ports defined in guid_routing_order file                              |
|          |                             | use_scatter_for_switch_lid    | FALSE   | RW             | Use scatter when routing to the switch's LIDs                                                |
|          | updn lid tracking mode      | updn_lid_tracking_mode        | FALSE   | RW             | Controls whether SM will use LID tracking or not when updn or ar_updn routing engine is used |
| Events   | Event Subscription Handling | drop_subscr_on_report_fail    | TRUE    | RW             | Drop subscription on report failure (o13-17.2.1)                                             |

| Category       | Property               | Config File Attribute                | Default | Mode/<br>Field | Description                                                                                      |
|----------------|------------------------|--------------------------------------|---------|----------------|--------------------------------------------------------------------------------------------------|
|                |                        | drop_event_subscriptions             | TRUE    | RW             | Drop event subscriptions (Info and Service Records) on port removal and SM coming out of STANDBY |
|                |                        | drop_unreachable_event_subscriptions | TRUE    | RW             | Drop event subscriptions (Info and Service Record) on ports that have no routing to SM           |
| Virtualization | Virtualization enabled | virt_enabled                         | 2       | RW             | Virtualization support 0: Ignore Virtualization - No virtualization support                      |

| Category | Property                                         | Config File Attribute         | Default      | Mode/<br>Field | Description                                                                                                                                        |
|----------|--------------------------------------------------|-------------------------------|--------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                                                  |                               |              |                | 1:<br>Disable<br>Virtuali-<br>zation -<br>Disable<br>virtualiz-<br>ation<br>2:<br>Enable<br>Virtuali-<br>zation -<br>Enable<br>virtualiz-<br>ation |
|          | Maximum<br>ports in<br>virtualization<br>process | virt_max_ports_in_p<br>rocess | 64           | RW             | Sets a<br>number<br>of<br>ports<br>to be<br>handle<br>d on<br>each<br>virtualiz-<br>ation<br>process<br>cycle                                      |
| Router   | Router aguid<br>enable                           | rtr_aguid_enable              | 0 (Disabled) | RW             | Defines<br>whethe<br>r the<br>SM<br>should<br>create<br>alias<br>GUIDs<br>require<br>d for<br>router<br>support<br>for<br>each                     |

| Category | Property                      | Config File Attribute | Default                | Mode/<br>Field | Description                                                          |
|----------|-------------------------------|-----------------------|------------------------|----------------|----------------------------------------------------------------------|
|          |                               |                       |                        |                | HCA port                                                             |
|          | Router path record flow label | rtr_pr_flow_label     | 0                      | RW             | Defines flow label value to use in multi-subnet path query responses |
|          | Router path record tclass     | rtr_pr_tclass         | 0                      | RW             | Defines tclass value to use in multi-subnet path query responses.    |
|          | Router path record sl         | rtr_pr_sl             | 0                      | RW             | Defines sl value to use in multi-subnet path query responses         |
|          | Router path record MTU        | rtr_pr_mtu            | 4<br>(IB_MTU_LEN_2048) | RW             | Define MTU value to use in multi-subnet path                         |

| Category    | Property                        | Config File Attribute               | Default                             | Mode/<br>Field | Description                                                            |
|-------------|---------------------------------|-------------------------------------|-------------------------------------|----------------|------------------------------------------------------------------------|
|             |                                 |                                     |                                     |                | query responses                                                        |
|             | Router path record rate         | rtr_pr_rate                         | 16<br>(IB_PATH_RECORD_RATE_100_GBS) | RW             | Defines rate value to use in multi-subnet path query responses         |
| SA Security | SA Enhanced Trust Model (SAETM) | sa_enhanced_trust_model             | FALSE                               | RW             | Controls whether SAETM is enabled.                                     |
|             | Untrusted GuidInfo records      | sa_etm_allow_untrusted_guidinfo_rec | FALSE                               | RW             | Controls whether to allow Untrusted GuidInfo record requests in SAETM. |
|             | GuidInfo record requests by VF  | sa_etm_allow_guidinfo_rec_by_vf     | FALSE                               | RW             | Controls whether to allow                                              |

| Category | Property                       | Config File Attribute                 | Default | Mode/<br>Field | Description                                                           |
|----------|--------------------------------|---------------------------------------|---------|----------------|-----------------------------------------------------------------------|
|          |                                |                                       |         |                | Guidinfo record requests by vf in SAETM.                              |
|          | Untrusted proxy requests       | sa_etm_allow_untrusted_proxy_requests | FALSE   | RW             | Controls whether to allow Untrusted proxy requests in SAETM.          |
|          | Max number of multicast groups | sa_etm_max_num_mcgs                   | 128     | RW             | Max number of multicast groups per port/vport that can be registered. |
|          | Max number of service records  | sa_etm_max_num_srvcs                  | 32      | RW             | Max number of service records per port/vport that can be              |

| Category | Property                          | Config File Attribute     | Default | Mode/<br>Field | Description                                                                                                                            |
|----------|-----------------------------------|---------------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
|          |                                   |                           |         |                | registered.                                                                                                                            |
|          | Max number of event subscriptions | sa_etm_max_num_event_subs | 32      | RW             | Max number of event subscriptions (Info) per port/vport that can be registered.                                                        |
|          | SGID spoofing                     | sa_check_sgid_spoofing    | TRUE    | RW             | If enabled, the SA checks for SGID spoofing in every request with GRH included, unless the SLID is from a router port at that request. |
|          | Topo config                       | topo_config_file          | (null)  | RW             | The file holding the                                                                                                                   |

| Category            | Property       | Config File Attribute                          | Default | Mode/<br>Field                             | Description                                                                                                                   |
|---------------------|----------------|------------------------------------------------|---------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|                     |                |                                                |         |                                            | topo configuration.                                                                                                           |
|                     |                | topo_config_enabled                            | FALSE   | RW                                         | If set to true, the SM will adjust its operational mode to take into account the topo_config file (predefined topology file). |
|                     | Tenant Manager | tenants_policy_enabled                         | FALSE   | RW                                         | If set to true, the SM will enable the tenants manager                                                                        |
| tenants_policy_file |                | /opt/ufm/files/conf/opensm/tenants-policy.conf | RW      | The file holding the tenant configuration. |                                                                                                                               |
| Application         | Fabric profile | fabric_mode_profile                            | none    | RW                                         | Fabric Mode                                                                                                                   |

| Category           | Property           | Config File Attribute   | Default                                            | Mode/<br>Field | Description                                                                                                                                                                                          |
|--------------------|--------------------|-------------------------|----------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| performance        |                    |                         |                                                    |                | feature Indicates which profile from fabric mode policy file to use for better user application performance. If set to none, feature is disabled and SM will not change current device configuration |
|                    |                    | fabric_mode_policy_file | /opt/ufm/files/conf/opensm/fabric-mode-policy.conf | RW             | The file holding the Fabric Mode policy                                                                                                                                                              |
| Congestion Control | Congestion Control | mlnx_congestion_control | 0                                                  | RW             | Enable Congestion Control Configuration                                                                                                                                                              |

| Category    | Property      | Config File Attribute          | Default                                   | Mode/<br>Field | Description                                                                                            |
|-------------|---------------|--------------------------------|-------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------|
|             |               |                                |                                           |                | 0:<br>Ignore congestion control<br>1:<br>Disable congestion control<br>2:<br>Enable congestion control |
|             |               | congestion_control_policy_file | /opt/ufm/files/conf/opensm/cc-policy.conf | RW             | The file holding the congestion control policy                                                         |
|             |               | ppcc_algo_dir                  | /opt/ufm/files/conf/opensm/ppcc_algo_dir  | RW             | The directory holding the PPCC algorithm profiles                                                      |
|             |               | cc_max_outstanding_mads        | 500                                       | RW             | Congestion Control Max outstanding MAD                                                                 |
| Statistics/ | SM Statistics | osm_stats_interval             | 60                                        | RW             | Time interval                                                                                          |

| Category            | Property | Config File Attribute      | Default | Mode/<br>Field | Description                                                                                                |
|---------------------|----------|----------------------------|---------|----------------|------------------------------------------------------------------------------------------------------------|
| Performance Logging |          |                            |         |                | [in min] between statistics dumps. The value 0 implies no statistics dump. Max value is 71,582             |
|                     |          | osm_stats_dump_limit       | 20      | RW             | Max size [in MB] of statistics dump file. The value 0 implies no size limitation. Max value is 4095 (4GB). |
|                     |          | osm_stats_dump_per_sm_port | TRUE    | RW             | Indication whether to dump MADs statistics per SM port                                                     |

| Category | Property                     | Config File Attribute      | Default | Mode/<br>Field | Description                                                                                             |
|----------|------------------------------|----------------------------|---------|----------------|---------------------------------------------------------------------------------------------------------|
|          | SM<br>Performance<br>Logging | osm_perflog_dump_limit     | 20      | RW             | Max size [in MB] of perflog dump file. The value 0 implies no size limitation. Max value is 4095 (4GB). |
|          |                              | enable_performance_logging | TRUE    | RW             | Enable performance logging. when enabled, SM dumps the time it took for specific stages.                |

**(i) Note**

Modifying the following parameters does not require a system manager (SM) restart and will not toggle fabric ports:

- Qos\_high\_limit (for HCA only)
- Qos\_vlarb\_high (for HCA only)

- Qos\_vlarb\_low
- Qos\_sl2vl

However, incorrect VLARB or SL2VL settings can impact application performance or lead to traffic failure.

## Configuring UFM for SR-IOV

Single-root I/O virtualization (SR-IOV) enables a PCI Express (PCIe) device to appear to be multiple separate physical PCIe devices.

UFM is ready to work with SR-IOV devices by default. You can fine-tune the configuration using the SM configuration.

The following arguments are available for ConnectX-5 and later devices:

| Argument                  | Value                                                                                                                                                                                                                                                | Description                                                                                                         |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| virt_enabled              | <ul style="list-style-type: none"> <li>• 0 – no virtualization support</li> <li>• 1 – disable virtualization on all virtualization supporting ports</li> <li>• 2 – enable virtualization on all virtualization supporting ports (default)</li> </ul> | Virtualization support                                                                                              |
| virt_max_ports_in_process | Possible values: 0-65535; where 0 processes all pending ports<br>Default: 64                                                                                                                                                                         | Maximum number of ports to be processed simultaneously by the virtualization manager                                |
| virt_default_hop_limit    | Possible values: 0-255<br>Default: 2                                                                                                                                                                                                                 | Default value for hop limit to be returned in path records where either the source or destination are virtual ports |

## Isolating Switch From Routing

UFM can isolate particular switches from routing in order to perform maintenance of the switches with minimal interruption to the existing traffic in the fabric.

Isolating a switch from routing is done via UFM Subnet Manager as follows:

1. Create a file that includes either the node GUIDs or system GUID of the switches under maintenance. For example:

```
0x1234566
0x1234567
```

2. Set the filename of the parameter `held_back_sw_file` in the `/conf/opensm.conf` file (the same as the file created in Step 1).

3. Run:

```
kill -s HUP 'pidof opensm'
```

Once SM completes rerouting, the traffic does not go through the ports of isolated switches.

To attach the switch to the routing:

1. Remove the GUID of the switch from the list of isolated switches defined in Step 1 of the isolation process.
2. Run:

```
kill -s HUP 'pidof opensm'
```

Once SM completes rerouting, traffic will go through the switch.

## Appendix – Partitioning

Partitioning enforces isolation of the fabric. The default partition is created on all managed devices. Devices that are running an SM, all switches, routers, and gateways are added to the default partition with full membership. By default, all the HCA ports are also added to the default partition with FULL membership.

Partitioning is provisioned to the Subnet Manager via the `partitions.conf` configuration file, which cannot be removed or manually modified.

### **Note**

For those who use NVIDIA gateway systems, for proper system functionality, disable the automatic partitioning by changing the attribute `gateway_port_partitioning = none` in the `/opt/ufm/files/conf/gv.cfg` configuration. Restart UFM for the change to take effect.

If required, you can add an extension to the `partitions.conf` file that is generated by UFM. You can edit the file, `/opt/ufm/files/conf/partitions.conf.user_ext`, and the content of this extension file will be added to the `partitions.conf` file. Files synchronization is done by UFM on every logical model change. However, it can also be triggered manually by running the `/opt/ufm/scripts/sync_partitions_conf.sh` script. The script validates and merges the `/opt/ufm/files/conf/partitions.conf.user_ext` file into the `/opt/ufm/files/conf/opensm/partitions.conf` file and starts the heavy sweep on the Subnet Manager.

### **Note**

The maximum length of the line in the `partitions.conf` file is 4096 characters. However, to enable long PKeys, it is possible to split the pkey membership to multiple lines:

```
IOPartition=0x4, ipoib, sl=0, defmember=full : <port-guid1> , <port-guid2> ;
```

```
IOPartition=0x4, ipoib, sl=0, defmember=full : <port-guid3> , <port-guid4> ;
```

The *partitions.conf.user\_ext* uses the same format as the *partitions.conf* file. See [SM Partitions.conf File Format](#) for the format of the *partitions.conf* file.

For example, to add server ports to PKey 4:

```
IOPartition=0x4, ipoib, sl=0, defmember=full : 0x8f10001072a41;
```

## SM Partitions.conf File Format

This appendix presents the content and format of the SM *partitions.conf* file.

```
OpenSM Partition configuration
=====
```

The default partition will be created by OpenSM unconditionally even when partition configuration file does not exist or cannot be accessed.

The default partition has P\_Key value 0x7fff. OpenSM's port will always have full membership in default partition. All other end ports will have full membership if the partition configuration file is not found or cannot be accessed, or limited membership if the file exists and can be accessed but there is no rule for the Default partition.

Effectively, this amounts to the same as if one of the following rules below appear in the partition configuration file:  
In the case of no rule for the Default partition:  
Default=0x7fff : ALL=limited, SELF=full ;

In the case of no partition configuration file or file cannot be accessed:

```
Default=0x7fff : ALL=full ;
```

File Format

```
=====
```

Comments:

Line content followed after '#' character is comment and ignored by parser.

General file format:

```
<Partition Definition>:[<newline>]<Partition Properties>;
```

Partition Definition:

```
[PartitionName][=PKey][, ipoib_bc_flags]
[, defmember=full|limited]
```

PartitionName - string, will be used with logging. When omitted

empty string will be used.

PKey - P\_Key value for this partition. Only low 15 bits will

be used. When omitted will be autogenerated.

ipoib\_bc\_flags - used to indicate/specify IPoIB capability of this partition.

defmember=full|limited - specifies default membership for port guid

list. Default is limited.

```
ipoib_bc_flags:
 ipoib_flag|[mgroup_flag]*
```

ipoib\_flag - indicates that this partition may be used for IPoIB, as a result the IPoIB broadcast group will be created with the flags given, if any.

```
Partition Properties:
 [<Port list>|<MCast Group>]* | <Port list>
```

```
Port list:
 <Port Specifier>[,<Port Specifier>]
```

```
Port Specifier:
 <PortGUID>[=[full|limited]]
```

PortGUID - GUID of partition member EndPort.  
Hexadecimal numbers should start from 0x, decimal numbers are accepted too.  
full or limited - indicates full or limited membership for this port. When omitted (or unrecognized) limited membership is assumed.

```
MCast Group:
 mgid=gid[,mgroup_flag]*<newline>
```

- gid specified is verified to be a Multicast address  
IP groups are verified to match the rate and mtu of the

mgid for IP broadcast group. The P\_Key bits of the P\_Key specified groups are verified to either match the in by "Partition Definition" or if they are 0x0000 the P\_Key will be copied into those bits.

mgroup\_flag:

rate=<val> - specifies rate for this MC group (default is 3 (10GBps))

mtu=<val> - specifies MTU for this MC group (default is 4 (2048))

sl=<val> - specifies SL for this MC group (default is 0)

scope=<val> - specifies scope for this MC group (default is 2 (link local)). Multiple

scope settings

are permitted for a partition.

NOTE: This overwrites the scope nibble of the specified

mgid. Furthermore specifying multiple scope settings will result in multiple MC groups

being created.

qkey=<val> - specifies the Q\_Key for this MC group (default: 0x0b1b for IP groups, 0 for other groups)

WARNING: changing this for the broadcast group may

break IPoIB on client nodes!!!

tclass=<val> - specifies tclass for this MC group (default is 0)

FlowLabel=<val> - specifies FlowLabel for this MC group (default is 0)

```
newline: '\n'
```

Note that values for rate, mtu, and scope, for both partitions and multicast groups, should be specified as defined in the IBTA specification (for example, mtu=4 for 2048).

There are several useful keywords for PortGUID definition:

- 'ALL' means all end ports in this subnet.
- 'ALL\_CAS' means all Channel Adapter end ports in this subnet.
- 'ALL\_SWITCHES' means all Switch end ports in this subnet.
- 'ALL\_ROUTERS' means all Router end ports in this subnet.
- 'SELF' means subnet manager's port.

Empty list means no ports in this partition.

Notes:

-----

White space is permitted between delimiters ('=', ',', ':', ';').

PartitionName does not need to be unique, PKey does need to be unique.

If PKey is repeated then those partition configurations will be merged

and first PartitionName will be used (see also next note).

It is possible to split partition configuration in more than one definition, but then PKey should be explicitly specified (otherwise

different PKey values will be generated for those definitions).

Examples:

-----

```
Default=0x7fff : ALL, SELF=full ;
```

```
Default=0x7fff : ALL, ALL_SWITCHES=full, SELF=full ;
```

```
NewPartition , ipoib : 0x123456=full, 0x3456789034=limited,
0x2134af2306 ;
```

```
YetAnotherOne = 0x300 : SELF=full ;
```

```
YetAnotherOne = 0x300 : ALL=limited ;
```

```
ShareIO = 0x80 , defmember=full : 0x123451, 0x123452;
```

```
0x123453, 0x123454 will be limited
```

```
ShareIO = 0x80 : 0x123453, 0x123454, 0x123455=full;
```

```
0x123456, 0x123457 will be limited
```

```
ShareIO = 0x80 : defmember=limited : 0x123456, 0x123457,
0x123458=full;
```

```
ShareIO = 0x80 , defmember=full : 0x123459, 0x12345a;
```

```
ShareIO = 0x80 , defmember=full : 0x12345b, 0x12345c=limited,
0x12345d;
```

```
multicast groups added to default
```

```
Default=0x7fff, ipoib:
```

```
 mgid=ff12:401b::0707, sl=1 # random IPv4 group
```

```
 mgid=ff12:601b::16 # MLDv2-capable routers
```

```
 mgid=ff12:401b::16 # IGMP
```

```
 mgid=ff12:601b::2 # All routers
```

```
 mgid=ff12::1, sl=1, Q_Key=0xDEADBEEF, rate=3, mtu=2 # random
```

```
group
```

```
 ALL=full;
```

Note:

----

The following rule is equivalent to how OpenSM used to run prior to the partition manager:

```
Default=0x7fff, ipoib:ALL=full;
```

## Appendix – Enhanced Quality of Service

Enhanced QoS provides a higher resolution of QoS at the service level (SL). Users can configure rate limit values per SL for physical ports, virtual ports, and port groups, using `enhanced_qos_policy_file` configuration parameter.

Valid values of this parameter:

- Full path to the policy file through which Enhanced QoS Manager is configured
- “null” – to disable the Enhanced QoS Manager (default value)

### **Note**

To enable Enhanced QoS Manager, QoS must be enabled in SM configuration file.

## Enhanced QoS Policy File

The policy file is comprised of two sections:

- **BW\_NAMES:** Used to define bandwidth setting and name (currently, rate limit is the only setting). Bandwidth names are defined using the syntax:

```
<name> = <rate limit in 1Mbps units>
```

**Example:**

```
My_bandwidth = 50
```

- **BW\_RULES:** Used to define the rules that map the bandwidth setting to a specific SL of a specific GUID. Bandwidth rules are defined using the syntax:

```
<guid>|<port group name> = <sl id>:<bandwidth name>, <sl id>:
<bandwidth name>...
```

**Examples:**

```
0x2c90000000025 = 5:My_bandwidth, 7:My_bandwidth
Port_grp1 = 3:My_bandwidth, 9:My_bandwidth
```

## Notes

- **Rate limit = 0** represents unlimited rate limit.
- Any unspecified SL in a rule will be set to 0 (unlimited) rate limit automatically.
- “default” is a well-known name which can be used to define a default rule used for any GUID with no defined rule (If no default rule is defined, any GUID without a specific rule will be configured with unlimited rate limit for all SLs).
- Failure to complete policy file parsing leads to an undefined behavior. User must confirm no relevant error messages in SM log in order to ensure Enhanced QoS

Manager is configured properly.

- An empty file with only 'BW\_NAMES' and 'BW\_RULES' keywords configures the network with an unlimited rate limit.
- The VPORT\_BW\_RULES section is optional and includes virtual port GUIDs only (including the vport0 GUID). Physical port GUIDs added to this section are treated as vport0 GUIDs.

## Policy File Example

The below is an example of configuring all ports in the fabric with rate limit of 50Mbps on SL1, except for GUID 0x2c90000000025, which is configured with rate limit of 100Mbps on SL1. In this example, all SLs (other than SL1) are unlimited.

```


BW_NAMES
bw1 = 50
bw2 = 100
BW_RULES
default: 1:bw1
0x2c90000000025: 1:bw2

VPORT_BW_RULES
default = all:DEF_BW_2
```

## Appendix – Routing Chains

The routing chains feature is offering a solution that enables one to configure different parts of the fabric and define a different routing engine to route each of them. The routings are done in a sequence (hence the name "chains") and any node in the fabric that is configured in more than one part is left with the last routing engine updated for it.

# Configuring Routing Chains

The configuration for the routing chains feature consists of the following steps:

1. Define the port groups.
2. Define topologies based on previously defined port groups.
3. Define configuration files for each routing engine.
4. Define routing engine chains over defined topologies.

## Defining Port Groups

The basic idea behind the port groups is the ability to divide the fabric into sub-groups and give each group an identifier that can be used to relate to all nodes in this group. The port groups are used to define the participants in each of the routing algorithms.

## Defining Port Group Policy File

In order to define a port group policy file, set the parameter 'pgrp\_policy\_file' in the opensm configuration file, as follows:

```
/opt/ufm/files/conf/opensm/port_groups_policy_file.conf
```

## Configuring Port Group Policy

The port groups policy file details the port groups in the fabric. The policy file should be composed of one or more paragraphs that define a group. Each paragraph should begin with the line 'port-group' and end with the line 'end-port-group'.

For example:

```
port-group
...port group qualifiers...
```

## Port Group Qualifiers

### Note

Unlike the port group's beginning and ending which do not require a colon, all qualifiers must end with a colon (':'). Also – a colon is a predefined mark that must not be used inside qualifier values. An inclusion of a colon in the name or the use of a port group, will result in the policy's failure.

**Table 62: Port Group Qualifiers**

| Parameter | Description                                                                                                                                                | Example               |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| name      | Each group must have a name. Without a name qualifier, the policy fails.                                                                                   | name: grp1            |
| use       | 'use' is an optional qualifier that one can define in order to describe the usage of this port group (if undefined, an empty string is used as a default). | use: first port group |

## Rule Qualifiers

There are several qualifiers used to describe a rule that determines which ports will be added to the group. Each port group may contain one or more rules of the rule qualifiers in Table 63 (at least one rule shall be defined for each port group).

**Table 63: Rule Qualifiers**

| Parameter | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Example                        |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| guid list | <p>Comma separated list of guides to include in the group.</p> <p>If no specific physical ports were configured, all physical ports of the guid are chosen. However, for each guid, one can detail specific physical ports to be included in the group. This can be done using the following syntax:</p> <ul style="list-style-type: none"><li>• Specify a specific port in a guid to be chosen</li></ul> <p>port-guid: 0x283@3</p> <ul style="list-style-type: none"><li>• Specify a specific list of ports in a guid to be chosen</li></ul> <p>port-guid: 0x286@1/5/7</p> <ul style="list-style-type: none"><li>• Specify a specific range of ports in a guid to be chosen</li></ul> <p>port-guid: 0x289@2-5</p> <ul style="list-style-type: none"><li>• Specify a list of specific ports and ports ranges in a guid to be chosen</li></ul> <p>port-guid: 0x289@2-5/7/9-13/18</p> <ul style="list-style-type: none"><li>• Complex rule</li></ul> | port-guid: 0x283, 0x286, 0x289 |

| Parameter       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Example                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|                 | port-guid: 0x283@5-8/12/14, 0x286, 0x289/6/8/12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |
| port guid range | <p>It is possible to configure a range of guides to be chosen to the group. However, while using the range qualifier, it is impossible to detail specific physical ports. Note: A list of ranges cannot be specified. The below example is invalid and will cause the policy to fail:</p> port-guid-range: 0x283-0x289, 0x290-0x295                                                                                                                                                                                                                                                                                               | port-guid-range: 0x283-0x289                |
| port name       | <p>One can configure a list of hostnames as a rule. Hosts with a node description that is built out of these hostnames will be chosen. Since the node description contains the network card index as well, one might also specify a network card index and a physical port to be chosen. For example, the given configuration will cause only physical port 2 of a host with the node description 'kuku HCA-1' to be chosen.</p> port and hca_idx parameters are optional. If the port is unspecified, all physical ports are chosen. If hca_idx is unspecified, all card numbers are chosen. Specifying a hostname is mandatory. | port-name: hostname=kuku; port=2; hca_idx=1 |

| Parameter     | Description                                                                                                                                                                                                                                                                                        | Example                   |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|               | <p>One can configure a list of hostname/port/hca_idx sets in the same qualifier as follows:</p> <p>port-name:<br/> hostname=kuku; port=2;<br/> hca_idx=1 ,<br/> hostname=host1; port=3,<br/> hostname=host2</p> <p>Note: port-name qualifier is not relevant for switches, but for HCA's only.</p> |                           |
| port regexp   | <p>One can define a regular expression so that only nodes with a matching node description will be chosen to the group</p>                                                                                                                                                                         | port-regexp: SW.*         |
|               | <p>It is possible to specify one physical port to be chosen for matching nodes (there is no option to define a list or a range of ports). The given example will cause only nodes that match physical port 3 to be added to the group.</p>                                                         | port-regexp: SW.*:3       |
| union rule    | <p>It is possible to define a rule that unites two different port groups. This means that all ports from both groups will be included in the united group.</p>                                                                                                                                     | union-rule: grp1, grp2    |
| subtract rule | <p>One can define a rule that subtracts one port group from another. The given rule, for example, will cause all the ports which are a part of grp1, but not</p>                                                                                                                                   | subtract-rule: grp1, grp2 |

| Parameter | Description                                                                                                                                                                                                                                                                                                                                                                               | Example |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|           | <p>included in grp2, to be chosen.</p> <p>In subtraction (unlike union), the order does matter, since the purpose is to subtract the second group from the first one. There is no option to define more than two groups for union/subtraction. However, one can unite/subtract groups which are a union or a subtraction themselves, as shown in the port groups policy file example.</p> |         |

## Predefined Port Groups

There are 3 predefined port groups that are available for use, yet cannot be defined in the policy file (if a group in the policy is configured with the name of one of these predefined groups, the policy fails) –

- ALL – a group that includes all nodes in the fabric
- ALL\_SWITCHES – a group that includes all switches in the fabric.
- ALL\_CAS – a group that includes all HCA's in the fabric.

## Port Groups Policy Examples

```
port-group
name: grp3
use: Subtract of groups grp1 and grp2
```

```
subtract-rule: grp1, grp2
end-port-group

port-group
name: grp1
port-guid: 0x281, 0x282, 0x283
end-port-group

port-group
name: grp2
port-guid-range: 0x282-0x286
port-name: hostname=server1 port=1
end-port-group

port-group
name: grp4
port-name: hostname=kika port=1 hca_idx=1
end-port-group

port-group
name: grp3
union-rule: grp3, grp4
end-port-group
```

## Defining Topologies Policy File

In order to define a port group policy file, set the parameter 'topo\_policy\_file' in the opensm configuration file.

```
/opt/ufm/files/conf/opensm/topo_policy_file.conf
```

## Configuring Topology Policy

The topologies policy file details a list of topologies. The policy file should be composed of one or more paragraphs which define a topology. Each paragraph should begin with the line 'topology' and end with the line 'end-topology'.

For example:

```
topology
...topology qualifiers...
end-topology
```

## Topology Qualifiers

### Note

Unlike topology and end-topology which do not require a colon, all qualifiers must end with a colon (':'). Also – a colon is a predefined mark that must not be used inside qualifier values. An inclusion of a colon in the qualifier values will result in the policy's failure.

All topology qualifiers are mandatory. Absence of any of the below qualifiers will cause the policy parsing to fail.

| Parameter | Description                                                                                     | Example               |
|-----------|-------------------------------------------------------------------------------------------------|-----------------------|
| id        | Topology ID.<br>Legal Values – any positive value.<br>Must be unique.                           | id: 1                 |
| sw-grp    | Name of the port group that includes all switches and switch ports to be used in this topology. | sw-grp: some_switches |

| Parameter | Description                                                                 | Example             |
|-----------|-----------------------------------------------------------------------------|---------------------|
| hca-grp   | Name of the port group that includes all HCA's to be used in this topology. | hca-grp: some_hosts |

## Configuration File per Routing Engine

Each engine in the routing chain can be provided by its own configuration file. Routing engine configuration file is the fraction of parameters defined in the main opensm configuration file.

Some rules should be applied when defining a particular configuration file for a routing engine:

- Parameters that are not specified in specific routing engine configuration file are inherited from the main opensm configuration file.
- The following configuration parameters are taking effect only in the main opensm configuration file:
  - qos and qos\_\* settings like (vl\_arb, sl2vl, etc.)
  - lmc
  - routing\_engine

## Defining Routing Chain Policy File

In order to define a port group policy file, set the parameter 'rch\_policy\_file' in the opensm configuration file, as follows:

```
/opt/ufm/files/conf/opensm/routing_chains_policy.conf
```

## First Routing Engine in Chain

The first unicast engine in a routing chain must include all switches and HCA's in the fabric (topology id must be 0). The path-bit parameter value is path-bit 0 and it cannot be changed.

## Configuring Routing Chains Policy

The routing chains policy file details the routing engines (and their fallback engines) used for the fabric's routing. The policy file should be composed of one or more paragraphs which defines an engine (or a fallback engine). Each paragraph should begin with the line 'unicast-step' and end with the line 'end-unicast-step'.

For example:

```
unicast-step
...routing engine qualifiers...
end-unicast-step
```

## Routing Engine Qualifiers

### Note

Unlike unicast-step and end-unicast-step which do not require a colon, all qualifiers must end with a colon (':'). Also – a colon is a predefined mark that must not be used inside qualifier values. An inclusion of a colon in the qualifier values will result in the policy's failure.

| Parameter | Description                                                                   | Example |
|-----------|-------------------------------------------------------------------------------|---------|
| id        | 'id' is mandatory. Without an id qualifier for each engine, the policy fails. | is: 1   |

| Parameter | Description                                                                                                                                                                                                                                                                                                                      | Example                          |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|           | <ul style="list-style-type: none"> <li>• Legal values – size_t value (0 is illegal).</li> <li>• The engines in the policy chain are set according to an ascending id order, so it is highly crucial to verify that the id that is given to the engines match the order in which you would like the engines to be set.</li> </ul> |                                  |
| engine    | <p>This is a mandatory qualifier that describes the routing algorithm used within this unicast step.</p> <p>Currently, on the first phase of routing chains, legal values are minhop/ftree/updn.</p>                                                                                                                             | engine: minhop                   |
| use       | <p>This is an optional qualifier that enables one to describe the usage of this unicast step. If undefined, an empty string is used as a default.</p>                                                                                                                                                                            | use: ftree routing for cluster 1 |
| config    | <p>This is an optional qualifier that enables one to define a separate opensm config file for a specific unicast step. If undefined, all parameters are taken from main opensm configuration file.</p>                                                                                                                           | config: /etc/config/opensm2.cfg  |
| topology  | <p>Define the topology that this engine uses.</p>                                                                                                                                                                                                                                                                                | topology: 1                      |

| Parameter   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Example |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|             | <ul style="list-style-type: none"> <li>• Legal value – id of an existing topology that is defined in topologies policy (or zero that represents the entire fabric and not a specific topology).</li> <li>• Default value – If unspecified, a routing engine will relate to the entire fabric (as if topology zero was defined).</li> <li>• Notice: The first routing engine (the engine with the lowest id) MUST be configured with topology: 0 (entire fabric) or else, the routing chain algorithm will fail.</li> </ul> |         |
| fallback-to | <p>This is an optional qualifier that enables one to define the current unicast step as a fallback to another unicast step. This can be done by defining the id of the unicast step that this step is a fallback to.</p> <ul style="list-style-type: none"> <li>• If undefined, the current unicast step is not a fallback.</li> <li>• If the value of this qualifier is a non-existent engine id, this step will be ignored.</li> </ul>                                                                                   | -       |

| Parameter | Description                                                                                                                                                                                                                                                                                                    | Example     |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
|           | <ul style="list-style-type: none"> <li>• A fallback step is meaningless if the step it is a fallback to did not fail.</li> <li>• It is impossible to define a fallback to a fallback step (such definition will be ignored)</li> </ul>                                                                         |             |
| path-bit  | <p>This is an optional qualifier that enables one to define a specific lid offset to be used by the current unicast step. Setting lmc &gt; 0 in main opensm configuration file is a prerequisite for assigning specific path-bit for the routing engine. Default value is 0 (if path-bit is not specified)</p> | Path-bit: 1 |

## Dump Files per Routing Engine

Each routing engine on the chain will dump its own data files if the appropriate log\_flags is set (for instance 0x43).

- The files that are dumped by each engine are:
  - opensm-lid-matrix.dump
  - opensm-lfts.dump
  - opensm.fdb
  - opensm-subnet.lst

These files should contain the relevant data for each engine topology.

## **Note**

sl2vl and mcfdbs files are dumped only once for the entire fabric and NOT by every routing engine.

- Each engine concatenates its ID and routing algorithm name in its dump files names, as follows:
  - opensm-lid-matrix.2.minhop.dump
  - opensm.fdb.3.ftree
  - opensm-subnet.4.updn.lst
- If a fallback routing engine is used, both the routing engine that failed and the fallback engine that replaces it, dump their data.

If, for example, engine 2 runs ftree and it has a fallback engine with 3 as its id that runs minhop, one should expect to find 2 sets of dump files, one for each engine:

- opensm-lid-matrix.2.ftree.dump
- opensm-lid-matrix.3.minhop.dump
- opensm.fdb.2.ftree
- opensm.fdb.3.minhop

## Appendix – Adaptive Routing

## **Note**

As of UFM v6.4, Adaptive Routing plugin is no longer required for Adaptive Routing and SHIELD configuration. AR is now part of the

core Subnet Manager implementation. However, upgrading UFM to v6.4 from an earlier version using the AR plugin will remain possible.

For information on how to set up AR and SHIELD, please refer to [How-To Configure Adaptive Routing and Self Healing Networking](#).

## Appendix – Security Features

### SA Enhanced Trust Model (SAETM)

Standard SA has a concept of trust-based requests on the SA\_Key that is part of each SA MAD. A **trusted request** is when the SA\_Key value is not equal to zero but equals the SA configured value, while an **untrusted request** is when the SA\_Key value equals zero in the request. If a request has a non-zero SA\_Key value that is different from the configured SA key, it will be dropped and reported.

When SAETM is enabled, the SA limits the set of untrusted requests allowed. Untrusted requests that are not allowed according to SAETM will be silently dropped (for the set of untrusted requests allowed, see [the following section](#) below).

SAETM feature is disabled by default. To enable it, set the sa\_enhanced\_trust\_model parameter to TRUE.

#### **Additional SAETM Configuration Parameters**

| Parameter                                                                  | Description                                                                                                                         |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| sa_etm_allow_untrusted_guidinfo_rec                                        | Defines whether to allow GUIDInfoRecord as part of the SAETM set of untrusted requests allowed (see <a href="#">section below</a> ) |
| sa_etm_allow_guidinfo_rec_by_vf                                            | Defines whether to drop GUIDInfoRecord from non-physical ports (see <a href="#">section below</a> )                                 |
| sa_etm_allow_untrusted_proxy_requests                                      | Defines the behavior for proxy requests (see <a href="#">section below</a> )                                                        |
| sa_etm_max_num_mcgs/<br>sa_etm_max_num_srvcs/<br>sa_etm_max_num_event_subs | Defines the registration limits in SAETM (see <a href="#">section below</a> )                                                       |

## Set of Untrusted SA Requests Allowed

The following table lists the untrusted requests allowed when SAETM is enabled:

| Request        | Request Type                                                                                                                                                                                                 |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MCMemberRecord | Get/Set/Delete                                                                                                                                                                                               |
| PathRecord     | Get                                                                                                                                                                                                          |
| PathRecord     | GetTable (only if both destination and source are specified (e.g. only point to point))                                                                                                                      |
| ServiceRecord  | Get/Set/Delete                                                                                                                                                                                               |
| ClassPortInfo  | Get                                                                                                                                                                                                          |
| InformInfo     | Set (for non-SM security traps)                                                                                                                                                                              |
| GUIDInfoRecord | Set/Delete – this request can only be part of this set depending on the values of <code>sa_etm_allow_untrusted_guidinfo_rec</code> and <code>sa_etm_allow_guidinfo_rec_by_vf</code> – see elaboration below. |

When `sa_etm_allow_untrusted_guidinfo_rec` is set to FALSE (and SAETM is enabled), the SA will drop GUIDInfoRecord Set/Delete untrusted requests.

When `sa_etm_allow_guidinfo_rec_by_vf` is set to FALSE (and SAETM is enabled), the SA will drop GUIDInfoRecord Set/Delete requests from non-physical ports.

If `sa_etm_allow_untrusted_guidinfo_rec=FALSE`, GUIDInfoRecord Set/Delete requests will become part of the SAETM set of untrusted requests allowed. Note that if `sa_etm_allow_guidinfo_rec_by_vf=FALSE`, the requests will only be allowed from physical ports.

## Proxy SA Requests

SA modification request (SET/DELETE) is identified as a proxy operation when the port corresponding with the requester source address (SLID from LRH/SGID from GRH) is different than the port for which the request applies:

- For MCMemberRecord, when the MCMemberRecord.PortGID field does not match the requester address

- For ServiceRecord, when the ServiceRecord.ServiceGID field does not match requester address
- For the GUIDInfoRecord, when the LID field in the RID of the record does not match the requester address

When sa\_etm\_allow\_untrusted\_proxy\_requests is set to FALSE and SAETM is enabled, untrusted proxy requests will be dropped.

## Registration Limits

When any of sa\_etm\_max\_num\_mcgs, sa\_etm\_max\_num\_srvcs or sa\_etm\_max\_num\_event\_subs parameters is set to 0, the number of this parameter's registrations can be unlimited. When the parameter's value is different than 0, attempting to exceed the maximum number of registrations will result in the request being silently dropped. Consequently, the requester and request info will be logged, and an event will be generated for the Activity Manager.

The following parameters control the maximum number of registrations:

| Parameter                 | Description                                                                               |
|---------------------------|-------------------------------------------------------------------------------------------|
| sa_etm_max_num_mcgs       | Maximum number of multicast groups per port/vport that can be registered.                 |
| sa_etm_max_num_srvcs      | Maximum number of service records per port/vport that can be registered.                  |
| sa_etm_max_num_event_subs | Maximum number of event subscriptions (InformInfo) per port/vport that can be registered. |

## SAETM Logging

When requesting an operation that is not part of the SAETM set of untrusted requests, it will be silently dropped and eventually written to the SM log.

The logging of the dropped MADs is repressed to not overload the OpenSM log. If the request that needs to be dropped was received from the same requester many times consecutively, OpenSM logs it only if the request number is part of the following sequence:

0, 1, 2, 5, 10, 20, 50, 100, 200... (similar to the trap log repression).

## SGID Spoofing

SA can validate requester addresses by comparing the SLID and SGID of the incoming request. SA determines the requester port by the SLID and SGID field of the request. SGID spoofing is when the SGID and SLID do not match.

When `sa_check_sgid_spoofing` parameter is enabled, SA checks for SGID spoofing in every request that includes GRH, unless the SLID belongs to a router port in that same request. In case the request SGID does not match its SLID, the request will be dropped. The default value of this parameter is TRUE.

## M\_Key Authentication

### M\_Key Per Port

This feature increases protection on the fabric as a unique M\_Key is generated and set for each HCA, router, or switch port.

OpenSM calculates an M\_Key per port by performing a hash function on the port GUID of the device and the M\_Key configured in `opensm.conf`.

To enable M\_Key per port, set the parameter below in addition to the parameters listed in the [previous section](#):

```
m_key_per_port TRUE
```

## Appendix – SM Activity Report

SM can produce an activity report in a form of a dump file that details the different activities done in the SM. Activities are divided into subjects. The table below specifies the different activities currently supported in the SM activity report.

Reporting of each subject can be enabled individually using the configuration parameter `activity_report_subjects`:

- Valid values:

Comma-separated list of subjects to dump. The current supported subjects are:

- - "mc" – activity IDs 1, 2 and 8
  - "prtn" – activity IDs 3, 4, and 5
  - "virt" – activity IDs 6 and 7
  - "routing" – activity IDs 8-12

Two predefined values can be configured as well:

- "all" – dump all subjects
- "none" – disable the feature by dumping none of the subjects
- Default value: "none"

## SM Supported Activities

| Activity ID | Activity Name | Additional Fields                                      | Comments                              | Description                        |
|-------------|---------------|--------------------------------------------------------|---------------------------------------|------------------------------------|
| 1           | mcm_member    | - MLid<br>- MGid<br>- Port Guid<br>- Join State        | Join state:<br>1 - Join<br>-1 - Leave | Member<br>joined/left MC<br>group  |
| 2           | mcg_change    | - MLid<br>- MGid<br>- Change                           | Change:<br>0 - Create<br>1 - Delete   | MC<br>group<br>created<br>/deleted |
| 3           | prtn_guid_add | - Port Guid<br>- PKey<br>- Block index<br>- Pkey Index |                                       | Guid<br>added<br>to<br>partition   |

| Activity ID | Activity Name           | Additional Fields                                                             | Comments                                                                  | Description                    |
|-------------|-------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------|
| 4           | prtn_create             | -PKey<br>- Prtn Name                                                          |                                                                           | Partition created              |
| 5           | prtn_delete             | - PKey<br>- Delete Reason                                                     | Delete Reason:<br>0 - empty prtn<br>1 - duplicate prtn<br>2 - sm shutdown | Partition deleted              |
| 6           | port_virt_discover      | - Port Guid<br>- Top Index                                                    |                                                                           | Port virtualization discovered |
| 7           | vport_state_change      | - Port Guid<br>- VPort Guid<br>- VPort Index<br>- VNode Guid<br>- VPort State | VPort State:<br>1 - Down<br>2 - Init<br>3 - ARMED<br>4 - Active           | Vport state changed            |
| 8           | mcast_tree_calc         | - mlid                                                                        |                                                                           | Mcast group tree calculated    |
| 9           | routing_succeed         | routing engine name                                                           |                                                                           | Routing done successfully      |
| 10          | routing_failed          | routing engine name                                                           |                                                                           | Routing failed                 |
| 11          | ucast_cache_invalidated |                                                                               |                                                                           | ucast cache invalidated        |

| Activity ID | Activity Name            | Additional Fields | Comments | Description              |
|-------------|--------------------------|-------------------|----------|--------------------------|
| 12          | ucast_cache_routing_done |                   |          | ucast cache routing done |

# OpenSM Configuration

## Enabling Congestion Control

In order to enable congestion control, set the parameter `m1nx_congestion_control` in the OpenSM configuration file to 2. For example:

```
m1nx_congestion_control 2
```

To disable congestion control, set the parameter value to 1. For example:

```
m1nx_congestion_control 1
```

## Defining a Congestion Control Policy File

To define a congestion control policy file, set the parameter `congestion_control_file` in OpenSM configuration file to point to congestion control policy file. For example:

```
congestion_control_policy_file
/opt/ufm/files/conf/opensm/conf/congestion_control_policy_file
```

The file includes a reference to an active algorithm file name. The algorithm file has to be inside the `ppcc_algo_dir`.

For Example:

```
ca_algo_import_start
 algo_start
 algo_id:1
 algo_file_name: active_algo_file_name
 # PPCC parameter by name, as defined in algo profile
 parameters: (BW_G,400), (ALPHA,3932), (MAX_DEC,63569),
(MAX_INC,69468), (AI,36), (HAI,1200)
 algo_end
ca_algo_import_end
```

The `ca_algo_import` block contains all the algo blocks that map an `algo_id` to an algorithm profile file. The `algo_id` field of the algo blocks must be unique and start from 1. This block is used to import the various PCC algorithms into the configuration and associate them with their `algo_id` values.

## Defining a directory for PPCC algorithm profiles

To define a directory for the programmable congestion control algorithm profiles, set the parameter `ppcc_algo_dir` in OpenSM configuration file. For Example:

```
ppcc_algo_dir /opt/ufm/files/conf/opensm/conf/ppcc_algo_dir
```

# Appendix – Diagnostic Utilities

### Note

For UFM-SDN Appliance, all the below diagnostics commands have `ib` prefix.

For example, for UFM-SDN Appliance, the command `ibstat` is  
`ib ibstat.`

## InfiniBand Diagnostics Commands

| Command                    | Description                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>ibstat</code>        | Shows the host adapters status.                                                                                                                                                   |
| <code>ibstatus</code>      | Similar to <code>ibstat</code> but implemented as a script.                                                                                                                       |
| <code>ibnetdiscover</code> | Scans the topology.                                                                                                                                                               |
| <code>ibaddr</code>        | Shows the LID range and default GID of the target (default is the local port).                                                                                                    |
| <code>ibroute</code>       | Displays unicast and multicast forwarding tables of the switches.                                                                                                                 |
| <code>ibtracert</code>     | Displays unicast or multicast route from source to destination.                                                                                                                   |
| <code>ibping</code>        | Uses vendor MADs to validate connectivity between InfiniBand nodes. On exit, (IP) ping-like output is shown.                                                                      |
| <code>ibsysstat</code>     | Obtains basic information for the specific node which may be remote. This information includes: hostname, CPUs, memory utilization.                                               |
| <code>sminfo</code>        | Queries the SMInfo attribute on a node.                                                                                                                                           |
| <code>smpdump</code>       | A general purpose SMP utility which gets SM attributes from a specified SMA. The result is dumped in hex by default.                                                              |
| <code>smpquery</code>      | Enables a basic subset of standard SMP queries including the following:<br>node info, node description, switch info, port info.<br>Fields are displayed in human readable format. |
| <code>perfquery</code>     | Dumps (and optionally clears) the performance counters of the destination port (including error counters).                                                                        |
| <code>ibswitches</code>    | Scans the net or uses existing net topology file                                                                                                                                  |

| Command       | Description                                                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | and lists all switches.                                                                                                                                                                       |
| ibhosts       | Scans the net or uses existing net topology file and lists all hosts.                                                                                                                         |
| ibnodes       | Scans the net or uses existing net topology file and lists all nodes.                                                                                                                         |
| ibportstate   | Gets the logical and physical port states of an InfiniBand port or disables or enables the port (only on a switch).<br>Note: This tool can change port settings. Should be used with caution. |
| saquery       | Issues SA queries.                                                                                                                                                                            |
| ibdiagnet     | ibdiagnet scans the fabric using directed route packets and extracts all the available information regarding its connectivity and devices.                                                    |
| ibnetsplit    | Automatically groups hosts and creates scripts that can be run to split the network into sub-networks each containing one group of hosts.                                                     |
| lbqueryerrors | Queries IB spec-defined errors from all fabric ports.<br>Note: This tool can change reset port counters. Should be used with caution.                                                         |
| smparquery    | Queries adaptive-routing related settings from a particular switch.<br>Note: This tool can change reset port counters. Should be used with caution.                                           |

## Diagnostic Tools

Model of operation: All utilities use direct MAD access to operate. Operations that require QP 0 mads only, may use direct routed mads, and therefore may work even in subnets that are not configured. Almost all utilities can operate without accessing the SM, unless GUID to lid translation is required.

## Dependencies

### Multiple port/Multiple CA support:

When no InfiniBand device or port is specified (as shown in the following example for "Local umad parameters"), the tools select the interface port to use by the following criteria:

1. The first InfiniBand ACTIVE port.
2. If not found, the first InfiniBand port that is UP (physical link up).

If a port and/or CA name is specified, the **tool** attempts to fulfill the user's request and will fail if it is not possible.

For example:

```
ibaddr # use the 'best port'
ibaddr -C mthca1 # pick the best port from mthca1 only.
ibaddr -P 2 # use the second (active/up) port from
the first available IB device.
ibaddr -C mthca0 -P 2 # use the specified port only.
```

## Common Options & Flags

Most diagnostics take the following flags. The exact list of supported flags per utility can be found in the usage message and can be shown using `util_name -h` syntax.

```
Debugging flags
-d raise the IB debugging level. May be used several times (-
ddd or -d -d -d).
-e show umad send receive errors (timeouts and others)
-h show the usage message
-v increase the application verbosity level.
 May be used several times (-vv or -v -v -v)
-V show the internal version info.
```

```
Addressing flags
-D use directed path address arguments.
```

```
The path is a comma separated list of out ports.
Examples:
"0" # self port
"0,1,2,1,4" # out via port 1, then 2, ...
-G use GUID address arguments.
In most cases, it is the Port GUID.
Examples:
"0x08f1040023"
-s <smlid> use 'smlid' as the target lid for SA queries.
```

```
Local umad parameters:
-C <ca_name> use the specified ca_name.
-P <ca_port> use the specified ca_port.
-t <timeout_ms> override the default timeout for the
solicited mads.
```

**CLI notation:** all utilities use the POSIX style notation, meaning that all options (flags) must precede all arguments (parameters).

## Utilities Descriptions

### **ibstatus**

A script that displays basic information obtained from the local InfiniBand driver. Output includes LID, SMLID, port state, link width active, and port physical state.

Syntax

```
ibstatus [-h] [devname[:port]]
```

Examples:

```
ibstatus # display status of all IB ports
ibstatus mthca1 # status of mthca1 ports
ibstatus mthca1:1 mthca0:2 # show status of specified ports
```

See also: `ibstat`

## **ibstat**

Similar to the `ibstatus` utility but implemented as a binary and not as a script. Includes options to list CAs and/or ports.

Syntax

```
ibstat [-d(ebug) -l(ist_of_cas) -p(ort_list) -s(hort)] <ca_name>
[portnum]
```

Examples:

```
ibstat # display status of all IB ports
ibstat mthca1 # status of mthca1 ports
ibstat mthca1 2 # show status of specified ports
ibstat -p mthca0 # list the port guides of mthca0
ibstat -l # list all CA names
```

See also: `ibstatus`

## **ibroute**

Uses SMPs to display the forwarding tables (unicast (LinearForwardingTable or LFT) or multicast (MulticastForwardingTable or MFT)) for the specified switch LID and the optional lid (mlid) range. The default range is all valid entries in the range 1...FDBTop.

Syntax

```
ibroute [options] <switch_addr> [<startlid> [<endlid>]]
```

Nonstandard flags:

```
-a show all lids in range, even invalid entries.
-n do not try to resolve destinations.
-M show multicast forwarding tables. In this case
the range parameters are specifying mlid range.
node-name-map node name map file
```

Examples:

```
ibroute 2 # dump all valid entries of switch lid 2
ibroute 2 15 # dump entries in the range 15...FDBTop.
ibroute -a 2 10 20 # dump all entries in the range 10..20
ibroute -n 2 # simple format
ibroute -M 2 # show multicast tables
```

See also: `ibtracert`

## **ibtracert**

Uses SMPs to trace the path from a source GID/LID to a destination GID/LID. Each hop along the path is displayed until the destination is reached or a hop does not respond. By using the `-m` option, multicast path tracing can be performed between source and destination nodes.

Syntax

```
ibtracert [options] <src-addr> <dest-addr>
```

Nonstandard flags:

```
-n simple format; don't show additional information.
-m <mlid> show the multicast trace of the specified mlid.
-f <force> force
node-name-map node name map file
```

Examples:

```
ibtracert 2 23 # show trace between lid 2 and 23
ibtracert -m 0xc000 3 5 # show multicast trace between lid 3
and 5 for mcast lid 0xc000.
```

## **smpquery**

Enables a basic subset of standard SMP queries including the following node info, node description, switch info, port info. Fields are displayed in human readable format.

Syntax

```
smpquery [options] <op> <dest_addr> [op_params]
```

Currently supported operations and their parameters:

```
nodeinfo <addr>
nodedesc <addr>
portinfo <addr> [<portnum>] # default port is zero
switchinfo <addr>
pkeys <addr> [<portnum>]
sl2vl <addr> [<portnum>]
vlarb <addr> [<portnum>]
```

```
GUIDInfo (GI) <addr>
MlnxExtPortInfo (MEPI) <addr> [<portnum>]
Combined (-c) : use Combined route address argument
node-name-map : node name map file
extended (-x) : use extended speeds
```

Examples:

```
smpquery nodeinfo 2 # show nodeinfo for lid 2
smpquery portinfo 2 5 # show portinfo for lid 2 port 5
```

## **smpdump**

A general purpose SMP utility that gets SM attributes from a specified SMA. The result is dumped in hex by default.

Syntax

```
smpdump [options] <dest_addr> <attr> [mod]
```

Nonstandard flags:

```
-s show output as string
```

Examples:

```
smpdump -D 0,1,2 0x15 2 # port info, port 2
smpdump 3 0x15 2 # port info, lid 3 port 2
```

## **ibaddr**

Can be used to show the LID and GUID addresses of the specified port or the local port by default. This utility can be used as simple address resolver.

## Syntax

```
ibaddr [options] [<dest_addr>]
```

## Nonstandard flags:

```
gid_show (-g) : show gid address only
lid_show (-l) : show lid range only
Lid_show (-L) : show lid range (in decimal) only
```

## Examples:

```
ibaddr # show local address
ibaddr 2 # show address of the specified port lid
ibaddr -G 0x8f1040023 # show address of the specified port guid
```

## **sminfo**

Issues and dumps the output of an sminfo query in human readable format. The target SM is the one listed in the local port info or the SM specified by the optional SM LID or by the SM direct routed path.

### **Warning**

CAUTION: Using sminfo for any purpose other than a simple query might result in a malfunction of the target SM.

## Syntax

```
sminfo [options] <sm_lid|sm_dr_path> [sminfo_modifier]
```

### Nonstandard flags:

```
-s <state> # use the specified state in sminfo mad
-p <priority> # use the specified priority in sminfo mad
-a <activity> # use the specified activity in sminfo mad
```

### Examples:

```
sminfo # show sminfo of SM listed in local portinfo
sminfo 2 # query SM on port lid 2
```

## perfquery

Uses PerfMgt GMPs to obtain the PortCounters (basic performance and error counters) from the Performance Management Agent (PMA) at the node specified. Optionally show aggregated counters for all ports of node. Also, optionally, reset after read, or only reset counters.

```
perfquery [options] [<lid|guid> [[port] [reset_mask]]]
```

### Nonstandard flags:

```
-a Shows aggregated counters for all ports
of the destination lid.
-r Resets counters after read.
-R Resets only counters.
```

```

Extended (-x) Shows extended port counters
Xmtsl (-X) Shows Xmt SL port counters
Rcvsl ,(-S) Shows Rcv SL port counters
Xmtdisc (-D) Shows Xmt Discard Details
rcvrr, (-E) Shows Rcv Error Details
extended_speeds (-T) Shows port extended speeds counters
oprvcounters Shows Rcv Counters per Op code
flowctlcounters Shows flow control counters
vloppackets Shows packets received per Op code per VL
vlopdata Shows data received per Op code per VL
vlxmitflowctlerrors Shows flow control update errors per VL
vlxmitcounters Shows ticks waiting to transmit counters per VL
swportvlcong Shows sw port VL congestion
rcvcc Shows Rcv congestion control counters
slrcvfec Shows SL Rcv FECN counters
slrcvbecn Shows SL Rcv BECN counters
xmitcc Shows Xmit congestion control counters
vlxmittlecc Shows VL Xmit Time congestion control counters
smplctl (-c) Shows samples control
loop_ports (-l) Iterates through each port

```

#### Examples:

```

perfquery # read local port's performance counters
perfquery 32 1 # read performance counters from lid 32,
port 1
perfquery -a 32 # read from lid 32 aggregated performance
counters
perfquery -r 32 1 # read performance counters from lid 32
port 1 and reset
perfquery -R 32 1 # reset performance counters of lid 32 port
1 only
perfquery -R -a 32 # reset performance counters of all lid 32
ports

```

```
perfquery -R 32 2 0xf000 # reset only non-error counters of lid
32 port 2
```

## ibping

Uses vendor mads to validate connectivity between InfiniBand nodes. On exit, (IP) ping like output is show. ibping is run as client/server. The default is to run as client. Note also that a default ping server is implemented within the kernel.

Syntax

```
ibping [options] <dest lid|guid>
```

Nonstandard flags:

```
-c <count> stop after count packets
-f flood destination: send packets back to back w/o
delay
-o <oui> use specified OUI number to multiplex vendor MADs
-S start in server mode (do not return)
```

## ibnetdiscover

Performs InfiniBand subnet discovery and outputs a human readable topology file. GUIDs, node types, and port numbers are displayed as well as port LIDs and node descriptions. All nodes (and links) are displayed (full topology). This utility can also be used to list the current connected nodes. The output is printed to the standard output unless a topology file is specified.

Syntax

```
ibnetdiscover [options] [<topology-filename>]
```

Nonstandard flags:

```
l Lists connected nodes
H Lists connected HCAs
S Lists connected switches
g Groups
full (-f) Shows full information (ports' speed and width,
 vlcap)
show (-s) Shows more information
Router_list (-R) Lists connected routers
node-name-map Nodes name map file
cache filename to cache ibnetdiscover data to
load-cache filename of ibnetdiscover cache to load
diff filename of ibnetdiscover cache to diff
diffcheck Specifies checks to execute for --diff
ports : (-p) Obtains a ports report
max_hops (-m) Reports max hops discovered by the library
outstanding_smps (-o) Specifies the number of outstanding SMP's
 which should be issued during the scan
```

## **ibhosts**

Traces the InfiniBand subnet topology or uses an already saved topology file to extract the CA nodes.

Syntax

```
ibhosts [-h] [<topology-file>]
```

Dependencies: ibnetdiscover, ibnetdiscover format

## **ibswitches**

Traces the InfiniBand subnet topology or uses an already saved topology file to extract the InfiniBand switches.

## Syntax

```
ibswitches [-h] [<topology-file>]
```

Dependencies: ibnetdiscover, ibnetdiscover format

## **ibportstate**

Enables the port state and port physical state of an InfiniBand port to be queried or a switch port to be disabled or enabled.

## Syntax

```
ibportstate [-d(ebug) -e(rr_show) -v(erbose) -D(irect) -G(uid) -s
smlid -V(ersion) -C ca_name -P ca_port -t timeout_ms] <dest
dr_path|lid|guid> <portnum> [<op>]
```

Supported ops: enable, disable, query, on, off, reset, speed, espeed, fdr10, width, down, arm, active, vls, mtu, lid, smlid, lmc, mkey, mkeylease, mkeyprot

Examples:

```
ibportstate 3 1 disable # by lid
ibportstate -G 0x2C9000100D051 1 enable # by guid
ibportstate -D 0 1 # by direct route
```

## **ibnodes**

Uses the current InfiniBand subnet topology or an already saved topology file and extracts the InfiniBand nodes (CAs and switches).

## Syntax

```
ibnodes [<topology-file>]
```

Dependencies: ibnetdiscover, ibnetdiscover format

## **ibqueryerrors**

Queries or clears the PMA error counters in PortCounters by walking the InfiniBand subnet topology.

```
ibqueryerrors [options]
```

### Syntax

Options:

```
--suppress, -s <err1,err2,...> suppress errors listed
--suppress-common, -c suppress some of the common counters
--node-name-map <file> node name map file
--port-guid, -G <port_guid> report the node containing the
port
 specified by <port_guid>
--, -S <port_guid> Same as "-G" for backward compatibility
--Direct, -D <dr_path> report the node containing the port
specified
 by <dr_path>
--skip-sl don't obtain SL to all destinations
--report-port, -r report port link information
--threshold-file <val> specify an alternate threshold file,
default: /etc/infiniband-diags/error_thresholds
--GNDN, -R (This option is obsolete and does
nothing)
--data include data counters for ports with
errors
```

```

--switch print data for switches only
--ca print data for CA's only
--router print data for routers only
--details include transmit discard details
--counters print data counters only
--clear-errors, -k Clear error counters after read
--clear-counts, -K Clear data counters after read
--load-cache <file> filename of ibnetdiscover cache to load
--outstanding_smps, -o <val> specify the number of outstanding
SMP's

 which should be issued during the
scan
--config, -z <config> use config file, default:
/etc/infiniband-diags/ibdiag.conf
--Ca, -C <ca> Ca name to use
--Port, -P <port> Ca port number to use
--timeout, -t <ms> timeout in ms
--m_key, -y <key> M_Key to use in request
--errors, -e show send and receive errors
--verbose, -v increase verbosity level
--debug, -d raise debug level
--help, -h help message
--version, -V show version

```

## smpquery

Issues Adaptive routing-related queries to the fabric switch.

Syntax

```

Supported ops (and aliases, case insensitive):
 ARInfo (ARI) <addr>

```

```

 ARGroupTable (ARGT) <addr> [<plft>] [<group_table>]
 [<blocknum>]
 ARLFTTable (ARLT) <addr> [<plft>] [<blocknum>]
 PLFTInfo (PLFTI) <addr>
 PLFTDef (PLFTD) <addr> [<blocknum>]
 PLFTMap (PLFTM) <addr> [<plft>] [<control_map>]
 PortSLToPLFTMap (PLFTP) <addr> [<blocknum>]
 RNSubGroupDirectionTable (DIRT) <addr> [<blocknum>]
 RNGenStringTable (GSTR) <addr> [<plft>] [<blocknum>]
 RNGenBySubGroupPriority (GSGP) <addr>
 RNRcvString (RSTR) <addr> [<blocknum>]
 RNXmitPortMask (RNXM) <addr> [<blocknum>]
 PortRNCounters (RNPC) <addr>

```

#### Options:

##### Main

```

 -C|--Ca <ca> : Ca name to use
 -P|--Port <port> : Ca port number to use
 -D|--Direct : use Direct address

```

##### argument

```

 -L|--Lid : use LID address argument
 -h|--help : help message
 -V|--version : show version
 -d|--debug : Print debug logs

```

## saquery

Issues SA queries.

### Syntax

```

saquery [-h -d -P -N -L -G -s -g][<name>]

```

Queries node records by default.

|                                           |                                                                                                                                                                                                                |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| d                                         | Enables debugging                                                                                                                                                                                              |
| P                                         | Gets PathRecord info                                                                                                                                                                                           |
| N                                         | Gets NodeRecord info                                                                                                                                                                                           |
| L (-L)                                    | Returns just the Lid of the name specified                                                                                                                                                                     |
| G (-G)                                    | Returns just the Guid of the name specified                                                                                                                                                                    |
| S (-S)                                    | Returns the PortInfoRecords with isSM capability mask bit on                                                                                                                                                   |
| G (-g)                                    | on                                                                                                                                                                                                             |
| L (-l)                                    | Gets multicast group info                                                                                                                                                                                      |
| O (-O)                                    | Returns the unique Lid of the name specified                                                                                                                                                                   |
| m(-m)                                     | Returns name for the Lid specified                                                                                                                                                                             |
| x (-x)                                    | Gets multicast member info (if multicast group specified, list member GIDs only for group specified for example 'saquery -m 0xC000')                                                                           |
| c (-c)                                    |                                                                                                                                                                                                                |
| S (-S)                                    |                                                                                                                                                                                                                |
| l (-l)                                    | Gets LinkRecord info"                                                                                                                                                                                          |
| list (-D)                                 | Gets the SA's class port info                                                                                                                                                                                  |
| src-to-dst (<src:dst>)                    | Gets ServiceRecord info                                                                                                                                                                                        |
| sgid-to-dgid (<sgid-dgid>)                | Gets InformlInfoRecord (subscription) info                                                                                                                                                                     |
| node-name-map                             | the node desc of the CA's                                                                                                                                                                                      |
| smkey <val>                               | Gets a PathRecord for <src:dst> where src and dst are either node names or LIDs                                                                                                                                |
| slid <lid>                                |                                                                                                                                                                                                                |
| dlid <lid>                                | Gets a PathRecord for <sgid-dgid> where sgid and dgid are addresses in IPv6 format                                                                                                                             |
| mild <lid>                                |                                                                                                                                                                                                                |
| sgid <gid>                                | Specifies a node name map file                                                                                                                                                                                 |
| dgid <gid>                                | SA SM_Key value for the query. If non-numeric value (like 'x') is specified then saquery will prompt for a value. Default (when not specified here or in ibdiag.conf) is to use SM_Key == 0 (or \"untrusted\") |
| gid <gid>                                 |                                                                                                                                                                                                                |
| mgid <gid>                                |                                                                                                                                                                                                                |
| Reversible", 'r', 1, NULL"                |                                                                                                                                                                                                                |
| numb_path ", 'n', 1, NULL"                | Source LID (PathRecord)                                                                                                                                                                                        |
| pkey: P_Key (PathRecord, MCMemberRecord). | Destination LID (PathRecord)                                                                                                                                                                                   |
| qos_class (-Q)                            | Multicast LID (MCMemberRecord)                                                                                                                                                                                 |
| sl                                        | Source GID (IPv6 format) (PathRecord)                                                                                                                                                                          |
| mtu : (-M)                                | Destination GID (IPv6 format) (PathRecord)                                                                                                                                                                     |
| rate (-R)                                 | Port GID (MCMemberRecord)                                                                                                                                                                                      |
| pkt_lifetime                              | Multicast GID (MCMemberRecord)                                                                                                                                                                                 |
| qkey (-q) (PathRecord, MCMemberRecord).   | Reversible path (PathRecord)                                                                                                                                                                                   |
| tclass (-T)                               | Number of paths (PathRecord)                                                                                                                                                                                   |
| flow_label : (-F)                         |                                                                                                                                                                                                                |
| hop_limit : (-H)                          | QoS Class (PathRecord)                                                                                                                                                                                         |
| scope                                     | Service level (PathRecord, MCMemberRecord)                                                                                                                                                                     |
| join_state (-j)                           | MTU and selector (PathRecord, MCMemberRecord)                                                                                                                                                                  |
| proxy_join (-X)                           | Rate and selector (PathRecord, MCMemberRecord)                                                                                                                                                                 |
| service_id                                | Packet lifetime and selector (PathRecord, MCMemberRecord)                                                                                                                                                      |
|                                           | If non-numeric value (like 'x') is specified then saquery will prompt for a value.                                                                                                                             |
|                                           | Traffic Class (PathRecord, MCMemberRecord)                                                                                                                                                                     |
|                                           | Flow Label (PathRecord, MCMemberRecord)                                                                                                                                                                        |
|                                           | Hop limit (PathRecord, MCMemberRecord)                                                                                                                                                                         |

|                                                                                                                |
|----------------------------------------------------------------------------------------------------------------|
| Scope (MCMemberRecord)<br>Join state (MCMemberRecord)<br>Proxy join (MCMemberRecord)<br>ServiceID (PathRecord) |
|----------------------------------------------------------------------------------------------------------------|

Dependencies: OpenSM libvendor, OpenSM libopensm, libibumad

## ibsysstat

```
ibsysstat [options] <dest lid|guid> [<op>]
```

Nonstandard flags:

Current supported operations:

```
ping - verify connectivity to server (default)
host - obtain host information from server
cpu - obtain cpu information from server
-o <oui> use specified OUI number to multiplex vendor mads
-S start in server mode (do not return)
```

## ibnetsplit

Automatically groups hosts and creates scripts that can be run in order to split the network into sub-networks containing one group of hosts.

Syntax

- Group:

```
ibnetsplit [-v][-h][-g grp-file] -s <.lst|.net|.topo> <-r
head-ports|-d max-dist>
```

- Split:

```
ibnetsplit [-v][-h][-g grp-file] -s <.lst|.net|.topo>
-o out-dir
```

- Combined:

```
ibnetsplit [-v][-h][-g grp-file] -s <.lst|.net|.topo> <-r
head-ports|-d max-dist> -o out-dir
```

## Usage

- Grouping:

The grouping is performed if the -r or -d options are provided.

- If the -r is provided with a file containing group head ports, the algorithm examines the hosts distance from the set of node ports provided in the head-ports file (these are expected to be the ports running standby SM's).
- If the -d is provided with a maximum distance of the hosts in each group, the algorithm partition the hosts by that distance.

### **Note**

This method of analyzation may not be suitable for some topologies.

The results of the identified groups are printed into the file defined by the -g option (default ibnetsplit.groups) and can be manually edited. For groups where the head port is a switch, the group file uses the FIRST host port as the port to run the isolation script from.

- Splitting:

- If the -o flag is included, this algorithm analyzes the MinHop table of the topology and identifies the set of links and switches that may potentially be used for routing each group ports. The cross-switch links between switches of the group to other switches are declared as split-links and the commands to turn them off using Directed Routes from the original Group Head ports are written into the out-dir provided by the -o flag.

Both stages require a subnet definition file to be provided by the -s flag. The supported formats for subnet definition are:

- \*.net - for ibnetdiscover
- \*.lst - for opensm-subnet.lst or ibiagnet.lst
- \*.topo - for a topology file

#### HEAD PORTS FILE

This file is provided by the user and defines the ports by which grouping of the other host ports is defined.

#### **Format:**

Each line should contain either the name or the GUID of a single port. For switches the port number shall be 0.

```
<node-name>/P<port-num> | <PGUID>
```

#### GROUPS FILE

This file is generated by the program if the head-ports file is provided to it. Alternatively it can be provided (or edited) by the user if different grouping is desired. The generated script for isolating or connecting the group should be run from the first node in each group.

#### Format:

Each line may be either:

```
GROUP: <group name>
```

```
<node-name>/P<port-num>|<PGUID>
```

## **ibdiagnet**

ibdiagnet scans the fabric using directed route packets and extracts all the available information regarding its connectivity and devices.

It then produces the following files in the output directory (see below):

- "ibdiagnet2.log" - A log file with detailed information.
- "ibdiagnet2.db\_csv" - A dump of the internal tool database.
- "ibdiagnet2.lst" - A list of all the nodes, ports and links in the fabric.
- "[ibdiagnet2.pm](#)" - A dump of all the nodes PM counters.
- "ibdiagnet2.mlnx\_cntrs" - A dump of all the nodes Mellanox diagnostic counters.
- "ibdiagnet2.net\_dump" - A dump of all the links and their features.
- "ibdiagnet2.pkey" - A list of all pkeys found in the fabric.
- "ibdiagnet2.aguid" - A list of all alias GUIDs found in the fabric.
- "[ibdiagnet2.sm](#)" - A dump of all the SM (state and priority) in the fabric.
- "ibdiagnet2.fdfs" - A dump of unicast forwarding tables of the fabric switches.
- "ibdiagnet2.mcfdfs" - A dump of multicast forwarding tables of the fabric switches.
- "ibdiagnet2.svl" - A dump of SLVL tables of the fabric switches.
- "ibdiagnet2.nodes\_info" - A dump of all the nodes vendor specific general information for nodes who supports it.
- "ibdiagnet2.plft" - A dump of Private LFT Mapping of the fabric switches.
- "[ibdiagnet2.ar](#)" - A dump of Adaptive Routing configuration of the fabric switches.
- "ibdiagnet2.vl2vl" - A dump of VL to VL configuration of the fabric switches.

### **Load plugins from:**

## /tmp/ibutils2/share/ibdiagnet2.1.1/plugins/

You can specify additional paths to be looked in with "IBDIAGNET\_PLUGINS\_PATH" env variable.

| Plugin Name                          | Result    | Comment       |
|--------------------------------------|-----------|---------------|
| libibdiagnet_cable_diag_plugin-2.1.1 | Succeeded | Plugin loaded |
| libibdiagnet_phy_diag_plugin-2.1.1   | Succeeded | Plugin loaded |

## Syntax

```
[-i|--device <dev-name>] [-p|--port <port-num>]
[-g|--guid <GUID in hex>] [--skip <stage>]
[--skip_plugin <library name>] [--sc]
[--scr] [--pc] [-P|--counter <<PM>=<value>>]
[--pm_pause_time <seconds>] [--ber_test]
[--ber_thresh <value>] [--llr_active_cell <64|128>]
[--extended_speeds <dev-type>] [--pm_per_lane]
[--ls <2.5|5|10|14|25|FDR10|EDR20>]
[--lw <1x|4x|8x|12x>] [--screen_num_errs <num>]
[--smp_window <num>] [--gmp_window <num>]
[--max_hops <max-hops>] [--read_capability <file name>]
[--write_capability <file name>]
[--back_compat_db <version.sub_version>]
[-V|--version] [-h|--help] [-H|--deep_help]
[--virtual] [--mads_timeout <mads-timeout>]
[--mads_retries <mads-retries>] [-m|--map <map-file>]
[--vlr <file>] [-r|--routing] [--r_opt <[vs,][mcast,]>]
[--sa_dump <file>] [-u|--fat_tree]
[--scope <file.guid>] [--exclude_scope <file.guid>]
[-w|--write_topo_file <file name>]
[-t|--topo_file <file>] [--out_ibnl_dir <directory>]
[-o|--output_path <directory>]
Cable Diagnostic (Plugin)
```

```
[--get_cable_info] [--cable_info_disconnected]
Phy Diagnostic (Plugin)
[--get_phy_info] [--reset_phy_info]
```

## Options

```
-i|--device <dev-name> : Specifies the name of the device
of the port
 used to connect to the IB fabric
(in case
 of multiple devices on he local
system).
-p|--port <port-num> : Specifies the local device's port
number
 used to connect to the IB fabric.
-g|--guid <GUID in hex> : Specifies the local port GUID
value of the
 port used to connect to the IB
fabric. If
 GUID given is 0 than ibdiagnet
displays
 a list of possible port GUIDs and
waits
 for user input.
--skip <stage> : Skip the executions of the given
stage.
 Applicable skip stages
(vs_cap_smp
 vs_cap_gmp | links | pm |
 speed_width_check | all).
--skip_plugin <library name> : Skip the load of the given
library name.
 Applicable skip plugins:
```

|                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>2.1.1  </p> <p>2.1.1).</p> <p>--sc<br/>counters</p> <p>--scr<br/>counters (if -sc</p> <p>--pc<br/>counters.</p> <p>-P --counter &lt;&lt;PM&gt;=&lt;value&gt;&gt;<br/>greater than</p> <p>it.</p> <p>--pm_pause_time &lt;seconds&gt;<br/>between</p> <p>second counters</p> <p>than no</p> <p>done.</p> <p>--ber_test<br/>port.</p> <p>and check no</p> <p>threshold.</p> <p>--ber_thresh &lt;value&gt;<br/>for the</p> <p>number of the</p> | <p>(libibdiagnet_cable_diag_plugin-<br/>libibdiagnet_phy_diag_plugin-<br/>: Provides a report of Mellanox</p> <p>: Reset all the Mellanox<br/>option selected).</p> <p>: Reset all the fabric PM</p> <p>: If any of the provided PM is<br/>its provided value than print</p> <p>: Specifies the seconds to wait<br/>first counters sample and<br/>sample. If seconds given is 0<br/>second counters sample will be<br/>(default=1).</p> <p>:Provides a BER test for each<br/>Calculate BER for each port<br/>BER value has exceeds the BER<br/>(default threshold="10^-12").</p> <p>:Specifies the threshold value<br/>BER test. The reciprocal</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Example: for

0 than all

be

--llr\_active\_cell <64|128>  
cell size

active in the

--extended\_speeds <dev-type>  
extended speeds

all).

--pm\_per\_lane  
(when

--ls <0|2.5|5|10|14|25|50|100|FDR10>  
link speed.

--lw <1x|4x|8x|12x>  
link width.

--screen\_num\_errs <num>  
for printing

(default=5).

--smp\_window <num>  
(default=8).

--gmp\_window <num>  
(default=128).

--max\_hops <max-hops>  
for the

BER should be provided.

$10^{-12}$  than value need to be  
1000000000000 or 0xe8d4a51000  
( $10^{12}$ ).If threshold given is

BER values for all ports will

reported.

: Specifies the LLR active

for BER test, when LLR is

fabric.

: Collect and test port

counters. dev-type: (sw |

: List all counters per lane

available).

: Specifies the expected

: Specifies the expected

: Specifies the threshold

errors to screen.

: Max smp MADs on wire.

: Max gmp MADs on wire.

: Specifies the maximum hops

|                                        |                                                         |
|----------------------------------------|---------------------------------------------------------|
| (default=64).                          | discovery process.                                      |
| --read_capability <file name>          | : Specifies capability masks configuration file, giving |
| capability                             | mask configuration for the                              |
| fabric.                                | ibdiagnet will use this                                 |
| mapping for                            | Vendor Specific MADs                                    |
| sending.                               |                                                         |
| --write_capability <file name>         | : Write out an example file                             |
| for                                    | capability masks                                        |
| configuration,                         | and also the default                                    |
| capability                             | masks for some devices.                                 |
| --back_compat_db <version.sub_version> | : Show ports section in                                 |
| according to                           | "ibdiagnet2.db_csv"                                     |
| version 2.0.                           | given version. Default                                  |
| -V --version                           | : Prints the version of the                             |
| tool.                                  |                                                         |
| -h --help                              | : Prints help information                               |
| (without                               | plugins help if exists).                                |
| -H --deep_help                         | : Prints deep help                                      |
| information                            | (including plugins help).                               |
| --virtual                              | : Discover VPorts during                                |
| discovery                              | stage.                                                  |
| --mads_timeout <mads-timeout>          | : Specifies the timeout (in                             |

|                                              |                                              |
|----------------------------------------------|----------------------------------------------|
| and received                                 | milliseconds) for sent                       |
|                                              | mads. (default=500).                         |
| --mads_retries <mads-retries><br>retries for | : Specifies the number of                    |
| (default=2).                                 | every timeout mad.                           |
| -m --map <map-file><br>that maps             | : Specifies mapping file,                    |
| "name").                                     | node guid to name<br>(format: 0x[0-9a-fA-F]+ |
| specified by                                 | Mapping file can also be                     |
|                                              | Environment variable                         |
| "IBUTILS_NODE_NAME_MAP_FILE_PATH".           |                                              |
| --src_lid <src-lid>                          | : source lid                                 |
| --dest_lid <dest-lid>                        | : destination lid                            |
| --dr_path <dr-path>                          | : direct route path                          |
| -o --output_path <directory><br>where the    | : Specifies the directory                    |
| placed.                                      | Output files will be                         |
| (default="/var/tmp/ibdiagpath/").            |                                              |
| Cable Diagnostic (Plugin)                    |                                              |
| --get_cable_info<br>QSFP cables              | : Indicates to query all                     |
| Cable                                        | for cable information.                       |
| stored                                       | information will be                          |
|                                              | in "ibdiagnet2.cables".                      |
| --cable_info_disconnected<br>disconnected    | : Get cable info on                          |

```

Phy Diagnostic (Plugin)
--get_phy_info : Indicates to query all
ports for phy information.
--reset_phy_info : Indicates to clear all
ports phy information.

```

### Cable Diagnostic (Plugin):

This plugin performs cable diagnostic. It can collect cable info (vendor, PN, OUI etc..) on each valid QSFP cable, if specified.

It produces the following files in the output directory (see below):

- "ibdiagnet2.cables" - In case specified to collect cable info, this file will contain all collected cable info.

### Phy Diagnostic (Plugin)

This plugin performs phy diagnostic.

### Load Plugins from:

```
/tmp/ibutils2/share/ibdiagnet2.1.1/plugins/
```

You can specify additional paths to be looked in with "IBDIAGNET\_PLUGINS\_PATH" env variableLoad plugins from:

| Plugin Name                                    | Result    | Comment |
|------------------------------------------------|-----------|---------|
| libibdiagnet_cable_diag_plugin-2.1.1<br>loaded | Succeeded | Plugin  |
| libibdiagnet_phy_diag_plugin-2.1.1<br>loaded   | Succeeded | Plugin  |

## Syntax

```
[-i|--device <dev-name>] [-p|--port <port-num>]
[-g|--guid <GUID in hex>] [--skip <stage>]
[--skip_plugin <library name>] [--sc]
[--scr] [--pc] [-P|--counter <<PM>=<value>>]
[--pm_pause_time <seconds>] [--ber_test]
[--ber_thresh <value>] [--llr_active_cell <64|128>]
[--extended_speeds <dev-type>] [--pm_per_lane]
[--ls <2.5|5|10|14|25|FDR10|EDR20>]
[--lw <1x|4x|8x|12x>] [--screen_num_errs <num>]
[--smp_window <num>] [--gmp_window <num>]
[--max_hops <max-hops>] [--read_capability <file name>]
[--write_capability <file name>]
[--back_compat_db <version.sub_version>]
[-V|--version] [-h|--help] [-H|--deep_help]
[--virtual] [--mads_timeout <mads-timeout>]
[--mads_retries <mads-retries>] [-m|--map <map-file>]
[--src_lid <src-lid>] [--dest_lid <dest-lid>]
[--dr_path <dr-path>] [-o|--output_path <directory>]
Cable Diagnostic (Plugin)
[--get_cable_info] [--cable_info_disconnected]
Phy Diagnostic (Plugin)
[--get_phy_info] [--reset_phy_info]
```

## Options

|                              |                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -i --device <dev-name>       | :Specifies the name of the device of the port used to connect to the IB fabric (in case of multiple devices on the local system).                                                     |
| -p --port <port-num>         | :Specifies the local device's port number used to connect to the IB fabric.                                                                                                           |
| -g --guid <GUID in hex>      | :Specifies the local port GUID value of the port used to connect to the IB fabric. If GUID given is 0 than ibdiagnet displays a list of possible port GUIDs and waits for user input. |
| --skip <stage>               | :Skip the executions of the given stage. Applicable skip stages: (vs_cap_smp   vs_cap_gmp   links   pm   speed_width_check   all).                                                    |
| --skip_plugin <library name> | :Skip the load of the given library name. Applicable skip plugins: (libibdiagnet_cable_diag_plugin-2.1.1   libibdiagnet_phy_diag_plugin-2.1.1).                                       |
| --sc                         |                                                                                                                                                                                       |
| --scr                        | :Provides a report of Mellanox counters                                                                                                                                               |

|                                                            |                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>--pc</code>                                          | :Reset all the Mellanox counters (if <code>-sc</code> option selected).                                                                                                                                                                                          |
| <code>-P --counter &lt;&lt;PM&gt;=&lt;value&gt;&gt;</code> | :Reset all the fabric PM counters.<br>:If any of the provided PM is greater then its provided value than print it.                                                                                                                                               |
| <code>--pm_pause_time &lt;seconds&gt;</code>               | :Specifies the seconds to wait between first counters sample and second counters sample. If seconds given is 0 than no second counters sample will be done. (default=1).                                                                                         |
| <code>--ber_test</code>                                    | :Provides a BER test for each port. Calculate BER for each port and check no BER value has exceeds the BER threshold.(default threshold="10^-12").                                                                                                               |
| <code>--ber_thresh &lt;value&gt;</code>                    | :Specifies the threshold value for the BER test. The reciprocal number of the BER should be provided. Example: for 10^-12 than value need to be 1000000000000 or 0xe8d4a51000(10^12).If threshold given is 0 than all BER values for all ports will be reported. |
| <code>--llr_active_cell &lt;64 128&gt;</code>              | :Specifies the LLR active cell size for BER test, when LLR is active in the fabric.                                                                                                                                                                              |
| <code>--extended_speeds &lt;dev-type&gt;</code>            | :Collect and test port extended speeds counters. dev-type: (sw   all).                                                                                                                                                                                           |
| <code>--pm_per_lane</code>                                 | :List all counters per lane (when available).                                                                                                                                                                                                                    |
| <code>--ls &lt;2.5 5 10 14 25 FD R10 EDR20&gt;</code>      | :Specifies the expected link speed.                                                                                                                                                                                                                              |
| <code>--lw &lt;1x 4x 8x 12x&gt;</code>                     | :Specifies the expected link width.                                                                                                                                                                                                                              |
| <code>--screen_num_errs &lt;num&gt;</code>                 | :Specifies the threshold for printing errors to screen. (default=5).                                                                                                                                                                                             |
| <code>--smp_window &lt;num&gt;</code>                      | :Max smp MADs on wire. (default=8).                                                                                                                                                                                                                              |
| <code>--gmp_window &lt;num&gt;</code>                      | :Max gmp MADs on wire. (default=128).                                                                                                                                                                                                                            |
| <code>--max_hops &lt;max-hops&gt;</code>                   | :Specifies the maximum hops for the discovery process.(default=64).                                                                                                                                                                                              |
| <code>--read_capability &lt;file name&gt;</code>           | :Specifies capability masks configuration file, giving capability mask configuration for the fabric. ibdiagnet will use this mapping for Vendor Specific MADs sending.                                                                                           |
| <code>--write_capability &lt;file name&gt;</code>          | :Write out an example file for capability masks configuration, and also the default capability masks for some devices.                                                                                                                                           |
| <code>--back_compat_db &lt;version.sub_version&gt;</code>  | :Show ports section in "ibdiagnet2.db_csv" according to given version. Default version 2.0.                                                                                                                                                                      |
| <code>-V --version</code>                                  | :Prints the version of the tool.                                                                                                                                                                                                                                 |
| <code>-h --help</code>                                     | :Prints help information (without plugins help if exists).                                                                                                                                                                                                       |
| <code>-H --deep_help</code>                                | :Prints deep help information (including plugins help).                                                                                                                                                                                                          |
| <code>--virtual</code>                                     | :Discover VPorts during discovery stage.                                                                                                                                                                                                                         |
| <code>--mads_timeout &lt;mads-timeout&gt;</code>           | :Specifies the timeout (in milliseconds) for sent and received mads.(default=500).                                                                                                                                                                               |
| <code>--mads_retries &lt;mads-retries&gt;</code>           | :Specifies the number of retries for every timeout mad.(default=2).                                                                                                                                                                                              |
| <code>-m --map &lt;map-file&gt;</code>                     | :Specifies mapping file, that maps node guid to name (format: 0x[0-9a-fA-F]+ "name"). Mapping file can also be specified by environment variable "IBUTILS_NODE_NAME_MAP_FILE_PATH".                                                                              |
| <code>--src_lid &lt;src-lid&gt;</code>                     | :source lid                                                                                                                                                                                                                                                      |
| <code>--dest_lid &lt;dest-lid&gt;</code>                   | :destination lid                                                                                                                                                                                                                                                 |
| <code>--dr_path &lt;dr-path&gt;</code>                     | :direct route path                                                                                                                                                                                                                                               |
| <code>-o --output_path &lt;directory&gt;</code>            | :Specifies the directory where the output files will be placed. (default="/var/tmp/ibdiagpath/").                                                                                                                                                                |
| <code>Cable Diagnostic (Plugin)</code>                     | :Indicates to query all QSFP cables for cable information. Cable information will be stored in "ibdiagnet2.cables".                                                                                                                                              |
| <code>--get_cable_info</code>                              | :Get cable info on disconnected ports.                                                                                                                                                                                                                           |
| <code>--</code>                                            |                                                                                                                                                                                                                                                                  |
| <code>cable_info_disconnected</code>                       | :Indicates to query all ports for phy information.                                                                                                                                                                                                               |
| <code>ed</code>                                            | :Indicates to clear all ports phy information.                                                                                                                                                                                                                   |

Phy Diagnostic (Plugin)  
--get\_phy\_info  
--reset\_phy\_info

# Appendix - Supported Port Counters and Events

Port counters and events are available in the following views:

- Events and Port Counters area, at the bottom of the UFM window
- Error window (Error tab) in the Manage Devices tab
- In the New Monitoring Session window, in the Monitor tab, when clicking Create New Session
- Event Log in the Log tab (click Show Event Log)

## InfiniBand Port Counters

The following tables list and describe the port counters and events currently supported:

- InfiniBand Port Counters
- Calculated Port Counters

| <i>InfiniBand Port Counters</i> |                                                                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter                         | Description                                                                                                                                                                                                                                                                                                |
| Xmit Data (in bytes)            | Total number of data octets, divided by 4, transmitted on all VLs from the port, including all octets between (and not including) the start of packet delimiter and the VCRC, and may include packets containing errors. All link packets are excluded. Results are reported as a multiple of four octets. |
| Rcv Data (in bytes)             | Total number of data octets, divided by 4, received on all VLs at the port. All octets between (and not including) the start of packet delimiter and the VCRC are excluded                                                                                                                                 |

| <i>InfiniBand Port Counters</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | and may include packets containing errors. All link packets are excluded. When the received packet length exceeds the maximum allowed packet length specified in C7-45: the counter may include all data octets exceeding this limit. Results are reported as a multiple of four octets.                                                                                                                                                                                                                 |
| Xmit Packets                    | Total number of packets transmitted on all VLs from the port, including packets with errors and excluding link packets.                                                                                                                                                                                                                                                                                                                                                                                  |
| Rcv Packets                     | Total number of packets, including packets containing errors and excluding link packets, received from all VLs on the port.                                                                                                                                                                                                                                                                                                                                                                              |
| Rcv Errors                      | Total number of packets containing errors that were received on the port including: <ul style="list-style-type: none"> <li>• Local physical errors (ICRC, VCRC, LPCRC, and all physical errors that cause entry into the BAD PACKET or BAD PACKET DISCARD states of the packet receiver state machine)</li> <li>• Malformed data packet errors (LVer, length, VL)</li> <li>• Malformed link packet errors (operand, length, VL)</li> <li>• Packets discarded due to buffer overrun (overflow)</li> </ul> |
| Xmit Discards                   | Total number of outbound packets discarded by the port when the port is down or congested for the following reasons: <ul style="list-style-type: none"> <li>• Output port is not in the active state</li> <li>• Packet length has exceeded NeighborMTU</li> <li>• Switch Lifetime Limit exceeded</li> <li>• Switch HOQ Lifetime Limit exceeded, including packets discarded while in VLStalled State.</li> </ul>                                                                                         |

| <i>InfiniBand Port Counters</i> |                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symbol Errors                   | Total number of minor link errors detected on one or more physical lanes.                                                                                                                                                                                                                                         |
| Link Error Recovery             | Total number of times the Port Training state machine has successfully completed the link error recovery process.                                                                                                                                                                                                 |
| Link Error Downed               | Total number of times the Port Training state machine has failed the link error recovery process and downed the link.                                                                                                                                                                                             |
| Local Integrity Error           | The number of times that the count of local physical errors exceeded the threshold specified by LocalPhyErrors                                                                                                                                                                                                    |
| Rcv Remote Physical Error       | Total number of packets marked with the EBP delimiter received on the port.                                                                                                                                                                                                                                       |
| Xmit Constraint Error           | Total number of packets not transmitted from the switch physical port for the following reasons: <ul style="list-style-type: none"> <li>• FilterRawOutbound is true and packet is raw</li> <li>• PartitionEnforcementOutbound is true and packet fails partition key check or IP version check</li> </ul>         |
| Rcv Constraint Error            | Total number of packets received on the switch physical port that are discarded for the following reasons: <ul style="list-style-type: none"> <li>• FilterRawInbound is true and packet is raw</li> <li>• PartitionEnforcementInbound is true and packet fails partition key check or IP version check</li> </ul> |
| Excess Buffer Overrun Error     | The number of times that OverrunErrors consecutive flow control update periods occurred, each having at least one overrun error                                                                                                                                                                                   |
| Rcv Switch Relay Error          | Total number of packets received on the port that were discarded when they could not be                                                                                                                                                                                                                           |

| <i>InfiniBand Port Counters</i> |                                                                                                                                                                                                      |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>forwarded by the switch relay for the following reasons:</p> <ul style="list-style-type: none"> <li>• DLID mapping</li> <li>• VL mapping</li> <li>• Looping (output port = input port)</li> </ul> |
| VL15 Dropped                    | Number of incoming VL15 packets dropped because of resource limitations (e.g., lack of buffers) in the port                                                                                          |
| XmitWait                        | The number of ticks during which the port selected by PortSelect had data to transmit but no data was sent during the entire tick because of insufficient credits or of lack of arbitration.         |

| <i>InfiniBand Calculated Port Counters</i> |                                                                                                                                                                                         |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter                                    | Description                                                                                                                                                                             |
| Normalized XmitData                        | Effective port bandwidth utilization in %<br>XmitData incremental/ Link Capacity                                                                                                        |
| Normalized Congested Bandwidth             | Amount of bandwidth that was suppressed due to congestion<br>(XmitWait incremental/ Time) * Link Capacity<br>Separate counters are used for Tier 4 ports and for the rest of the ports. |

## Supported Traps and Events

Device events are listed as VDM or CDM in the Source column of the Events table in the UFM GUI. For information about defining event policy, see [Events Policy](#).

| Alarm ID | Alarm Name             | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 64       | GID Address In Service | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification | SM     |

| Alarm ID | Alarm Name                          | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category             | Source    |
|----------|-------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|----------------------|-----------|
| 65       | GID Address Out of Service          | 1      | 0     | Warning          | 1                 | 0           | Port           | Fabric Notification  | SM        |
| 66       | New MCast Group Created             | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification  | SM        |
| 67       | MCast Group Deleted                 | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification  | SM        |
| 110      | Symbol Error                        | 1      | 1     | Warning          | 200               | 0           | Port           | Hardware             | Telemetry |
| 111      | Link Error Recovery                 | 1      | 1     | Minor            | 1                 | 0           | Port           | Hardware             | Telemetry |
| 112      | Link Downed                         | 1      | 1     | Critical         | 0                 | 0           | Port           | Hardware             | Telemetry |
| 113      | Port Receive Errors                 | 1      | 1     | Minor            | 5                 | 0           | Port           | Hardware             | Telemetry |
| 114      | Port Receive Remote Physical Errors | 0      | 0     | Minor            | 5                 | 0           | Port           | Hardware             | Telemetry |
| 115      | Port Receive Switch Relay Errors    | 1      | 1     | Minor            | 50                | 0           | Port           | Fabric Configuration | Telemetry |

| Alarm ID | Alarm Name                                | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source    |
|----------|-------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|-----------|
| 116      | Port Xmit Discards                        | 1      | 1     | Minor            | 200               | 0           | Port           | Communication Error | Telemetry |
| 117      | Port Xmit Constraint Errors               | 1      | 1     | Minor            | 1                 | 0           | Port           | Communication Error | Telemetry |
| 118      | Port Receive Constraint Errors            | 1      | 1     | Minor            | 1                 | 0           | Port           | Communication Error | Telemetry |
| 119      | Local Link Integrity Errors               | 1      | 1     | Minor            | 5                 | 0           | Port           | Hardware            | Telemetry |
| 120      | Excessive Buffer Overrun Errors           | 1      | 1     | Minor            | 1                 | 0           | Port           | Communication Error | Telemetry |
| 121      | VL15 Dropped                              | 1      | 1     | Minor            | 500               | 0           | Port           | Communication Error | Telemetry |
| 122      | Congested Bandwidth (%) Threshold Reached | 1      | 1     | Minor            | 10                | 0           | Port           | Hardware            | Telemetry |
| 123      | Port Bandwi                               | 1      | 1     | Minor            | 95                | 0           | Port           | Communication       | Telemetry |

| Alarm ID | Alarm Name                                 | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source    |
|----------|--------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|-----------|
|          | dth (%) Threshold Reached                  |        |       |                  |                   |             |                | Error               |           |
| 130      | Non-optimal link width                     | 1      | 1     | Minor            | 1                 | 0           | Port           | Hardware            | SM        |
| 134      | T4 Port Congested Bandwidth                | 1      | 1     | Warning          | 10                | 0           | Port           | Communication Error | Telemetry |
| 141      | Flow Control Update Watchdog Timer Expired | 1      | 0     | Warning          | 1                 | 0           | Port           | Hardware            | SM        |
| 144      | Capability Mask Modified                   | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification | SM        |
| 145      | System Image GUID changed                  | 1      | 0     | Info             | 1                 | 0           | Port           | Communication Error | SM        |
| 156      | Link Speed Enforcement Disabled            | 1      | 0     | Critical         | 0                 | 0           | Site           | Fabric Notification | SM        |

| Alarm ID | Alarm Name                     | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source    |
|----------|--------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|-----------|
| 250      | Running in Limited Mode        | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | Licensing |
| 251      | Switching to Limited Mode      | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | Licensing |
| 252      | License Expired                | 1      | 1     | Warning          | 1                 | 0           | Grid           | Maintenance | Licensing |
| 253      | Duplicated licenses            | 1      | 0     | Critical         | 1                 | 0           | Grid           | Maintenance | Licensing |
| 254      | License Limit Exceeded         | 1      | 0     | Critical         | 1                 | 0           | Grid           | Maintenance | Licensing |
| 255      | License is About to Expire     | 1      | 0     | Warning          | 1                 | 0           | Grid           | Maintenance | Licensing |
| 256      | Bad M_Key                      | 1      | 0     | Minor            | 1                 | 0           | Port           | Security    | SM        |
| 257      | Bad P_Key                      | 1      | 0     | Minor            | 1                 | 0           | Port           | Security    | SM        |
| 258      | Bad Q_Key                      | 1      | 0     | Minor            | 1                 | 0           | Port           | Security    | SM        |
| 259      | Bad P_Key Switch External Port | 1      | 0     | Critical         | 1                 | 0           | Port           | Security    | SM        |

| Alarm ID | Alarm Name                  | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category        | Source |
|----------|-----------------------------|--------|-------|------------------|-------------------|-------------|----------------|-----------------|--------|
| 328      | Link is Up                  | 1      | 1     | Info             | 1                 | 10          | Link           | Fabric Topology | SM     |
| 329      | Link is Down                | 1      | 1     | Warning          | 1                 | 10          | Site           | Fabric Topology | SM     |
| 331      | Node is Down                | 1      | 0     | Warning          | 1                 | 60          | Site           | Fabric Topology | SM     |
| 332      | Node is Up                  | 1      | 0     | Info             | 1                 | 60          | Site           | Fabric Topology | SM     |
| 336      | Port Action Succeeded       | 1      | 0     | Info             | 1                 | 0           | Port           | Maintenance     | UFM    |
| 337      | Port Action Failed          | 1      | 0     | Minor            | 1                 | 0           | Port           | Maintenance     | UFM    |
| 338      | Device Action Succeeded     | 1      | 0     | Info             | 1                 | 0           | Port           | Maintenance     | UFM    |
| 339      | Device Action Failed        | 1      | 0     | Minor            | 1                 | 0           | Port           | Maintenance     | UFM    |
| 344      | Partial Switch ASIC Failure | 1      | 1     | Critical         | 1                 | 0           | Switch         | Maintenance     | UFM    |
| 352      | Network Added               | 1      | 0     | Info             | 1                 | 0           | Network        | Logical Model   | UFM    |

| Alarm ID | Alarm Name                | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category      | Source |
|----------|---------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------|--------|
| 353      | Network Removed           | 1      | 0     | Info             | 1                 | 0           | Network        | Logical Model | UFM    |
| 380      | Switch Upgrade Error      | 1      | 1     | Critical         | 1                 | 0           | Switch         | Maintenance   | UFM    |
| 381      | Switch Upgrade Failed     | 1      | 0     | Info             | 1                 | 0           | Switch         | Maintenance   | UFM    |
| 382      | Module status NOT PRESENT | 1      | 1     | Warning          | 1                 | 0           | Switch         | Module Status | UFM    |
| 383      | Host Upgrade Failed       | 1      | 0     | Info             | 1                 | 0           | Computer       | Maintenance   | UFM    |
| 384      | Switch Module Powered Off | 1      | 1     | Info             | 1                 | 0           | Switch         | Module Status | UFM    |
| 385      | Switch FW Upgrade Started | 1      | 0     | Info             | 1                 | 0           | Switch         | Maintenance   | UFM    |
| 386      | Switch SW Upgrade Started | 1      | 0     | Info             | 1                 | 0           | Switch         | Maintenance   | UFM    |
| 387      | Switch Upgrade            | 1      | 0     | Info             | 1                 | 0           | Switch         | Maintenance   | UFM    |

| Alarm ID | Alarm Name                           | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|--------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          | Finished                             |        |       |                  |                   |             |                |                     |        |
| 388      | Host FW Upgrade Started              | 1      | 0     | Info             | 1                 | 0           | Computer       | Maintenance         | UFM    |
| 389      | Host OFED Upgrade Started            | 1      | 0     | Info             | 1                 | 0           | Computer       | Maintenance         | UFM    |
| 391      | Switch Module Removed                | 1      | 0     | Info             | 1                 | 0           | Switch         | Fabric Notification | Switch |
| 392      | Module Temperature Threshold Reached | 1      | 0     | Info             | 60                | 0           | Module         | Hardware            | Switch |
| 393      | Switch Module Added                  | 1      | 0     | Info             | 1                 | 0           | Switch         | Fabric Notification | Switch |
| 394      | Module Status FAULT                  | 1      | 1     | Critical         | 1                 | 0           | Switch         | Module Status       | Switch |
| 395      | Device Action Started                | 1      | 0     | Info             | 1                 | 0           | Port           | Maintenance         | UFM    |
| 396      | Site Action Started                  | 1      | 0     | Info             | 1                 | 0           | Port           | Maintenance         | UFM    |

| Alarm ID | Alarm Name                           | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|--------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 397      | Site Action Failed                   | 1      | 0     | Minor            | 1                 | 0           | Port           | Maintenance         | UFM    |
| 398      | Switch Chip Added                    | 1      | 0     | Info             | 1                 | 0           | Switch         | Fabric Notification | Switch |
| 399      | Switch Chip Removed                  | 1      | 0     | Critical         | 1                 | 0           | Switch         | Fabric Notification | Switch |
| 403      | Device Pending Reboot                | 1      | 1     | Warning          | 0                 | 0           | Device         | Maintenance         | UFM    |
| 404      | System Information is missing        | 1      | 1     | Warning          | 1                 | 0           | Switch         | Communication Error | UFM    |
| 405      | Switch Identity Validation Failed    | 1      | 1     | Warning          | 1                 | 0           | Switch         | Communication Error | UFM    |
| 406      | Switch System Information is missing | 1      | 1     | Warning          | 1                 | 0           | Switch         | Communication Error | UFM    |
| 407      | COMEX Ambient Temperature Threshold  | 1      | 1     | Minor            | 60                | 0           | Switch         | Hardware            | Switch |

| Alarm ID | Alarm Name              | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|-------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          | Reached                 |        |       |                  |                   |             |                |                     |        |
| 408      | Switch is Unresponsive  | 1      | 1     | Critical         | 1                 | 0           | Switch         | Communication Error | UFM    |
| 502      | Device Upgrade Finished | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance         | UFM    |
| 506      | Device Upgrade Finished | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance         | UFM    |
| 508      | Core Dump Created       | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 510      | SM Failover             | 0      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notification | SM     |
| 511      | SM State Change         | 0      | 1     | Info             | 1                 | 0           | Grid           | Fabric Notification | SM     |
| 512      | SM UP                   | 0      | 1     | Info             | 1                 | 0           | Grid           | Fabric Notification | SM     |
| 513      | SM System Log Message   | 0      | 1     | Minor            | 1                 | 0           | Grid           | Fabric Notification | SM     |
| 514      | SM LID Change           | 0      | 1     | Warning          | 1                 | 0           | Grid           | Fabric Notification | SM     |

| Alarm ID | Alarm Name                               | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          |                                          |        |       |                  |                   |             |                | tion                |        |
| 515      | Fabric Health Report Info                | 1      | 1     | Info             | 1                 | 0           | Grid           | Fabric Notification | UFM    |
| 516      | Fabric Health Report Warning             | 1      | 1     | Warning          | 1                 | 0           | Grid           | Fabric Notification | UFM    |
| 517      | Fabric Health Report Error               | 1      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notification | UFM    |
| 518      | UFM-related process is down              | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 519      | Logs purge failure                       | 1      | 1     | Minor            | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 520      | Restart of UFM-related process succeeded | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 521      | UFM is being stopped                     | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 522      | UFM is being restarted                   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |

| Alarm ID | Alarm Name                           | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|--------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 523      | UFM failover is being attempted      | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 524      | UFM cannot connect to DB             | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 525      | Disk utilization threshold reached   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 526      | Memory utilization threshold reached | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 527      | CPU utilization threshold reached    | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 528      | Fabric interface is down             | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                   | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 529      | UFM standby server problem   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 530      | SM is down                   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 531      | DRBD Bad Condition           | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 532      | Remote UFM-SM Sync           | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 533      | Remote UFM-SM problem        | 1      | 1     | Critical         | 1                 | 0           | Site           | Maintenance | UFM    |
| 536      | UFM Health Watchdog Info     | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 537      | UFM Health Watchdog Critical | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 538      | Time Diff Between HA Servers | 1      | 1     | Warning          | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                          | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|-------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 539      | DRBD TCP Connection Performance     | 1      | 1     | Warning          | 1                 | 0           | Grid           | Maintenance | UFM    |
| 540      | Daily Report Completed successfully | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 541      | Daily Report Completed with Error   | 1      | 0     | Minor            | 1                 | 0           | Grid           | Maintenance | UFM    |
| 542      | Daily Report Failed                 | 1      | 0     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 543      | Daily Report Mail Sent successfully | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 544      | Daily Report Mail Sent Failed       | 1      | 0     | Minor            | 1                 | 0           | Grid           | Maintenance | UFM    |
| 545      | SM is not responding                | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                          | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|-------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 546      | Management interface is down        | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 547      | UFM stopped polling SM for updates  | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 548      | Failed to run generic script test   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 551      | General External Event Notification | 1      | 0     | Info             | 0                 | 0           | Grid           | Maintenance | UFM    |
| 552      | General External Event Notice       | 1      | 0     | Minor            | 0                 | 0           | Grid           | Maintenance | UFM    |
| 553      | General External Event Alert        | 1      | 0     | Warning          | 0                 | 0           | Grid           | Maintenance | UFM    |
| 554      | General External Event Error        | 1      | 0     | Critical         | 0                 | 0           | Grid           | Maintenance | UFM    |
| 560      | User Connec                         | 1      | 0     | Info             | 1                 | 0           | Grid           | Security    | UFM    |

| Alarm ID | Alarm Name                        | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|-----------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          | ted                               |        |       |                  |                   |             |                |                     |        |
| 561      | User Disconnected                 | 1      | 0     | Info             | 1                 | 0           | Grid           | Security            | UFM    |
| 602      | UFM Server Failover               | 1      | 1     | Critical         | 1                 | 0           | Site           | Fabric Notification | UFM    |
| 603      | Events Suppression                | 1      | 0     | Critical         | 0                 | 0           | Site           | Maintenance         | UFM    |
| 604      | Report Succeeded                  | 1      | 1     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 605      | Report Failed                     | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 606      | Correction Attempts Paused        | 1      | 0     | Warning          | 1                 | 0           | Site           | Fabric Notification | UFM    |
| 610      | Monitoring History Enabled        | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 611      | Monitoring History Disabled       | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 612      | Monitoring History Bad Connection | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |

| Alarm ID | Alarm Name                                | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|-------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 613      | Monitoring History Connection Established | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 614      | Monitoring History Inconsistent Version   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 615      | Monitoring History Failed save metadata   | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 616      | Monitoring History Failed update metadata | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 617      | Monitoring History Failed save data       | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 618      | Monitoring History Failed                 | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                                         | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|----------------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
|          | get metadata                                       |        |       |                  |                   |             |                |             |        |
| 619      | Monitoring History Failed get data                 | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 620      | Monitoring History Failed remove file              | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 621      | Monitoring History version not matches UFM version | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 622      | Monitoring History Purge DB Occurred               | 1      | 1     | Warning          | 1                 | 0           | Grid           | Maintenance | UFM    |
| 623      | Monitoring History Migration is not                | 1      | 1     | Warning          | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                                                    | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|---------------------------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
|          | completed                                                     |        |       |                  |                   |             |                |             |        |
| 624      | Monitoring History partition utilization threshold reached    | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |
| 625      | Monitoring History local report files are about to be cleaned | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 626      | Monitoring History oldest DB table is about to be removed     | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance | UFM    |
| 627      | Monitoring History partition is not                           | 1      | 0     | Critical         | 1                 | 0           | Grid           | Maintenance | UFM    |

| Alarm ID | Alarm Name                             | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|----------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          | mounted                                |        |       |                  |                   |             |                |                     |        |
| 701      | Non-optimal Link Speed                 | 1      | 1     | Minor            | 1                 | 0           | Port           | Hardware            | UFM    |
| 702      | Unhealthy IB Port                      | 1      | 1     | Warning          | 1                 | 0           | Port           | Hardware            | SM     |
| 703      | Fabric Collector Connected             | 1      | 0     | Info             | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 704      | Fabric Collector Disconnected          | 1      | 1     | Critical         | 1                 | 0           | Grid           | Maintenance         | UFM    |
| 750      | High data retransmission count on port | 1      | 1     | Warning          | 500               | 0           | Port           | Hardware            | SM     |
| 901      | Fabric Configuration Started           | 0      | 1     | Info             | 1                 | 0           | Grid           | Fabric Notification | UFM    |
| 902      | Fabric Configuration Completed         | 0      | 1     | Info             | 1                 | 0           | Grid           | Fabric Notification | UFM    |
| 903      | Fabric Configu                         | 0      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notifica     | UFM    |

| Alarm ID | Alarm Name                       | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source    |
|----------|----------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|-----------|
|          | ration Failed                    |        |       |                  |                   |             |                | tion                |           |
| 904      | Device Configuration Failure     | 0      | 1     | Critical         | 1                 | 0           | Device         | Fabric Notification | UFM       |
| 905      | Device Configuration Timeout     | 0      | 1     | Critical         | 1                 | 0           | Device         | Fabric Notification | UFM       |
| 906      | Provisioning Validation Failure  | 0      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notification | UFM       |
| 907      | Switch is Down                   | 1      | 1     | Critical         | 1                 | 120         | Site           | Fabric Topology     | UFM       |
| 908      | Switch is Up                     | 1      | 1     | Info             | 1                 | 120         | Site           | Fabric Topology     | UFM       |
| 909      | Director Switch is Down          | 1      | 1     | Critical         | 1                 | 300         | Site           | Fabric Topology     | UFM       |
| 910      | Director Switch is Up            | 1      | 1     | Info             | 1                 | 300         | Site           | Fabric Topology     | UFM       |
| 911      | Module Temperature Low Threshold | 1      | 1     | Warning          | 0                 | 0           | Module         | Hardware            | Telemetry |

| Alarm ID | Alarm Name                                                             | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category      | Source    |
|----------|------------------------------------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------|-----------|
|          | Reached (Unmanaged IB switches only)                                   |        |       |                  |                   |             |                |               |           |
| 912      | Module Temperature High Threshold Reached (Unmanaged IB switches only) | 1      | 1     | Critical         | 0                 | 0           | Module         | Hardware      | Telemetry |
| 913      | Module High Voltage                                                    | 1      | 1     | Warning          | 15                | 0           | Switch         | Module Status | Telemetry |
| 914      | Module High Current                                                    | 1      | 1     | Warning          | 10                | 0           | Switch         | Module Status | Telemetry |
| 915      | Critical BER reported                                                  | 1      | 1     | Critical         | 10                | 0           | Port           | Hardware      | Telemetry |
| 916      | High BER reported                                                      | 1      | 1     | Warning          | 10                | 0           | Port           | Hardware      | Telemetry |
| 917      | Critical Symbol BER reported                                           | 1      | 1     | Critical         | 10                | 0           | Port           | Hardware      | Telemetry |

| Alarm ID | Alarm Name                              | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category | Source    |
|----------|-----------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|----------|-----------|
| 918      | High Symbol BER reported                | 1      | 1     | Warning          | 10                | 0           | Port           | Hardware | Telemetry |
| 919      | Cable Temperature High                  | 1      | 1     | Critical         | 1                 | 0           | Port           | Hardware | UFM       |
| 920      | Cable Temperature Low                   | 1      | 1     | Critical         | 1                 | 0           | Port           | Hardware | UFM       |
| 1300     | SA Key violation                        | 1      | 1     | Warning          | 5                 | 0           | Port           | Security | SM        |
| 1301     | SGID Spoofed                            | 1      | 1     | Warning          | 5                 | 0           | Port           | Security | SM        |
| 1302     | SA High Rate detected                   | 1      | 1     | Warning          | 5                 | 0           | Port           | Security | SM        |
| 1303     | Multicast subscriptions over limit      | 1      | 1     | Warning          | 5                 | 0           | Port           | Security | SM        |
| 1304     | Service Record subscriptions over limit | 1      | 1     | Warning          | 5                 | 0           | Port           | Security | SM        |

| Alarm ID | Alarm Name                                        | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|---------------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 1305     | Event subscriptions over limit                    | 1      | 1     | Warning          | 5                 | 0           | Port           | Security            | SM     |
| 1306     | Unallowed SM was detected in the fabric           | 1      | 1     | Warning          | 0                 | 0           | Port           | Fabric Notification | SM     |
| 1307     | SMInfo SET request was received from unallowed SM | 1      | 1     | Warning          | 0                 | 0           | Port           | Fabric Notification | SM     |
| 1309     | SM was detected with non-matching SMKey           | 1      | 1     | Warning          | 0                 | 0           | Port           | Fabric Notification | SM     |
| 1310     | Duplicated node GUID was detected                 | 1      | 1     | Critical         | 1                 | 0           | Device         | Fabric Notification | SM     |
| 1311     | Duplicated port GUID                              | 1      | 1     | Critical         | 1                 | 0           | Port           | Fabric Notification | SM     |

| Alarm ID | Alarm Name                  | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source   |
|----------|-----------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|----------|
|          | was detected                |        |       |                  |                   |             |                |                     |          |
| 1312     | Switch was Rebooted         | 1      | 1     | Info             | 1                 | 0           | Device         | Fabric Notification | UFM      |
| 1315     | Topo Config File Error      | 1      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notification | UFM      |
| 1316     | Topo Config Subnet Mismatch | 1      | 1     | Critical         | 1                 | 0           | Grid           | Fabric Notification | Topodiff |
| 1321     | Link Flaps                  | 1      | 0     | Warning          | 0                 | 10          | Site           | Fabric Topology     | SM       |
| 1400     | High Ambient Temperature    | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware            | Switch   |
| 1401     | High Fluid Temperature      | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware            | Switch   |
| 1402     | Low Fluid Level             | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware            | Switch   |
| 1403     | Low Supply Pressure         | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware            | Switch   |

| Alarm ID | Alarm Name                 | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category | Source |
|----------|----------------------------|--------|-------|------------------|-------------------|-------------|----------------|----------|--------|
| 1404     | High Supply Pressure       | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1405     | Low Return Pressure        | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1406     | High Return Pressure       | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1407     | High Differential Pressure | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1408     | Low Differential Pressure  | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1409     | System Fail Safe           | 1      | 1     | Warning          | 0                 | 0           | Switch         | Hardware | Switch |
| 1410     | Fault Critical             | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1411     | Fault Pump1                | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1412     | Fault Pump2                | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1413     | Fault Fluid Level Critical | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |

| Alarm ID | Alarm Name                         | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category | Source |
|----------|------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|----------|--------|
| 1414     | Fault Fluid Over Temperature       | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1415     | Fault Primary DC                   | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1416     | Fault Redundant DC                 | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1417     | Fault Fluid Leak                   | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1418     | Fault Sensor Failure               | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1419     | Cooling Device Monitoring Error    | 1      | 0     | Critical         | 0                 | 0           | Grid           | Hardware | Switch |
| 1420     | Cooling Device Communication Error | 1      | 1     | Critical         | 0                 | 0           | Switch         | Hardware | Switch |
| 1500     | New cable detected                 | 1      | 0     | Info             | 1                 | 0           | Link           | Security | UFM    |
| 1502     | Cable detected in a                | 1      | 0     | Warning          | 1                 | 0           | Link           | Security | UFM    |

| Alarm ID | Alarm Name                          | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|-------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
|          | new location                        |        |       |                  |                   |             |                |             |        |
| 1503     | Duplicate Cable Detected            | 1      | 0     | Critical         | 1                 | 0           | Link           | Security    | UFM    |
| 1504     | SHARP Allocation Succeeded          | 1      | 1     | Info             | 1                 | 0           | Grid           | SHARP       | SHARP  |
| 1505     | SHARP Allocation Failed             | 1      | 0     | Warning          | 1                 | 0           | Grid           | SHARP       | SHARP  |
| 1506     | SHARP Deallocation Succeeded        | 1      | 0     | Info             | 1                 | 0           | Grid           | SHARP       | SHARP  |
| 1507     | SHARP Deallocation Failed           | 1      | 0     | Warning          | 1                 | 0           | Grid           | SHARP       | SHARP  |
| 1508     | Device Collect System Dump Started  | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance | UFM    |
| 1509     | Device Collect System Dump Finished | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance | UFM    |

| Alarm ID | Alarm Name                               | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|------------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 1510     | Device Collect System Dump Error         | 1      | 0     | Critical         | 1                 | 0           | Device         | Maintenance         | UFM    |
| 1511     | Virtual Port Added                       | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification | SM     |
| 1512     | Virtual Port Removed                     | 1      | 0     | Warning          | 1                 | 0           | Port           | Fabric Notification | SM     |
| 1513     | Burn Cables Transceivers Started         | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance         | UFM    |
| 1514     | Burn Cables Transceivers Finished        | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance         | UFM    |
| 1515     | Burn Cables Transceivers Failed          | 1      | 0     | Warning          | 1                 | 0           | Device         | Maintenance         | UFM    |
| 1516     | Activate Cables Transceivers FW Finished | 1      | 0     | Info             | 1                 | 0           | Device         | Maintenance         | UFM    |

| Alarm ID | Alarm Name                             | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category    | Source |
|----------|----------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|-------------|--------|
| 1517     | Activate Cables Transceivers FW Failed | 1      | 0     | Warning          | 1                 | 0           | Device         | Maintenance | UFM    |
| 1520     | Aggregation Node Discovery Failed      | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1521     | Job Started                            | 1      | 0     | Info             | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1522     | Job Ended                              | 1      | 0     | Info             | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1523     | Job Start Failed                       | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1524     | Job Error                              | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1525     | Trap QP Error                          | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1526     | Trap Invalid Request                   | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |
| 1527     | Trap Sharp Error                       | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP       | SHARP  |

| Alarm ID | Alarm Name                           | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|--------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 1528     | Trap QP Alloc timeout                | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1529     | Trap AMKey Violation                 | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1530     | Unsupported Trap                     | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1531     | Reservation Updated                  | 1      | 0     | Info             | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1532     | Sharp is not Responding              | 1      | 0     | Critical         | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1533     | Agg Node Active                      | 1      | 0     | Info             | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1534     | Agg Node Inactive                    | 1      | 0     | Warning          | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1535     | Trap AMKey Violation Triggered by AM | 1      | 0     | Warning          | 1                 | 0           | SHARP AM       | SHARP               | SHARP  |
| 1550     | GUIDs Were Added to Pkey             | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification | UFM    |

| Alarm ID | Alarm Name                            | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|---------------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
| 1551     | GUIDs Were Removed from Pkey          | 1      | 0     | Info             | 1                 | 0           | Port           | Fabric Notification | UFM    |
| 1600     | VS/CC Classes Key Violation           | 1      | 0     | Warning          | 1                 | 0           | Port           | Security            | SM     |
| 1601     | Tenant Access Violation               | 1      | 0     | Warning          | 1                 | 0           | Port           | Security            | SM     |
| 1602     | PCI Speed Degradation Warning         | 1      | 1     | Critical         | 1                 | 0           | Port           | Fabric Notification | UFM    |
| 1603     | PCI Width Degradation Warning         | 1      | 1     | Critical         | 1                 | 0           | Port           | Fabric Notification | UFM    |
| 1604     | Non-optimal aggregated port bandwidth | 1      | 1     | Warning          | 1                 | 0           | Port           | Hardware            | UFM    |
| 1605     | Routing Engine                        | 1      | 1     | Warning          | 1                 | 0           | Switch         | Fabric Notification | UFM    |

| Alarm ID | Alarm Name                    | To Log | Alarm | Default Severity | Default Threshold | Default TTL | Related Object | Category            | Source |
|----------|-------------------------------|--------|-------|------------------|-------------------|-------------|----------------|---------------------|--------|
|          | Action Remove                 |        |       |                  |                   |             |                |                     |        |
| 1606     | Routing Engine Action Recover | 1      | 1     | Info             | 1                 | 0           | Switch         | Fabric Notification | UFM    |
| 1612     | Database File is Corrupted    | 1      | 1     | Critical         | 0                 | 10          | Grid           | Maintenance         | UFM    |

## Appendix – Used Ports

The following is the list of ports used by the UFM Server for internal and external communication:

| Port                 | Purpose                                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 25(tcp)              | Used by smtp mail server, for sending daily reports and events summary via email                                                                    |
| 80(tcp), 443(tcp)    | Used by WS clients (Apache Web Server)                                                                                                              |
| 8000(udp)            | Used for UFM server listening for REST API requests (redirected by Apache web server)                                                               |
| 6306(udp)            | Used for Multicast requests – communication with latest UFM Agents<br><u>Closed</u> by default (as UFM Agent is deprecated and disabled by default) |
| 8081(tcp), 8082(tcp) | Used for internal communication with Subnet Manager                                                                                                 |

Optional ports, in case working with HA nodes

| Port                                  | Purpose                                                                  |
|---------------------------------------|--------------------------------------------------------------------------|
| 2224(tcp)                             | Used by pacemaker for communication between the two UFM HA nodes         |
| 7788(udp)                             | Used by DRBD for filesystem synchronization between the two UFM HA nodes |
| 5403(tcp),<br>5404(tcp),<br>5405(udp) | Used by corosync port                                                    |

## Appendix – Configuration Files Auditing

The main purpose of this feature is to allow users to track changes made to selected configuration files. When activating the feature, all the changes are reflected in specific log files which contain information about the changes and when they took place.

### To activate this feature:

In *TrackConfig* section in *gv.cfg*, file value of *track\_config* key should be set to **true** and value of *track\_conf\_files* key should contain a comma-separated list of defined conf files to be tracked.

By default – ALL conf-files are tracked. To activate the feature, after *track\_config* key is set to true, the UFM server should be restarted.

Example:

```
[TrackConfig]
track config files changes
track_config = true
Could be selected options (comaseparated) UFM, SM, SHARP,
Telemetry. Or ALL for all the files.
track_conf_files = ALL
```

The below lists the configuration files that can be tracked:

| Conf File Alias | Configuration Files                                       |
|-----------------|-----------------------------------------------------------|
| UFM             | /opt/ufm/files/conf/gv.cfg                                |
| SM              | /opt/ufm/files/conf/opensm/opensm.conf                    |
| SHARP           | /opt/ufm/files/conf/sharp2/sharp_am.cfg                   |
| Telemetry       | /opt/ufm/files/conf/telemetry/launch_ibdiagnet_config.ini |
| ALL             | All the above configuration files.                        |

Once the feature is activated and the UFM server is restarted, the UFM generates file which list the changes made in each of the tracked conf files. These files are located in */opt/ufm/files/auditing/* directory and the file naming convention is as follows: original conf file name with audit.log suffix.

Example: For gv.cfg, the name of the changes-tracking file is gv.cfg.audit.log. Changes are stored in auditing files in “linux diff”-like format.

```
cat /opt/ufm/files/auditing/gv.cfg.audit.log
=== Change occurred at 2022-07-24 07:31:48.679247 ===

+++
@@ -45,7 +45,7 @@
mon_mode_discovery_period = 60
check_interface_retry = 5
The number of times to try if the InfiniBand fabric interface is
down. The duration of each retry is 1 second.
-ibport_check_retries = 90
+ibport_check_retries = 92
ws_address = UNDEFINED
ws_port = 8088
ws_protocol = https
```

## Appendix – IB Router

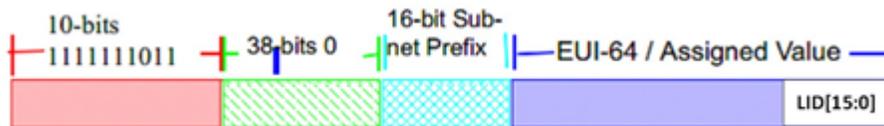
IB router provides the ability to send traffic between two or more IB subnets thereby potentially expanding the size of the network to over 40k end-ports, enabling separation and fault resilience between islands and IB subnets, and enabling connection to different topologies used by different subnets.

The forwarding between the IB subnets is performed using GRH lookup. The IB router's basic functionality includes:

- Removal of current L2 LRH (local routing header)
- Routing table lookup – using GID from GRH
- Building new LRH according to the destination according to the routing table

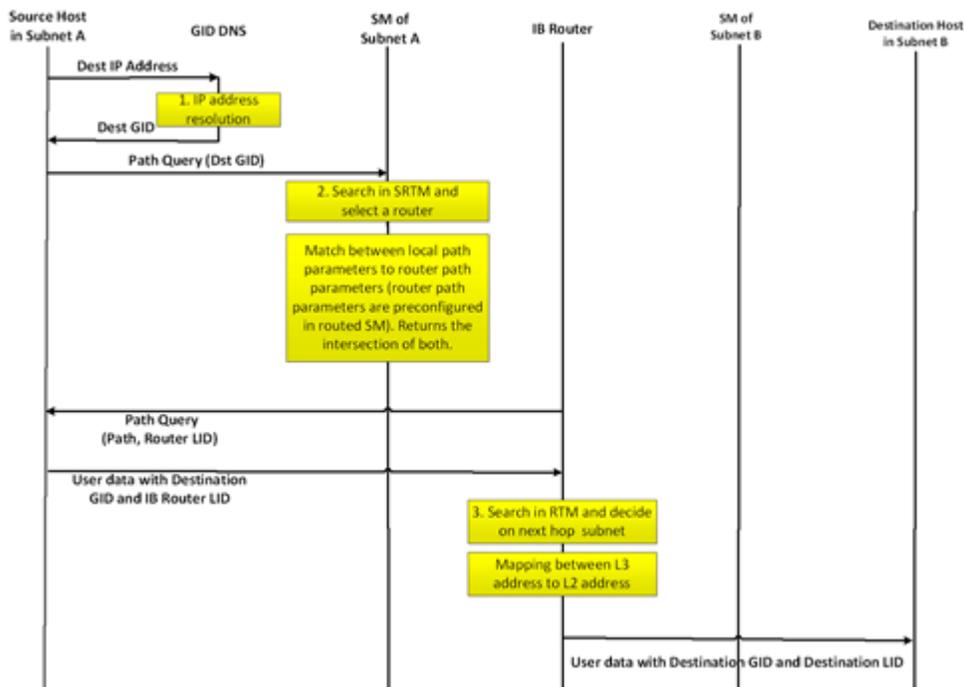
The DLID in the new LRH is built using simplified GID-to-LID mapping (where LID = 16 LSB bits of GID) thereby not requiring to send for ARP query/lookup.

### **Site-Local Unicast GID Format**



For this to work, the SM allocates an alias GID for each host in the fabric where the alias GID = {subnet prefix[127:64], reserved[63:16], LID[15:0]}. Hosts should use alias GIDs in order to transmit traffic to peers on remote subnets.

### **Host-to-Host IB Router Unicast Flow**



## IB Router Scripts

The following scripts are supplied as part of UFM installation package.

### set\_num\_of\_subnets.sh

- **Arguments**

```
/opt/ufm/scripts/ib_router/set_num_of_subnets.sh --hostname
<hostname> --username <username> --password <password> --num-
of-subnets <num-of-subnets>
```

- **Description** – Configures system profile to InfiniBand allowing multiple switch IDs

- **Syntax Description**

|          |                                  |
|----------|----------------------------------|
| hostname | IB router hostname or IP address |
| username | IB router username               |
| password | IB router user password          |

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| num-of-subnets | Specified number of subnets (AKA SWIDs) to be initialized by the system. Value range: 2-6 |
|----------------|-------------------------------------------------------------------------------------------|

- **Example**

```
/opt/ufm/scripts/ib_router/set_num_of_subnets.sh --hostname 10.6.204.12 --username admin --password admin --num-of-subnets 6
```

**i Note**

As a result of running this script, reboot is performed and all configuration is removed

## add\_interfaces\_to\_subnet.sh

- **Arguments**

```
/opt/ufm/scripts/ib_router/add_interfaces_to_subnet.sh --hostname <hostname> --username <username> --password <password> --interface <interface | interface-range> --subnet <subnet>
```

- **Description**

Maps an interface to a subnet and enables it

- **SyntaxDescription**

|                                |                                                                                                                                             |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| hostname                       | IB router hostname or IP address                                                                                                            |
| username                       | IB router username                                                                                                                          |
| password                       | IB router user password                                                                                                                     |
| interface  <br>interface-range | Single IB interface or range of IB interfaces.<br>Single IB interface: 1/<interface><br>Range of IB interfaces: 1/<interface>-1/<interface> |
| subnet                         | Name of IB subnet (AKA SWID): infiniband-default, infiniband-1...<br>infiniband-5                                                           |

- **Example**

```
/opt/ufm/scripts/ib_router/add_interfaces_to_subnet.sh --
hostname 10.6.204.12 --username admin --password admin --
interface 1/1-1/6 --subnet infiniband-1
```

## remove\_interfaces\_from\_subnet.sh

- **Arguments**

```
/opt/ufm/scripts/ib_router/remove_interfaces_from_subnet.sh
--hostname <hostname> --username <username> --password
<password> --interface <interface | interface-range>
```

- **Description**

Un-maps an interface from a subnet after it has been disabled

- **Syntax Description**

|          |                                  |
|----------|----------------------------------|
| hostname | IB router hostname or IP address |
| username | IB router username               |

|                             |                                                                                                                                             |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| password                    | IB router user password                                                                                                                     |
| interface   interface-range | Single IB interface or range of IB interfaces.<br>Single IB interface: 1/<interface><br>Range of IB interfaces: 1/<interface>-1/<interface> |

- **Example**

```
/opt/ufm/scripts/ib_router/remove_interfaces_from_subnet.sh
--hostname 10.6.204.12 --username admin --password admin --
interface 1/6Example
```

## add\_subnet\_to\_router.sh

- **Arguments**

```
/opt/ufm/scripts/ib_router/add_subnet_to_router.sh --hostname
<hostname> --username <username> --password <password> --
subnet <subnet>
```

- **Description**

Creates routing on IB subnet interface and enables routing on that interface

- **Syntax Description**

|          |                                                                               |
|----------|-------------------------------------------------------------------------------|
| hostname | IB router hostname or IP address                                              |
| username | IB router username                                                            |
| password | IB router user password                                                       |
| subnet   | Name of IB subnet (AKA SWID): infiniband-default, infiniband-1...infiniband-5 |

- **Example**

```
/opt/ufm/scripts/ib_router/add_subnet_to_router.sh --hostname
10.6.204.12 --username admin --password admin --subnet
infiniband-3Example
```

### **Note**

As a result of running this script, the set of commands that allow control of IB router functionality is being enabled

## **remove\_subnet\_from\_router.sh**

- **Arguments**

```
/opt/ufm/scripts/ib_router/remove_subnet_from_router.sh --
hostname <hostname> --username <username> --password
<password> --subnet <subnet>
```

- **Description**

Destroys routing on IB subnet interface after routing on that interface has been disabled

- **Syntax Description**

|          |                                        |
|----------|----------------------------------------|
| hostname | IB router<br>hostname or IP<br>address |
| username | IB router<br>username                  |

|          |                                                                                         |
|----------|-----------------------------------------------------------------------------------------|
| password | IB router user password                                                                 |
| subnet   | Name of IB subnet (AKA SWID):<br>infiniband-default,<br>infiniband-1...<br>infiniband-5 |

- **Example**

```
/opt/ufm/scripts/ib_router/remove_subnet_from_router.sh --
hostname 10.6.204.12 --username admin --password admin --
subnet infiniband-defaultExample
```

## set\_ufm\_sm\_router\_support.sh

- **Arguments**

```
/opt/ufm/scripts/ib_router/set_ufm_sm_router_support.sh [-c
<subnet prefix>] [-r][-h]
```

- **Description**

[-c <subnet prefix>]: Used for updating OpenSM configuration file with new subnet prefix and forces OpenSM to re-read configuration.

[-r]: Used for resetting OpenSM configuration to default value and canceling IB routing.

- **Syntax Description**

|    |                                                                                         |
|----|-----------------------------------------------------------------------------------------|
| -c | Configure new IB subnet prefix. Should be followed by new IB router subnet prefix value |
| -r | Reset to default                                                                        |
| -h | Show help                                                                               |

- **Example**

```
/opt/ufm/scripts/ib_router/set_ufm_sm_router_support.sh -c
0xfec0000000001234Examples
```

```
/opt/ufm/scripts/ib_router/set_ufm_sm_router_support.sh -r
```

## IB Router Configuration

**Step 1:** Configure multi-switch. Run:

```
/opt/ufm/scripts/set_num_of_subnets.sh --hostname 10.6.204.12 --
username admin --password admin --num-of-subnets 6
```

**Step 2:** Map interface to a subnet. Run:

```
/opt/ufm/scripts/add_ports_to_subnet.sh --hostname 10.6.204.12 --
username admin --password admin --interface 1/1 --subnet
infiniband-default
```

**Step 3:** Create routing on IB subnet interface. Run:

```
/opt/ufm/scripts/add_subnet_to_router.sh --hostname 10.6.204.12
--username admin --password admin --subnet infiniband-default
```

## Appendix – NVIDIA SHARP Integration

### NVIDIA Scalable Hierarchical Aggregation and Reduction Protocol (SHARP)<sup>™</sup>

NVIDIA SHARP is a technology that improves the performance of MPI operation by offloading collective operations from the CPU and dispatching to the switch network, and eliminating the need to send data multiple times between endpoints. This approach decreases the amount of data traversing the network as aggregation nodes are reached, and dramatically reduces the MPI operation time.

NVIDIA SHARP software is based on:

- Hardware capabilities in Switch-IB<sup>™</sup> 2
- Hierarchical communication algorithms (HCOL) library into which NVIDIA SHARP capabilities are integrated
- NVIDIA SHARP daemons, running on the compute nodes
- NVIDIA SHARP Aggregation Manager, running on UFM

1. These components should be installed from HPCX or MLNX\_OFED packages on compute nodes. Installation details can be found in SHARP Deployment Guide.

### NVIDIA SHARP Aggregation Manager

Aggregation Manager (AM) is a system management component used for system level configuration and management of the switch-based reduction capabilities. It is used to set up the NVIDIA SHARP trees, and to manage the use of these entities.

AM is responsible for:

- NVIDIA SHARP resource discovery
- Creating topology aware NVIDIA SHARP trees

- Configuring NVIDIA SHARP switch capabilities
- Managing NVIDIA SHARP resources
- Assigning NVIDIA SHARP resource upon request
- Freeing NVIDIA SHARP resources upon job termination

AM is configured by a topology file created by Subnet Manager (SM): subnet.lst. The file includes information about switches and HCAs.

## NVIDIA SHARP AM Prerequisites

In order for UFM to run NVIDIA SHARP AM, the following conditions should be met:

- Managed InfiniBand fabric must include at least one of the following Switch-IB 2 switches with minimal firmware version of 15.1300.0126:
  - CS7500
  - CS7510
  - CS7520
  - MSB7790
  - MSB7800
- NVIDIA SHARP software capability should be enabled for all Switch-IB 2 switches in the fabric (a dedicated logical port #37, for NVIDIA SHARP packets transmission, should be enabled and should be visible via UFM).
- UFM OpenSM should be running to discover the fabric topology.

NVIDIA SHARP AM is tightly dependent on OpenSM as it uses the topology discovered by OpenSM.

- NVIDIA SHARP AM should be enabled in UFM configuration by running:

```
[Sharp]
sharp_enabled = true
```

Alternatively, you may run the command "ib sharp enable".

## NVIDIA SHARP AM Configuration

By default, when running NVIDIA SHARP AM by UFM, there is no need to run further configuration. To modify the configuration of NVIDIA SHARP AM, you can edit the following NVIDIA SHARP AM configuration file:

```
/opt/ufm/files/conf/sharp/sharp_am.cfg .conf/sharp/sharp_am.cfg.
```

## Running NVIDIA SHARP AM in UFM

➤ *To run NVIDIA SHARP AM within UFM, do the following:*

1. Make sure that the root GUID configuration file (root\_guid.conf) exists in conf/opensm. This file is required for activating NVIDIA SHARP AM.
2. Enable NVIDIA SHARP in conf/opensm/opensm.conf OpenSM configuration file by running "ib sm sharp enable" or by setting the sharp\_enabled parameter to 2:

```
SHArP support
0: Ignore SHArP - No SHArP support
1: Disable SHArP - Disable SHArP on all supporting switches
2: Enable SHArP - Enable SHArP on all supporting switches
sharp_enabled 2
```

3. Make sure that port #6126 (on which NVIDIA SHARP AM is communicating with NVIDIA SHARP daemons) is not being used by any other application. If the port is being used, you can change it by modifying **smx\_sock\_port** parameter in the NVIDIA SHARP AM configuration file: conf/sharp2/sharp\_am.cfg or via the command "ib sharp port".
4. Enable NVIDIA SHARP AM in conf/gv.cfg UFM configuration file by running the command "ib sharp enable" or by setting the sharp\_enabled parameter to true (it is false by default):

```
[Sharp]
sharp_enabled = true
```

5. (Optional) Enable NVIDIA SHARP allocation in conf/gv.cfg UFM configuration file by setting the sharp\_allocation\_enabled parameter to true (it is false by default):

```
[Sharp]
sharp_allocation_enabled = true
```

### Note

If the field sharp\_enabled, and sharp\_allocation\_enabled are both set as true in gv.cfg, UFM sends an allocation (reservation) request to NVIDIA SHARP Aggregation Manager (AM) to allocate a list of GUIDs to the specified PKey when a new “Set GUIDs for PKey” REST API is called. If an empty list of GUIDs is sent, a PKEY deallocation request is sent to the SHARP AM.

NVIDIA SHARP allocations (reservations) allow SHARP users to run jobs on top of these resource (port GUID) allocations for the specified PKey. For more information, please refer to the *UFM REST API Guide* under Actions REST API → PKey GUIDs → Set/Update PKey GUIDs.

## Operating NVIDIA SHARP AM with UFM

If NVIDIA SHARP AM is enabled, running UFM will run NVIDIA SHARP AM, and stopping UFM will stop NVIDIA SHARP AM.

To

 **start UFM with NVIDIA SHARP AM (enabled):**

```
/etc/init.d/ufmd start
```

The same command applies to HA, using `/etc/init.d/ufmha`.

Upon startup of UFM or SHARP Aggregation Manager, UFM will resend all existing persistent allocation to SHARP AM.

➤ **To stop UFM with NVIDIA SHARP AM (enabled):**

```
/etc/init.d/ufmd stop
```

➤ **To stop only NVIDIA SHARP AM while leaving UFM running:**

```
/etc/init.d/ufmd sharp_stop
```

➤ **To start only NVIDIA SHARP AM while UFM is already running:**

```
/etc/init.d/ufmd sharp_start
```

Upon startup of UFM or SHARP Aggregation Manager, UFM will resend all existing persistent allocation to SHARP AM.

**To restart only NVIDIA SHARP AM while UFM is running:**

```
/etc/init.d/ufmd sharp_restart
```

Upon startup of UFM or SHARP Aggregation Manager, UFM will resend all existing persistent allocation to SHARP AM.

**To display NVIDIA SHARP AM status while UFM is running:**

```
/etc/init.d/ufmd sharp_status
```

## Monitoring NVIDIA SHARP AM by UFMHealth

UFMHealth monitors SHARP AM and verifies that NVIDIA SHARP AM is always running. When UFMHealth detects that NVIDIA SHARP AM is down, it will try to re-start it, and will trigger an event to the UFM to notify it that NVIDIA SHARP AM is down.

## Managing NVIDIA SHARP AM by UFM High Availability (HA)

In case of a UFM HA failover or takeover, NVIDIA SHARP AM will be started on the new master node using the same configuration that was used prior to the failover/takeover.

## NVIDIA SHARP AM Logs

NVIDIA SHARP AM log file (sharp\_am.log) at /opt/ufm/files/log.

NVIDIA SHARP AM log files are rotated by UFM logrotate mechanism.

## NVIDIA SHARP AM Version

NVIDIA SHARP AM version can be found at /opt/ufm/sharp/share/doc/SHARP\_VERSION.

# Appendix - UFM SLURM Integration

Simple Linux Utility for Resource Management (SLURM) is a job scheduler for Linux and Unix-like kernels.

By integrating SLURM with UFM, you can:

- Assign partition keys (PKeys) to SLURM nodes that are assigned for specific SLURM jobs.
- Create SHARP reservations based on SLURM nodes assigned for specific SLURM jobs.

## Prerequisites

- UFM 6.9.0 (or newer)
- Python 3.0 on SLURM controller
- UFM-SLURM integration files (provided independently)

## Automatic Installation

A script is provided to install the UFM-SLURM integration automatically.

1. Using the SLURM controller, extract the UFM-SLURM integration tar file:

```
tar -xf ufm_slurm_integration.tar.gz
```

2. Run the installation script using root privileges.

```
sudo ./install.sh
```

## Manual Installation

To install the UFM-SLURM integration manually:

1. Extract the UFM-SLURM integration tar file:

```
tar -xf ufm_slurm_integration.tar.gz
```

2. Copy the UFM-SLURM integration files to the SLURM controller folder.
3. Change the permissions of the UFM-SLURM integration files to 755.
4. Modify the SLURM configuration file on the SLURM controller, `/etc/slurm/slurm.conf`, and add/modify the following two parameters:

```
PrologSlurmctld=/etc/slurm/ufm-prolog.sh
EpilogSlurmctld=/etc/slurm/ufm-epilog.sh
```

## UFM SLURM Config File

The integration process uses a configuration file located at `/etc/slurm/ufm_slurm.conf`. This file is used to configure settings and attributes for UFM-SLURM integration.

Here are the contents:

| Attribute Name  | Description                                                                                                                                                                                                                                                                | Optionality                         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| ufm_server      | IP of UFM server to connect to                                                                                                                                                                                                                                             | Mandatory                           |
| auth_type       | Should be <code>token_auth</code> , or <code>basic_auth</code><br>If you select <code>basic_auth</code> , you need to set <code>ufm_server_user</code> and <code>ufm_server_pass</code><br>If you select <code>token_auth</code> , you need to set <code>token_auth</code> | Mandatory                           |
| ufm_server_user | Username of UFM server used to connect to UFM, if you set <code>auth_type=basic_auth</code>                                                                                                                                                                                | Mandatory, depends on the auth_type |
| ufm_server_pass | UFM server user password                                                                                                                                                                                                                                                   | Mandatory, depends on the auth_type |
| token           | Generated token when you set <code>uth_type</code> to                                                                                                                                                                                                                      | Mandatory, depends on the auth_type |

| Attribute Name                   | Description                                                                                                                                                                         | Optionality                                                         |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
|                                  | <code>token_auth</code>                                                                                                                                                             |                                                                     |
| <code>pkey_allocation</code>     | By setting <code>pkey_allocation</code> to true, UFM SLURM Integration will use static Pkey assignment to create new Pkey, otherwise it will use the default management Pkey 0x7fff | Mandatory, default is True.                                         |
| <code>pkey</code>                | Hexadecimal string between "0x0001"- "0x7ffe" exclusive                                                                                                                             | Optional, default is "0x7fff" (This is the default management pkey) |
| <code>ip_over_ib</code>          | PKey is a member in a multicast group that uses IP over InfiniBand                                                                                                                  | Hidden param, default is True                                       |
| <code>index0</code>              | If true, the API will store the PKey at index 0 of the PKey table of the GUID                                                                                                       | Hidden param, default is False                                      |
| <code>sharp_allocation</code>    | By setting <code>sharp_allocation</code> to true, UFM SLURM Integration will create new SHARP allocation with all SLURM job IDs allocated to hosts                                  | Mandatory, default is False                                         |
| <code>partially_alloc</code>     | By setting this to false, UFM will fail the SHARP allocation request if at least one node does not exist in the fabric                                                              | Optional, default is False                                          |
| <code>app_resources_limit</code> | Application resources limitation                                                                                                                                                    | Hidden param, default is -1                                         |
| <code>log_file_name</code>       | Name of integration logging file                                                                                                                                                    | Optional                                                            |

## Configuring UFM for NVIDIA SHARP Allocation

To configure UFM for NVIDIA SHARP allocation/deallocation you must set `sharp_enabled` and `enable_sharp_allocation` to true in `gv.cfg` file.

### Generate token\_auth

If you set `auth_type=token_auth` in UFM SLURM's config file, you must generate a new token by logging into the UFM server and running the following `curl` command:

```
curl -H "X-Remote-User:admin" -XPOST
http://127.0.0.1:8000/app/tokens
```

Then you must copy the generated token and paste it into the config file beside the `token_auth` parameter.

## Prolog and Epilog

After submitting jobs on SLURM, there are two scripts that are automatically executed:

- `ufm-prolog.sh` – the prolog script is executed when a job is submitted and before running the job itself. It creates the partition key (pkey) assignment and/or NVIDIA SHARP reservation and assigns the SLURM job hosts for them.
- `ufm-epilog.sh` – the epilog script is executed when a job is complete. It removes the partition key (PKey) assignment and/or NVIDIA SHARP reservation and free the associated SLURM job hosts.

## Integration Files

The integration use scripts and configuration files to work, which should be copied to SLURM controller `/etc/slurm`. Here is a list of these files:

| File Name           | Description                                                                                                                          |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| ufm-prolog.sh       | Bash file which executes jobs related to UFM after the SLURM job is completed                                                        |
| ufm-epilog.sh       | Bash file which executes jobs related to UFM before the SLURM job is executed                                                        |
| ufm_slurm.conf      | UFM-SLURM integration configuration file                                                                                             |
| ufm_slurm_prolog.py | Python script file which creates the partition key (pkey) assignment and/or SHARP reservation when the prolog bash script is running |
| ufm_slurm_epilog.py | Python script file which removes partition key (pkey) assignment and/or SHARP reservation based on the SLURM job hosts.              |
| ufm_slurm_utils.py  | Utility Python file containing functions and utilities used by the integration process                                               |

## Running UFM-SLURM Integration

Using the SLURM controller, execute the following commands to run your batch job:

```
$ sbatch -N4 slurm_demo.sh
Submitted batch job 1
```

### Note

N4 is the number of compute nodes used to run the jobs.  
`slurm_demo.sh` is the job batch file to be run.

The output and result are stored on the working directory `slurm-{id}.out` where `{id}` is the ID of the submitted job.

In the above example, after executing `sbatch` command, you can see that the submitted job ID is 1. Therefore, the output file would be stored in `slurm-1.out`.

Execute the following command to see the output:

```
$cat slurm-1.out
```

On the UFM side, a partition key (PKey) is created in case the `pkey_allocation` parameter is set to true in the configuration file, and the user provided the PKey name including the SLURM job IDs allocated to the hosts. Otherwise it will use the default management PKey.

In addition, the UFM-SLURM will create SHARM AM reservation in case the `sharp_allocation` parameter is set to true in the `ufm_slurm.conf` file.

After the SLURM job is completed, the UFM removes the job-related partition key (PKey) assignment and SHARP reservation, if they were created.

From the moment a job is submitted by the SLURM server until its completion, a log file named `/tmp/ufm_slurm.log` logs all of the actions and errors that occurred during the execution.

This log file can be changed by modifying the `log_file_name` parameter in `/etc/slurm /ufm_slurm.conf`.

## Appendix - Switch Grouping

To facilitate the logical grouping of 1U switches into a "director-like switch" group, the UFM implements a special dedicated group of interconnected 1U switches based on a YAML configuration file. This group, which is of type "superswitch", only includes 1U switches connected to each other, with some functioning as lines and others as spines.

To access the configuration file for superswitches, users can define the path in the [SubnetManager] section of the `gv.cfg` file, using the variable name "`super_switch_config_file_path`". For instance, the path can be specified as follows:

```
super_switch_config_file_path=/opt/ufm/files/conf/super_switches_conf
```

It is important to note that the file must be located in the `/opt/ufm/files file` tree, as it should be replicated between master and slave UFM servers in a high-availability configuration.

The structure of the superswitch definition should be as follows, based on the following example:

```
superswitch:
 - name: "Marlin01" # Director switch name
 description: "primary dc switch" # Free text with the customer
facing description
 location: "US,NC,DC01" # Director switch location (global
location, includes all racks/switches)
 racks: # Director switch Racks definitions
 #Rack definition
 - name: "rack A" # Director switch rack name
 location:
 dc-grid-row: "A" # formalized rack location in DC
 dc-grid-column: "1" # formalized
 comments: "left-most rack in the line" #Cutomer facing comment on
the rack
 leafs: # List of Director switch leafs (for the rack
specified)
 - guid: "0x043f720300922a00" #required filed. Switch GUID.
 location-u: 1 # required field. Device location in
rack: "U#"
 description: "MF0;gorilla-01:MQM9700/U1" # optional field.
 - guid: "0x043f720300899cc0" #required filed. Switch GUID.
 location-u: XX # required field. Device location in
rack: "U#"
 description: "MF0;gorilla-01:MQM9700/U2" # optional field.
 spines: # List of Director switch spines (for the rack
specified)
 - guid: "0x043f720900922a00" #required filed. Switch GUID.
 location-u: 10 # required field. Device location in
rack: "U#"
```

```

description: "MF0;gorilla-02:MQM9700/U1" # optional field.
- guid: "0x043f720900899cc0" #required filed. Switch GUID.
 location-u: XX # required field. Device location in
rack: "U#"
description: "MF0;gorilla-02:MQM9700/U2" # optional field.
- name: "Marlin02" # Director switch name
 description: "primary dc switch" # Free text with the customer
facing description
 location: "US,NC,DC01" # Director switch location (global
location, includes all racks/switches)
 racks: # Director switch Racks definitions
 #Rack definition
 - name: "rack B" # Director switch rack name
 location:
 dc-grid-row: "B" # formalized rack location in DC
 dc-grid-column: "1" # formalized
 comments: "left-most rack in the line" #Cutomer facing comment on
the rack
 leafs: # List of Director switch leafs (for the rack
specified)
 - guid: "0x093f720300922a00" #required filed. Switch GUID.
 location-u: 1 # required field. Device location in
rack: "U#"
description: "MF0;gorilla-03:MQM9700/U1" # optional field.
- guid: "0x093f720300899cc0" #required filed. Switch GUID.
 location-u: XX # required field. Device location in
rack: "U#"
description: "MF0;gorilla-03:MQM9700/U2" # optional field.
spines: # List of Director switch spines (for the rack
specified)
- guid: "0x093f720900922a00" #required filed. Switch GUID.
 location-u: 10 # required field. Device location in
rack: "U#"
description: "MF0;gorilla-04:MQM9700/U1" # optional field.
- guid: "0x093f720900899cc0" #required filed. Switch GUID.

```

```
location-u: XX # required field. Device location in
rack: "U#"
description: "MF0;gorilla-04:MQM9700/U2" # optional field
```

## UI Presentation

The logical grouping can be accessed under the "Groups" view, specifically listed as "SuperSwitch group" type.

| Severity | Name ↑                                | Description                                                  | Type        |
|----------|---------------------------------------|--------------------------------------------------------------|-------------|
| Info     | 1U Switches                           | Includes all 1U Switches that exist in the fabric            | General     |
| Info     | Alarmed Devices                       | Devices with alarms                                          | General     |
| Info     | Devices Pending FW Transceivers Reset | Includes all Devices that pending FW transceivers reset t... | General     |
| Info     | Gateway Devices                       | Includes all Gateway Devices that exist in the fabric        | General     |
| Info     | Marlin01                              | SuperSwitch group                                            | SuperSwitch |
| Info     | Marlin02                              | SuperSwitch group                                            | SuperSwitch |
| Info     | Modular Switches                      | Includes all Modular Switches that exist in the fabric       | General     |
| Info     | Routers                               | Includes all Router Devices that exist in the fabric         | General     |
| Info     | Servers                               | Includes all Hosts that exist in the fabric                  | General     |
| Info     | Servers With DPU                      | Includes all Devices that has DPU that exist in the fabric   | General     |
| Info     | Suppressed Devices                    | No event notifications issued                                | General     |
| Info     | Switches                              | Includes all Switches that exist in the fabric               | General     |

Upon selecting the group type SuperSwitch, additional columns containing information related to the SuperSwitch are added to the details view.

The screenshot shows the 'Groups' management interface. On the left, a list of groups is displayed, with 'Marlin01' selected. The right pane shows the 'Marlin01 - Members' table. The table has the following data:

| Name       | GUID        | IP      | Type  | Descri...   | Locati... | Rack   |
|------------|-------------|---------|-------|-------------|-----------|--------|
| gorilla-01 | 0x043f72... | 0.0.0.0 | leaf  | MF0:gori... | 1         | rack A |
| gorilla-01 | 0x043f72... | 0.0.0.0 | leaf  | MF0:gori... | XX        | rack A |
| gorilla-07 | 0x073f72... | 0.0.0.0 | spine | MF0:gori... | 10        | rack A |
| gorilla-07 | 0x073f72... | 0.0.0.0 | spine | MF0:gori... | XX        | rack A |

An icon for the SuperSwitch group in its collapsed view exists on the network map.

The screenshot shows the 'Network Map' interface. The main area displays a hierarchical graph with two nodes labeled 'Marlin01' and 'Marlin02'. The right pane shows the 'Properties' view for the selected node. The properties are as follows:

- Display Label: System Name
- Type:
  - Rack:
  - Host:
  - Gateway:
  - Switch:
  - Router:
- Severity:
  - Info:
  - Warning:
  - Minor:
  - Critical:
- Network Analysis:
  - Link Analysis:
- Network Compare:
  - Topology Compare:

Upon selecting the SuperSwitch group, all of its properties can be viewed in the details view.

Network Map

Layout: Hierarchical Graph Views: Default Regex Filters: Starts With: Enter filter

View Zoom In Filters: Select nodes to highlight and display in Zoom In tab

View Properties

Super Switch Properties

| Property      | Value                                                                   |
|---------------|-------------------------------------------------------------------------|
| Name          | Marlin01                                                                |
| Severity      | Info                                                                    |
| Description   | primary dc switch                                                       |
| Location      | US, NC, DC01                                                            |
| Rack          | rack A                                                                  |
| Rack Location | dc-grid-row= A, dc-grid-column= 1, comments= left-most rack in the line |

Leaves

| Description               | Location | Rack   |
|---------------------------|----------|--------|
| MF0.gorilla-01.MQM9700/U1 | 1        | rack A |
| MF0.gorilla-01.MQM9700/U2 | XX       | rack A |

Spines

| Description               | Location | Rack   |
|---------------------------|----------|--------|
| MF0.gorilla-02.MQM9700/U1 | 10       | rack A |
| MF0.gorilla-02.MQM9700/U2 | XX       | rack A |

Expanding the SuperSwitch group icon displays all the switches included in the group as separate 1U switches, along with their respective properties.

Network Map

Layout: Hierarchical Graph Views: Default Regex Filters: Starts With: Enter filter

View Zoom In Filters: Select nodes to highlight and display in Zoom In tab

View Properties

Super Switch Properties

| Property      | Value                                                                   |
|---------------|-------------------------------------------------------------------------|
| Name          | Marlin01                                                                |
| Severity      | Info                                                                    |
| Description   | primary dc switch                                                       |
| Location      | US, NC, DC01                                                            |
| Rack          | rack A                                                                  |
| Rack Location | dc-grid-row= A, dc-grid-column= 1, comments= left-most rack in the line |

Leaves

| Description               | Location | Rack   |
|---------------------------|----------|--------|
| MF0.gorilla-01.MQM9700/U1 | 1        | rack A |
| MF0.gorilla-01.MQM9700/U2 | XX       | rack A |

Spines

| Description               | Location | Rack   |
|---------------------------|----------|--------|
| MF0.gorilla-02.MQM9700/U1 | 10       | rack A |
| MF0.gorilla-02.MQM9700/U2 | XX       | rack A |

Network Map

Layout: Hierarchical Graph Views: Default Regex Filters: Starts With: Enter filter

View: Zoom In Filters: Select nodes to highlight and display in Zoom In tab

View Properties

System Properties

| Property     | Value              |
|--------------|--------------------|
| Name         | gorilla-07         |
| IP           | 0.0.0.0            |
| GUID         | 0x073f720300922a00 |
| Type         | switch             |
| Model        | MQM9700            |
| Severity     | Info               |
| FW Version   | N/A                |
| PSID         | N/A                |
| Total Alarms | 0                  |
| Temperature  | N/A                |
| Description  | MQM9700            |
| SW Version   | N/A                |

System Ports

| Port Name     |
|---------------|
| gorilla-07:1  |
| gorilla-07:13 |
| gorilla-07:14 |

On the devices view, switches that are part of the SuperSwitch group are marked with an additional icon that indicates their role in the group. The "S" icon denotes spines, while the "L" icon denotes lines.

Devices

Local Time Last Update admin

All Types All Groups Displayed Columns CSV

| Severity | Name       | GUID               | Type   | Model   | IP      | Firmware Version |
|----------|------------|--------------------|--------|---------|---------|------------------|
| Info     | gorilla-01 | 0x043f720300922a00 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-07 | 0x073f720300922a00 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-08 | 0x083f720300922a00 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-02 | 0x093f720300922a00 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-01 | 0x043f720300899cc0 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-07 | 0x073f720300899cc0 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-08 | 0x083f720300899cc0 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | gorilla-02 | 0x093f720300899cc0 | switch | MQM9700 | 0.0.0.0 |                  |
| Info     | r-ufm50    | 0x248a0703008fa050 | host   |         | 0.0.0.0 |                  |

Viewing 1-9 of 9

Selecting a switch that belongs to the SuperSwitch group in the properties view allows you to view all the switch properties related to the SuperSwitch group.

Devices Local Time Last Update [redacted] admin

---

All Types All Groups Refresh Displayed Columns CSV

| Name       | GUID         | Type    | Model | IP      | Firmwa... |
|------------|--------------|---------|-------|---------|-----------|
| gorilla-01 | 0x043f720... | L switc | MQM97 | 0.0.0.0 |           |
| gorilla-07 | 0x073f720... | S switc | MQM97 | 0.0.0.0 |           |
| gorilla-08 | 0x083f720... | S switc | MQM97 | 0.0.0.0 |           |
| gorilla-02 | 0x093f720... | L switc | MQM97 | 0.0.0.0 |           |
| gorilla-01 | 0x043f720... | L switc | MQM97 | 0.0.0.0 |           |
| gorilla-07 | 0x073f720... | S switc | MQM97 | 0.0.0.0 |           |
| gorilla-08 | 0x083f720... | S switc | MQM97 | 0.0.0.0 |           |
| gorilla-02 | 0x093f720... | L switc | MQM97 | 0.0.0.0 |           |
| r-ufm50    | 0x248a07...  | host    |       | 0.0.0.0 |           |

Viewing 1-9 of 9

0x073f720300922a00 - Device Information

General Ports Cables Groups Alarms Events Inventory

Device Access Super Switch

| Property          | Value                                       |
|-------------------|---------------------------------------------|
| Description       | MF0:gorilla-02:MQM9700/U1                   |
| Location          | 10                                          |
| Type              | spine                                       |
| Rack Name         | rack A                                      |
| Rack Location     | dc-grid-row=A, dc-grid-column=1, comment... |
| Super Switch Name | Marlin01                                    |

**Note**

Each SuperSwitch definition can include one or more racks where each embedded rack can include multiple leafs and spines switches.

# Appendix – Device Management Feature Support

The following table describes the management features available on supported devices.

| Feature   | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switches | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5020 | HP C-Class | Linux Hosts | Windows Hosts |
|-----------|-------------------------------|-----------------------------------------|-------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------|---------------|
| Discovery |                               |                                         |                         |                         |                                             |                |            |             |               |

| Feature                                                           | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switches | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5200 | HP C-Class | Linux Hosts             | Windows Hosts |
|-------------------------------------------------------------------|-------------------------------|-----------------------------------------|-------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------------------|---------------|
| IB L2 Discovery                                                   | Yes                           | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |
| Advanced Discovery (IP, hostname, Hosts: CPU, memory, FW version) | Yes                           | Yes                                     | No                      | Yes                     | No                                          | No             | No         | Yes with UFM Host Agent | No            |
| Ethernet access Management interface                              | Yes                           | Yes                                     | Yes                     | Yes                     | No                                          | No             | No         | Yes                     | Yes           |
| Provisioning/ Configuration                                       |                               |                                         |                         |                         |                                             |                |            |                         |               |
| IB Partitioning (pkey)                                            | Yes                           | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |

|                                                          |                               |                                         |                         |                         |                                             |                |            |                         |               |
|----------------------------------------------------------|-------------------------------|-----------------------------------------|-------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------------------|---------------|
| Feature                                                  | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switches | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5200 | HP C-Class | Linux Hosts             | Windows Hosts |
| QoS: SL (SM configuration)                               | N/A                           | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |
| QoS: Rate Limit (SM configuration)                       | N/A                           | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |
| Interface/VIF Configuration (IP, hostname, mtu, Bonding) | N/A                           | N/A                                     | N/A                     | N/A                     | N/A                                         | No             | N/A        | Yes with UFM Host Agent | No            |
| Device Monitoring                                        |                               |                                         |                         |                         |                                             |                |            |                         |               |
| Device Resources: CPU, Memory, Disk                      | No                            | Yes                                     | No                      | No                      | No                                          | No             | No         | Yes with UFM Host Agent | No            |

| Feature                                                                                                      | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switches | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5020 | HP C-Class | Linux Hosts             | Windows Hosts |
|--------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------|-------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------------------|---------------|
| Get device alerts (Temperature, PS, Fan)<br><b>Note:</b> This feature is not supported on Switch-X switches. | Yes                           | Yes                                     | No                      | Yes                     | Yes                                         | No             | No         | No                      | No            |
| L1 (Physical Port) – Monitoring                                                                              | Yes                           | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |
| L2-3 (Interface/VIF) – Monitoring                                                                            | No                            | No                                      | No                      | No                      | No                                          | No             | No         | Yes with UFM Host Agent | No            |
| Congestion                                                                                                   | No                            | Yes                                     | Yes                     | Yes                     | Yes                                         | Yes            | Yes        | Yes                     | Yes           |

| Feature                                           | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switchesv | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5200 | HP C-Class | Linux Hosts | Windows Hosts |
|---------------------------------------------------|-------------------------------|-----------------------------------------|--------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------|---------------|
| Monitoring per port (enables congestion map)      |                               |                                         |                          |                         |                                             |                |            |             |               |
| Congestion Monitoring per flow (Advanced Package) | No                            | Yes                                     | No                       | No                      | No                                          | No             | No         | No          | No            |
| Device Management                                 |                               |                                         |                          |                         |                                             |                |            |             |               |
| Add/remove to/from Rack                           | Yes                           | Yes                                     | Yes                      | Yes                     | Yes                                         | Yes            | Yes        | Yes         | Yes           |
| Add/remove to/from Logical Server                 | N/A                           | N/A                                     | N/A                      | N/A                     | N/A                                         | N/A            | N/A        | Yes         | Yes           |

| Feature                         | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switches | Managed SX6000 Switches             | Externally Managed IS5000 / SX6000 Switches | Gateway BX5200 | HP C-Class | Linux Hosts   | Windows Hosts |
|---------------------------------|-------------------------------|-----------------------------------------|-------------------------|-------------------------------------|---------------------------------------------|----------------|------------|---------------|---------------|
| View/clear Alarms               | Yes                           | Yes                                     | Yes                     | Yes                                 | Yes                                         | Yes            | Yes        | Yes           | Yes           |
| SSH terminal to device          | Yes                           | Yes                                     | Yes                     | Yes                                 | No                                          | No             | No         | Yes           | Yes           |
| Power On                        | No                            | No                                      | No                      | No                                  | No                                          | No             | No         | Yes with IPMI | No            |
| Reboot                          | No                            | No                                      | No                      | Yes (SX3606 only)                   | No                                          | No             | No         | Yes with IPMI | No            |
| Shutdown                        | No                            | No                                      | No                      | No                                  | No                                          | No             | No         | Yes with IPMI | No            |
| Port Enable/Disable             | No                            | Yes                                     | Yes                     | Yes                                 | Yes                                         | Yes            | Yes        | Yes           | Yes           |
| Firmware Upgrade (HCA & switch) | No                            | Yes                                     | No                      | Yes (Upon SW upgrade – SX6036 only) | No                                          | No             | No         | Yes           | No            |
| Inband Firmw                    | No                            | No                                      | No                      | No                                  | Yes                                         | No             | No         | Yes           | Yes           |

|                                           |                               |                                         |                          |                         |                                             |                |            |                         |               |
|-------------------------------------------|-------------------------------|-----------------------------------------|--------------------------|-------------------------|---------------------------------------------|----------------|------------|-------------------------|---------------|
| Feature                                   | 10 Gb Ethernet Gateway Module | Grid Director 4700/4200/4036/4036E v3.5 | Managed IS5000 Switchesv | Managed SX6000 Switches | Externally Managed IS5000 / SX6000 Switches | Gateway BX5200 | HP C-Class | Linux Hosts             | Windows Hosts |
| are Upgrade (over InfiniB and connection) |                               |                                         |                          |                         |                                             |                |            |                         |               |
| Software Upgrade (OFED & switch)          | No                            | Yes                                     | No                       | Yes (SX3606 only)       | No                                          | No             | No         | Yes with UFM Host Agent | No            |
| Protocols                                 |                               |                                         |                          |                         |                                             |                |            |                         |               |
| Communication UFM Server - Device         | IB/SNMP                       | IB/UDP/SSH                              | IB                       | IB/HTTP/SSH             | IB                                          | IB             | IB         | IB, SSH, IPMI, UDP      | IB            |

1. QoS Rate Limit (SM configuration): On ConnectX HCAs-only, for hosts.
2. XmitWait counter monitoring requires ConnectX HCAs with firmware version 2.6 and above.
3. This feature requires that the IP address is configured.

# Document Revision History

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.20.0  | Feb 10, 2025 | <p>Updated:</p> <ul style="list-style-type: none"><li>• <a href="#">Changes and New Features</a></li><li>• <a href="#">Bug Fixes in This Release</a></li><li>• <a href="#">Known Issues in This Release</a></li><li>• <a href="#">Installation Notes</a></li><li>• <a href="#">Cable Information</a> - Added a note about XDR ports and a note on port labels</li><li>• <a href="#">Installing UFM Server Software</a> - Added information regarding DOCA Host installation</li><li>• <a href="#">Proxy Authentication</a> - Added the <code>auth_proxy_cn_whitelist</code> option</li><li>• <a href="#">Changing Maximum SSL Request Size when Using Client Certificate</a></li><li>• <a href="#">Plugins Bundle</a> - Updated the list of plugins included in the bundle.</li><li>• <a href="#">Low-Frequency (Secondary) Telemetry Fields</a> - Added the <code>host_name</code> counter</li></ul> <p>Added:</p> <ul style="list-style-type: none"><li>• <a href="#">UFM Plugins Upgrade</a></li><li>• <a href="#">Changing Telemetry Endpoint Protocol</a></li><li>• <a href="#">Client Based Authentication</a></li><li>• <a href="#">Installing UFM on Podman Using Unprivileged User While Setting Client Certificate Authentication</a></li><li>• <a href="#">Appendix - Supported Port Counters and Events</a> - Added event IDs# 1321, 1612</li><li>• <a href="#">UFM Server Health Monitoring</a> - Added test "</li></ul> |

| Release | Date        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |             | <p><code>CheckGvSqliteCorruptionTest</code> "</p> <ul style="list-style-type: none"> <li>• <a href="#">Configuring UFM Logging</a> - Added the <code>stream_all_events</code> field</li> <li>• <a href="#">Secure Server using mTLS and Certificate Subject Identifier</a></li> <li>• <a href="#">Plugins Bundle</a> - Updated the list of plugins included in the bundle and added step 3 in <a href="#">For a UFM Bare Metal Deployment</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6.19.0  | Nov 7, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Installation Notes</a></li> <li>• <a href="#">Installing UFM Server Software</a> - Updated the <a href="#">Prerequisites for UFM Server Software Bare Metal Installation</a>, removed RedHat 7 and Ubuntu 18</li> <li>• <a href="#">Installing UFM on Bare Metal Server - High Availability Mode</a> - Updated instructions to include the resource-agents-extra driver</li> <li>• <a href="#">UFM Server Health Monitoring</a> - Added "<code>PluginIsRunningTest</code>" test</li> <li>• <a href="#">Devices Window</a> - Added <a href="#">Open Terminal</a> and <a href="#">Open Webpage</a></li> <li>• <a href="#">Threshold-Crossing Events Reference</a> - Added two events: 1609 and 1610</li> <li>• <a href="#">Telemetry</a> - Updated screenshots and added <a href="#">XDR Per-Plane Zoom-In</a></li> <li>• <a href="#">Fabric Validation Tab</a> - Updated tests table</li> <li>• <a href="#">Telemetry</a> - Added instructions on how to manage UFM Telemetry via the UTM plugin</li> <li>• <a href="#">Events &amp; Alarms</a> - Added SM Configuration Events</li> </ul> |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | <ul style="list-style-type: none"> <li>• <a href="#">Autonomous Link Maintenance (ALM) Plugin</a></li> <li>• <a href="#">UFM Light Plugin</a></li> <li>• <a href="#">Plugins Bundle</a> - Added the IB Link Resiliency plugin as part of the default bundle</li> <li>• <a href="#">Appendix - Supported Port Counters and Events</a>- Updated event IDs# 331, 332, 907, 908, 909, 910, 912</li> <li>• <a href="#">Appendix – UFM Subnet Manager Default Properties</a></li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• <a href="#">Plugins Changes and New Features</a> that includes plugin version and newly introduced features and changes</li> <li>• <a href="#">Setting Up SSL and CA Certificates in UFM</a></li> <li>• <a href="#">Enabling UFM Telemetry Manager Plugin</a></li> <li>• <a href="#">Changing Maximum SSL Request Size when Using Client Certificate</a></li> <li>• <a href="#">XDR Per-Plane Zoom-In</a></li> <li>• <a href="#">Changing Telemetry Bind Address</a></li> <li>• <a href="#">Open Terminal</a> and <a href="#">Open Webpage</a></li> </ul> |
| 6.18.0  | Aug 14, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Installation Notes</a></li> <li>• <a href="#">Installing UFM Server Software</a> - Added a note on Docker installation via SNAP on Ubuntu OSs</li> <li>• <a href="#">Data Streaming</a></li> <li>• <a href="#">Installing UFM on Docker Container - High Availability Mode</a> - Added two pre-deployment requirements</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | <ul style="list-style-type: none"> <li>• <a href="#">REST-RDMA Plugin</a> - Updated "Authenticated Remote ibdiagnet Request"</li> <li>• <a href="#">Topology Compare Tab</a> and <a href="#">Events &amp; Alarms</a> - Updated screenshots</li> <li>• <a href="#">Appendix - Supported Port Counters and Events</a> - Added 1605 and 1606 alarm IDs</li> <li>• Autonomous Link Maintenance (ALM) Plugin - Added "Data Filter" and "Metric Filter" ALM jobs</li> <li>• <a href="#">UFM Telemetry Manager (UTM) Plugin</a> - Added an important note on UFM credentials, added instructions on accessing UTM API commands and "Command List"</li> <li>• <a href="#">GNMI-Telemetry Plugin</a></li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• Excluding Unhealthy Ports from Fabric Health Report</li> <li>• UFM Configuration Files Based on Fabric Size</li> <li>• Exposing Performance Histogram Counters</li> <li>• <a href="#">Plugins Bundle</a></li> <li>• <a href="#">UFM Plugins Management</a></li> <li>• <a href="#">Key Performance Indexes (KPI) Plugin</a></li> <li>• <a href="#">UFM Light Plugin</a></li> </ul> |
| 6.17.2  | Jun 24, 2024 | Added bug fix (Ref #3912416) to <a href="#">Bug Fixes in This Release</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|         | Jun 26, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Upgrading UFM on Bare Metal Server</a></li> <li>• <a href="#">Upgrading UFM on Docker Container</a></li> <li>• <a href="#">GNMI-Telemetry Plugin</a></li> <li>• Model-2 Plugin</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6.17.1  | May 28, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Bug Fixes in This Release</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | <ul style="list-style-type: none"> <li>• <a href="#">Known Issues in This Release</a></li> </ul> <p>Added Model-2 Plugin</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|         | Jun 17, 2024 | <ul style="list-style-type: none"> <li>• Updated the Model-2 Plugin name</li> <li>• Updated Enabling UFM Authentication Server</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 6.17.0  | May 7, 2024  | <p>Introduced a minor reorganization of the document.</p> <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Events Policy</a> - Updated event policy parameters</li> <li>• <a href="#">Inventory Window</a></li> <li>• <a href="#">Devices Window</a></li> <li>• <a href="#">UFM Health Tab</a></li> <li>• <a href="#">UFM System Dump Tab</a></li> <li>• <a href="#">Device Access</a> - Updated screenshot and parameters</li> <li>• Configurations of the UFM Authentication Server - Updated that it is turned on by default</li> <li>• Autonomous Link Maintenance (ALM) Plugin</li> <li>• PDR Deterministic Plugin - updated the configuration table</li> <li>• Appendix – Secondary Telemetry Fields</li> <li>• <a href="#">Appendix - Supported Port Counters and Events</a> - Added and removed alarm IDs</li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• <a href="#">Events</a></li> <li>• <a href="#">Reports</a></li> <li>• <a href="#">Telemetry</a></li> <li>• <a href="#">Events Policy Simulation</a></li> <li>• <a href="#">UFM Telemetry Manager (UTM) Plugin</a></li> </ul> |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | <ul style="list-style-type: none"> <li>• <a href="#">UFM Consumer Plugin</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|         | May 13, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Known Issues in This Release</a> - Added issue # 3862847</li> <li>• <a href="#">Installation Notes</a> - Updated the latest tested FW versions in Supported NVIDIA Externally/Internally Managed Switches</li> <li>• PDR Deterministic Plugin</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                           |
|         | May 24, 2024 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Known Issues in This Release</a> - Added issue #3872303</li> <li>• <a href="#">UFM Telemetry Fluentd Streaming (TFS) Plugin</a></li> <li>• <a href="#">GNMI-Telemetry Plugin</a></li> <li>• PDR Deterministic Plugin</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 6.16.0  | Feb 8, 2024  | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Installation Notes</a></li> <li>• In <a href="#">Optional Configurations</a> → Low-Frequency (Secondary) Telemetry - Added the secondary_slvl_support flag and information on the default counters and added</li> <li>• <a href="#">Secondary Telemetry Exposing IPv6 Counters</a></li> <li>• PDR Deterministic Plugin - Updated instructions</li> <li>• <a href="#">Link Analysis</a> - Updated GUI screenshots</li> <li>• <a href="#">Device Cable Tab</a> - Updated GUI screenshots</li> </ul> |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | <ul style="list-style-type: none"> <li>• <a href="#">Cables Window</a> - Updated GUI screenshots</li> <li>• <a href="#">Packet Level Monitoring Collector (PMC) Plugin</a> - Updated overview and GUI screenshots</li> <li>• <a href="#">General Tab, Inventory Tab and Inventory Window</a> - Updated GUI screenshots</li> <li>• <a href="#">SM Congestion Control Configuration</a> - Updated GUI screenshot</li> <li>• Autonomous Link Maintenance (ALM) Plugin - Added GUI screenshots in <a href="#">ALM UI</a></li> <li>• <a href="#">Appendix – UFM Subnet Manager Default Properties</a> - Updated the max_op_vls from 3 to 2.</li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• Kerberos Authentication and Enabling Kerberos Authentication</li> <li>• <a href="#">Secondary Telemetry Exposing IPv6 Counters</a></li> <li>• <a href="#">Dynamic Telemetry</a></li> <li>• <a href="#">Configuring Syslog</a></li> <li>• <a href="#">Configuring UFM Logging</a></li> <li>• <a href="#">Appendix - OpenSM Configuration Files for Congestion Control</a></li> </ul> |
|         | Mar 6, 2024  | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Troubleshooting</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Installation Notes</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 6.15.2  | Jan 4, 2024  | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Known Issues in This Release</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|         | Jan 23, 2024 | <p>Added a note to <a href="#">Installation Notes</a> about the UFM SM version</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.15.1  | Dec 14, 2023 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Supported NVIDIA Internally Managed Switches</a> - Removed MTX6100, MTX6240 and MTX6280 switches and the SX6036G (FDR) gateway</li> <li>• <a href="#">Installation Notes</a> - Updated with the new MFT package version</li> <li>• <a href="#">System Requirements</a> - Added MLNX_OFED23.x</li> <li>• <a href="#">Unsupported Functionalities/Features</a></li> </ul> <p>Added:<br/><a href="#">Cable Validation Report in Subnet Merger</a></p>                                                                                                                                                      |
|         | Dec 19, 2023 | <ul style="list-style-type: none"> <li>• Updated <a href="#">Changes and New Features</a></li> <li>• Added a Known issue to <a href="#">Bug Fixes in This Release</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 6.15.0  | Nov 5, 2023  | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• Azure Authentication Login Page - Introduced new Azure authentication login page</li> <li>• Enabling Azure AD Authentication - Added further instructions</li> <li>• <a href="#">UFM Logs Tab</a> - Added log occurrences display</li> </ul> <p>Added</p> <ul style="list-style-type: none"> <li>• <a href="#">Events History</a></li> <li>• <a href="#">Device Status Events</a></li> <li>• <a href="#">Link Status Events</a></li> <li>• <a href="#">GNMI-Telemetry Plugin</a></li> <li>• In <a href="#">Optional Configurations</a> → Low-Frequency (Secondary) Telemetry, added instructions on Exposing</li> </ul> |

| Release | Date         | Description                                                                                                                                                                                                                                                                            |
|---------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |              | Switch Aggregation Nodes Telemetry and Stopping Telemetry Endpoint Using CLI Command <ul style="list-style-type: none"> <li>• UFM Authentication Server</li> <li>• Enabling UFM Authentication Server</li> <li>• <a href="#">Low-Frequency (Secondary) Telemetry Fields</a></li> </ul> |
| 6.14.1  | Aug 31, 2023 | Updated: <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> </ul>                                                                                                                             |
|         | Oct 17, 2023 | Updated: <a href="#">System Requirements</a>                                                                                                                                                                                                                                           |

| Release | Date         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.14.0  | Aug 10, 2023 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">UFM Plugins Management</a></li> <li>• <a href="#">Optional Configurations</a> → Low-Frequency (Secondary) Telemetry</li> <li>• PDR Deterministic Plugin - Updated step 3 in "Deployment".</li> <li>• <a href="#">rest-rdma Plugin</a></li> <li>• <a href="#">NDT Plugin</a></li> <li>• Autonomous Link Maintenance (ALM) Plugin</li> <li>• <a href="#">Appendix - Supported Port Counters and Events</a> - Added alarm ID #134, 1602 and 1603 and status column for all alarm IDs.</li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• Disabling Rest Roles Access Control</li> <li>• Enabling Azure AD Authentication</li> <li>• Azure AD Authentication</li> <li>• Health Policy Management</li> <li>• Rest Roles Access Control</li> <li>• <a href="#">UFM Factory Reset</a></li> </ul> |
| 6.13.1  | May 18, 2023 | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6.13.0  | May 5, 2023  | <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Changes and New Features</a></li> <li>• <a href="#">Bug Fixes in This Release</a></li> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Email</a> - Added time zone preference</li> <li>• <a href="#">NDT Plugin</a></li> <li>• <a href="#">UFM Telemetry Fluent Streaming (TFS) Plugin</a> - Updated REST API</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Release | Date        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |             | <ul style="list-style-type: none"> <li>• <a href="#">UFM System Dump Tab</a></li> <li>• <a href="#">Appendix - Supported Port Counters and Events</a></li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>• <a href="#">Multi-Subnet UFM</a></li> <li>• Enable Network Fast Recovery</li> <li>• NDT Format Merger</li> <li>• <a href="#">Subnet Merger UI</a></li> <li>• Added the following Plugins: <ul style="list-style-type: none"> <li>◦ <a href="#">UFM Bright Cluster Integration Plugin</a></li> <li>◦ UFM Cyber-AI Plugin</li> <li>◦ Autonomous Link Maintenance (ALM) Plugin</li> <li>◦ DTS Plugin</li> <li>◦ <a href="#">Sysinfo Plugin</a></li> <li>◦ <a href="#">SNMP Plugin</a></li> <li>◦ <a href="#">Packet Mirroring Collector (PMC) Plugin</a></li> <li>◦ PDR Deterministic Plugin</li> </ul> </li> </ul> |
|         | May 9, 2023 | <p>Updated</p> <ul style="list-style-type: none"> <li>• <a href="#">Known Issues in This Release</a></li> <li>• <a href="#">Appendix – Enhanced Quality of Service</a> - Updated notes and example</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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| Clonezilla                             | 1.2.10                                                          | <a href="http://clonezilla.org/">http://clonezilla.org/</a>                                                                                                             | GNU General Public License v3.0 or later                                                       |
| Cron                                   | 3.0pl1                                                          | <a href="https://alioth.debian.org/projects/pkg-cron/">https://alioth.debian.org/projects/pkg-cron/</a>                                                                 | Cron License                                                                                   |
| CyanogenMod - android_external_busybox | cm-10.1-M1, cm-10.1-M2                                          | <a href="https://github.com/CyanogenMod/android_external_busybox/blob/cm-12.0/LICENSE">https://github.com/CyanogenMod/android_external_busybox/blob/cm-12.0/LICENSE</a> | GNU General Public License v2.0 or later                                                       |
| D-Bus                                  | 1.2.6                                                           | <a href="http://www.freedesktop.org/wiki/Software/dbus">http://www.freedesktop.org/wiki/Software/dbus</a>                                                               | Academic Free License v2.1                                                                     |
| DHCP (ISC)                             | 4.3.6                                                           | <a href="http://www.isc.org/downloads/dhcp/">http://www.isc.org/downloads/dhcp/</a>                                                                                     | ISC License                                                                                    |
| Darik's Boot and Nuke                  | dban-2.0.0                                                      | <a href="http://sourceforge.net/projects/dban">http://sourceforge.net/projects/dban</a>                                                                                 | (GNU Lesser General Public License v3.0 or later AND GNU General Public License v3.0 or later) |
| Debian Games                           | 11.04.1+repack                                                  | <a href="http://wiki.debian.org/Games">http://wiki.debian.org/Games</a>                                                                                                 | BSD 3-clause "New" or "Revised" License                                                        |
| FLAC - Free Lossless Audio Codec       | flac-1.1.1-beta1-src                                            | <a href="http://flac.sourceforge.net">http://flac.sourceforge.net</a>                                                                                                   | BSD 3-clause "New" or "Revised" License                                                        |
| FarGroup/FarManager                    | builds/3.0.2890                                                 | <a href="https://github.com/FarGroup/FarManager/blob/master/LICENSE">https://github.com/FarGroup/FarManager/blob/master/LICENSE</a>                                     | BSD 3-clause "New" or "Revised" License                                                        |
| FreeBSD                                | 5.5, 6, 9.0-BETA1, release/11.2.0, 12.2, 2.2.0, 2.2.6, 5.0.0cvs | <a href="https://github.com/trueos/trueos">https://github.com/trueos/trueos</a>                                                                                         | BSD 2-clause "Simplified" License                                                              |

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| FreeBSD                 | bsd_44_lite                                                   | <a href="https://github.com/truEOS/truEOS">https://github.com/truEOS/truEOS</a>         | BSD 4-clause "Original" or "Old" License |
| FreeBSD Ports           | RELEASE_4_5_0<br>RELEASE_4_6_0                                | <a href="https://www.freebsd.org/ports/">https://www.freebsd.org/ports/</a>             | BSD 2-clause FreeBSD License             |
| FreeNAS                 | 0.7                                                           | <a href="https://www.freenas.org/">https://www.freenas.org/</a>                         | BSD 3-clause "New" or "Revised" License  |
| GD                      | 2.0.1beta, 2.0.32,<br>2.0.33, 2.0.34RC1,<br>2.0.35, 2.0.35RC5 | <a href="http://www.libgd.org">http://www.libgd.org</a>                                 | GD License                               |
| GD                      | 2.0.36_rc1                                                    | <a href="http://www.libgd.org">http://www.libgd.org</a>                                 | (X11 License OR MIT License)             |
| GLib                    | 1.2.3, 2.14.6, 2.19.5                                         | <a href="http://library.gnome.org/devel/glib/">http://library.gnome.org/devel/glib/</a> | Apache License 2.0                       |
| GNU Compiler Collection | 4.7.0                                                         | <a href="http://gcc.gnu.org/">http://gcc.gnu.org/</a>                                   | (GD License OR Unknown License)          |
| GNU Libtool             | 1.4.1                                                         | <a href="http://www.gnu.org/software/libtool/">http://www.gnu.org/software/libtool/</a> | BSD 3-clause "New" or "Revised" License  |
| GNU Parted              | 1.8.1, 2.4                                                    | <a href="http://www.gnu.org/software/parted">http://www.gnu.org/software/parted</a>     | GNU General Public License v2.0 or later |
| GNU Parted              | 2.4                                                           | <a href="http://www.gnu.org/software/parted">http://www.gnu.org/software/parted</a>     | GNU General Public License v3.0 or later |
| Gentoo Linux            | release_1_3_17                                                | <a href="https://www.gentoo.org/">https://www.gentoo.org/</a>                           | GNU General Public License v2.0 or later |
| Heimdal Kerberos        | heimdal-0.0n                                                  | <a href="http://www.h5l.org/">http://www.h5l.org/</a>                                   | BSD 3-clause "New" or                    |

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|                                |                                                                                           |                                                                                                   | "Revised" License                                                   |
| HipHop Virtual Machine for PHP | HHVM-3.1.0                                                                                | <a href="https://github.com/facebook/hhvm">https://github.com/facebook/hhvm</a>                   | (PHP License v3.01 AND Zend License v2.0)                           |
| Kablinc                        | 1.1 Alpha1                                                                                | <a href="https://www.kablinc.org/">https://www.kablinc.org/</a>                                   | Apache License 2.0                                                  |
| Less                           | 374                                                                                       | <a href="http://www.greenwoodsoftware.com/less/">http://www.greenwoodsoftware.com/less/</a>       | BSD 2-clause "Simplified" License                                   |
| Less                           | 429                                                                                       | <a href="http://www.greenwoodsoftware.com/less/">http://www.greenwoodsoftware.com/less/</a>       | GNU General Public License v2.0 or later OR Less License            |
| LineageOS                      | cm-10.1.0-RC1                                                                             | <a href="https://lineageos.org/">https://lineageos.org/</a>                                       | (FSF Unlimited License AND BSD 3-clause "New" or "Revised" License) |
| Linux Test Project             | 2004                                                                                      | <a href="https://github.com/linux-test-project/ltp">https://github.com/linux-test-project/ltp</a> | GNU General Public License v2.0 or later                            |
| Linux-Pam                      | 0.59, 0.72, 0.74, 0.76, 0.99.1.0, 0.99.2.0, 0.99.4.0, 0.99.5.0, 0.99.6.1, 0.99.6.2, 1.0.0 | <a href="http://www.linux-pam.org">http://www.linux-pam.org</a>                                   | BSD 3-clause "New" or "Revised" License                             |
| Linux-Pam                      | 1.0.1                                                                                     | <a href="http://www.linux-pam.org">http://www.linux-pam.org</a>                                   | (X11 License AND FSF Unlimited License)                             |
| MapServer                      | rel-1-0-0                                                                                 | <a href="http://mapserver.org">http://mapserver.org</a>                                           | (X11 License AND MIT License)                                       |

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| Merruk-Technology                  | 2.0-20121113                                                                                      | <a href="http://www.merruk.ma">http://www.merruk.ma</a>                   | GNU General Public License v2.0 only                                                                    |
| MinGW - Minimalist GNU for Windows | binutils-2.20                                                                                     | <a href="http://mingw.sourceforge.net/">http://mingw.sourceforge.net/</a> | Public Domain                                                                                           |
| MythTV                             | v0.13                                                                                             | <a href="http://www.mythtv.org">http://www.mythtv.org</a>                 | GNU General Public License v2.0 or later                                                                |
| NFS                                | 1.0.6                                                                                             | <a href="http://linux-nfs.org/">http://linux-nfs.org/</a>                 | GNU General Public License v2.0 or later                                                                |
| Net-SNMP                           | 5.0.9, 5.4.2.1, 5.5.2.pre1, 5.7.3, END-UCD-SNMP. Ext-5-3-cvs20050331, JBPN-CBL-1, 5.0.11.1, 5.2.2 | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a>             | (CMU License AND BSD 3-clause "New" or "Revised" License)                                               |
| Net-SNMP                           | 5.1.2, Ext-5-0, Ext-5-0-2, Ext-5-0-4, Ext-5-4-1-1, V4-2-patches-merge2                            | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a>             | (Diffstat License OR BSD 3-clause "New" or "Revised" License)                                           |
| Net-SNMP                           | Ext-5-0, Ext-5-0-4                                                                                | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a>             | (Diffstat License AND BSD 3-clause "New" or "Revised" License AND Christian Michelsen Research License) |
| Net-SNMP                           | Ext-5-4-1-1                                                                                       | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a>             | (Diffstat License AND BSD 3-clause "New" or                                                             |

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| Net-SNMP       | V4-2-patches-merge2                                                                                                                                                                                                                                                                                                                                                                                                        | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a> | Diffstat License AND Christian Michelsen Research License)                    |
| Net-SNMP       | 5.2.4 source code, 5.2.5 pre-releases, 5.3.1, 5.3.2 pre-releases, 5.4.2 pre-releases, 5.5, Ext-4-0-pre5, Ext-4-1-pre1, Ext-5-0-2-pre1, Ext-5-0-7-pre1, Ext-5-0-8-pre1, Ext-5-2-2rc6, Ext-5-2-pre2, Ext-5-2-pre3, Ext-5-3-pre1, Ext-5-3-pre3, Ext-5-3-pre4, Ext-5-4-1-pre1, Ext-5-4-1-pre3, Ext-5-4-pre1, Ext-5-4-pre4, Ext-5-5-pre1, Ext-5-5-pre2, Ext-5-5-pre3, Ext-5-5-rc1, Ext-5-5-rc3, 5.3.0.1. 5.8.1.pre1, 5.8.1.pre2 | <a href="http://www.net-snmp.org">http://www.net-snmp.org</a> | BSD 3-clause "New" or "Revised" License                                       |
| NetBSD         | 1.1, 1.5, 2                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="http://www.netbsd.org">http://www.netbsd.org</a>     | BSD 3-clause "New" or                                                         |

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| OpenFabrics Enterprise Distribution - OFED             | 1.2, 1.5, 3.3.2018                                                   | <a href="https://www.openfabrics.org/downloads/rdmacm/">https://www.openfabrics.org/downloads/rdmacm/</a> | BSD 2-clause "Simplified" License        |
| OpenFabrics Enterprise Distribution - OFED             | 3.1.8                                                                | <a href="https://www.openfabrics.org/downloads/rdmacm/">https://www.openfabrics.org/downloads/rdmacm/</a> | BSD 3-clause "New" or "Revised" License  |
| OpenLDAP                                               | 2.4.44                                                               | <a href="http://www.openldap.org/">http://www.openldap.org/</a>                                           | Open LDAP Public License v2.8            |
| OpenSSH                                                | 5.3p1, 7.4p1, 7.7, 7.7p1, 7.8, 7.8p1, 7.9, 7.9p1, 8.0p1, pre-reorder | <a href="http://www.openssh.com/">http://www.openssh.com/</a>                                             | BSD 3-clause "New" or "Revised" License  |
| OpenSSH                                                | 7.2p2, 7.6p1                                                         | <a href="http://www.openssh.com/">http://www.openssh.com/</a>                                             | X11 License                              |
| OpenWrt                                                | 12.09, 14.07                                                         | <a href="http://openwrt.org/">http://openwrt.org/</a>                                                     | GNU General Public License v2.0 or later |
| PCRE                                                   | 7.1, 7.4, 7.6                                                        | <a href="http://www.pcre.org/">http://www.pcre.org/</a>                                                   | PCRE License                             |
| PCRE                                                   | 4, 7.6, 7.7, 7.8                                                     | <a href="http://www.pcre.org/">http://www.pcre.org/</a>                                                   | BSD 3-clause "New" or "Revised" License  |
| PHP                                                    | MERGE_FROM_NEW_LOOK_2001_TAG_1                                       | <a href="http://svn.php.net">http://svn.php.net</a>                                                       | BSD 2-clause "Simplified" License        |
| <a href="http://portableapps.com">PortableApps.com</a> | WinMerge 2.10.0 , 2.6.12Source                                       | <a href="http://portableapps.com/">http://portableapps.com/</a>                                           | Apache License 2.0                       |
| Python programming language                            | v2.4a2                                                               | <a href="https://www.python.org">https://www.python.org</a>                                               | Python Software Foundation License 2.0   |

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| Qualcomm Kernel Tree for MSM/QSD family and Android 4.4 | ath-201808291719                         | <a href="https://www.codeaurora.org/projects/all-active-projects/linux-msm">https://www.codeaurora.org/projects/all-active-projects/linux-msm</a> | ISC License                                     |
| TACACS+ client library and PAM module                   | 1.2.10, 1.2.9                            | <a href="https://sourceforge.net/projects/tacplus">https://sourceforge.net/projects/tacplus</a>                                                   | BSD 3-clause "New" or "Revised" License         |
| Stephane-D/SGDK                                         | V1.62                                    | <a href="https://github.com/Stephane-D/SGDK/blob/master/license.txt">https://github.com/Stephane-D/SGDK/blob/master/license.txt</a>               | MIT License                                     |
| TACACS+ client library and PAM module                   | 1.3.2                                    | <a href="https://sourceforge.net/projects/tacplus">https://sourceforge.net/projects/tacplus</a>                                                   | GNU General Public License v2.0 or later        |
| Tarifa                                                  | Tarifa019.tar                            | <a href="http://sourceforge.net/projects/tarifa">http://sourceforge.net/projects/tarifa</a>                                                       | GNU General Public License v2.0 or later        |
| Tcl/Tk                                                  | 8.1.1                                    | <a href="http://www.tcl.tk/">http://www.tcl.tk/</a>                                                                                               | TCL/TK License                                  |
| Tecla Library                                           | 1.2.3, 1.4.0, 1.4.1, 1.5.0, 1.6.0, 1.6.2 | <a href="http://www.astro.caltech.edu/~mcs/tecla/index.html">http://www.astro.caltech.edu/~mcs/tecla/index.html</a>                               | MIT License                                     |
| The GWARE Project                                       | 2.10.2                                   | <a href="http://sourceforge.net/projects/gware">http://sourceforge.net/projects/gware</a>                                                         | GNU Lesser General Public License v2.1 or later |
| TizenRT                                                 | 1.1_Public_Release                       | <a href="https://github.com/Samsung/TizenRT">https://github.com/Samsung/TizenRT</a>                                                               | Apache License 2.0                              |
| UC-7402.7408.7410.7420-LX Plus Source                   | 20100210                                 | <a href="http://www.moxa.com/product/UC-7408.htm">http://www.moxa.com/product/UC-7408.htm</a>                                                     | GNU General Public License v2.0 only            |
| WinMerge                                                | 2.11.1.7                                 | <a href="https://winmerge.org/">https://winmerge.org/</a>                                                                                         | Apache License 2.0                              |
| XAMPP                                                   | 1.4.5, 1.6.4                             | <a href="https://www.apachefriends.org/index.html">https://www.apachefriends.org/index.html</a>                                                   | BSD 3-clause "New" or "Revised" License         |

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| XAMPP                      | 1.6.4                                     | <a href="https://www.apachefriends.org/index.html">https://www.apachefriends.org/index.html</a>   | GNU General Public License v2.0 or later        |
| XQilla                     | 1.1.0                                     | <a href="http://xqilla.sourceforge.net">http://xqilla.sourceforge.net</a>                         | BSD 3-clause "New" or "Revised" License         |
| YaST                       | broken/svn/openSUSE-9_3                   | <a href="http://opensuse.org/YaST">http://opensuse.org/YaST</a>                                   | MIT License                                     |
| Zile (Zile is Lossy Emacs) | 1.4, 1.5, 1.5.2, 1.5.3, 1.6, 1.6.1, 1.6.2 | <a href="http://zile.sourceforge.net">http://zile.sourceforge.net</a>                             | GNU General Public License v2.0 or later        |
| afwall                     | V2.6.0.1, v2.8.0, v2.9.0, v2.9.1, v2.9.4  | <a href="https://github.com/ukanth/afwall">https://github.com/ukanth/afwall</a>                   | MIT License                                     |
| alcatel                    | 20                                        | <a href="http://www.alcatel-mobilephones.com/">http://www.alcatel-mobilephones.com/</a>           | Apache License 2.0                              |
| alcatel                    | 4/18/2012, 20120601, 918                  | <a href="http://www.alcatel-mobilephones.com/">http://www.alcatel-mobilephones.com/</a>           | GNU General Public License v2.0 or later        |
| appweb                     | 3.0B.0-0                                  | <a href="http://code.google.com/p/appweb">http://code.google.com/p/appweb</a>                     | Apache License 2.0                              |
| asuswrt-merlin             | 376.48, 376.48, 380.62                    | <a href="https://github.com/RMerl/asuswrt-merlin">https://github.com/RMerl/asuswrt-merlin</a>     | Artistic License 1.0                            |
| asuswrt-merlin             | 378.51, 380.62                            | <a href="https://github.com/RMerl/asuswrt-merlin">https://github.com/RMerl/asuswrt-merlin</a>     | GNU General Public License v2.0 or later        |
| avahi                      | v0.6                                      | <a href="http://avahi.org">http://avahi.org</a>                                                   | GNU Lesser General Public License v2.1 or later |
| awokengazebo-lfi           | lfi-20080723                              | <a href="http://www.awokengazebo.com/software/lfi/">http://www.awokengazebo.com/software/lfi/</a> | BSD 4-clause "Original" or "Old" License        |

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| beefproject                    | beef-0.4.3.1                                                                                                                                                                          | <a href="http://beefproject.com">http://beefproject.com</a>                                           | Apache License 2.0                       |
| bitswitcher                    | 0.2.0, 0.3.0, 0.3.3                                                                                                                                                                   | <a href="http://sourceforge.net/projects/bitswitcher">http://sourceforge.net/projects/bitswitcher</a> | GNU General Public License v2.0 or later |
| buildroot-kindle               | master-20130206                                                                                                                                                                       | <a href="https://github.com/twobob/buildroot-kindle">https://github.com/twobob/buildroot-kindle</a>   | GNU General Public License v2.0 or later |
| busybox                        | 1.10.0, 1.12.0, 1.2.0, 1.4.0, 1.5.0, 1.8.0, 1_11_0, 1_13_0, 1_14_1, 1_16_0, 1_17_1 17 1, 1_17_2, 1_18_0, 1_18_2, 1_19_0, 1_19_1, 1_19_4, 1_20_2, 1_21_0, 1_24_0, 1_29_0, 1_3_0, 1_7_0 | <a href="https://github.com/mirror/busybox">https://github.com/mirror/busybox</a>                     | GNU General Public License v2.0 only     |
| busybox                        | 1_14_0, 1_15_0, 1_17_0, 1_19_2, 1_19_3, 1_20_0, 1_20_1, 1_28_0,                                                                                                                       | <a href="https://github.com/mirror/busybox">https://github.com/mirror/busybox</a>                     | GNU General Public License v2.0 or later |
| catboost/catboost              | v0.2                                                                                                                                                                                  | <a href="https://catboost.ai">https://catboost.ai</a>                                                 | Apache License 2.0                       |
| curl                           | 7.16.0                                                                                                                                                                                | <a href="https://curl.se/">https://curl.se/</a>                                                       | curl License                             |
| decorator-ko                   | 26, 28                                                                                                                                                                                | <a href="http://jinseltistory.com/372">http://jinseltistory.com/372</a>                               | Public Domain                            |
| file                           | 5.22                                                                                                                                                                                  | <a href="http://www.darwinsys.com/file/">http://www.darwinsys.com/file/</a>                           | Fine Free File Command License           |
| fluxcapacitor                  | 0                                                                                                                                                                                     | <a href="https://github.com/majek/fluxcapacitor">https://github.com/majek/fluxcapacitor</a>           | MIT License                              |
| fvpatwds : fvpat Webdev Server | fvpatwds v0.1.4                                                                                                                                                                       | <a href="http://sourceforge.net/projects/fvpatwds">http://sourceforge.net/projects/fvpatwds</a>       | Apache License 2.0                       |

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| generator-minxing                        | 1.0.2                                             | <a href="https://github.com/yeoman/generator-minxing#readme">https://github.com/yeoman/generator-minxing#readme</a>                 | Apache License 2.0                                      |
| geonkick                                 | 2.3.6                                             | <a href="https://github.com/iurie-sw/geonkick">https://github.com/iurie-sw/geonkick</a>                                             | GNU General Public License v3.0 or later                |
| hostap-ct                                | If-5.1.7, If-5.3.3, If-5.3.3b, If-5.3.4, If-5.3.5 | <a href="https://github.com/greearb/hostap-ct">https://github.com/greearb/hostap-ct</a>                                             | BSD 3-clause "New" or "Revised" License                 |
| hostapd                                  | hostap_0_5_2, hostap_0_5_3, hostap_0_5_6,         | <a href="http://w1.fi/hostapd/">http://w1.fi/hostapd/</a>                                                                           | GNU General Public License v2.0 or later                |
| howl                                     | 0.9.4, 0.9.6, 0.9.7, 0.9.9, 1.0.0, 0.9.3, 0.9.1   | <a href="https://howl.io">https://howl.io</a>                                                                                       | BSD 3-clause "New" or "Revised" License                 |
| illumos-joyent                           | 20121101                                          | <a href="http://www.illumos.org/projects/illumos-gate">http://www.illumos.org/projects/illumos-gate</a>                             | Common Development and Distribution License 1.0         |
| krb5/krb5                                | 1.0-alpha3, 1.0-beta2, 1.0-beta5                  | <a href="https://github.com/krb5/krb5">https://github.com/krb5/krb5</a>                                                             | Krb5-MIT License                                        |
| libevent - an event notification library | 0.1, 1.0d, 1.0e, 1.4.1-beta                       | <a href="http://libevent.org/">http://libevent.org/</a>                                                                             | BSD 3-clause "New" or "Revised" License                 |
| libexpat                                 | 1.95.0, 1.95.1, 1.95.2, 2.0.0, v19991013          | <a href="http://www.libexpat.org/">http://www.libexpat.org/</a>                                                                     | Expat License                                           |
| libexpat                                 | V19991013                                         | <a href="http://www.libexpat.org/">http://www.libexpat.org/</a>                                                                     | Mozilla Public License 1.1                              |
| linux-yocto-dev                          | v2.6.12                                           | <a href="http://git.yoctoproject.org/cgit/cgit.cgi/linux-yocto-dev/">http://git.yoctoproject.org/cgit/cgit.cgi/linux-yocto-dev/</a> | GNU General Public License v2.0 with Linux Syscall Note |

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|--------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| littlekernel-m900-eclair | master-20110326          | <a href="http://github.com/LouZiffer/littlekernel-m900-eclair">http://github.com/LouZiffer/littlekernel-m900-eclair</a> | GNU General Public License v2.0 only                                                                           |
| lmbd                     | 0.9.18                   | <a href="http://symas.com/mdb/">http://symas.com/mdb/</a>                                                               | Open LDAP Public License                                                                                       |
| math-linux               | 0.0.1                    | <a href="http://sourceforge.net/projects/math-linux">http://sourceforge.net/projects/math-linux</a>                     | GNU General Public License v3.0 or later                                                                       |
| mod_dup                  | 2.5.0                    | <a href="http://github.com/Orange-OpenSource/mod_dup/">http://github.com/Orange-OpenSource/mod_dup/</a>                 | Apache License 2.0                                                                                             |
| ngx_pagespeed            | 1.9.32.4-dbg-ssl-crash   | <a href="https://github.com/pagespeed/nginx_pagespeed">https://github.com/pagespeed/nginx_pagespeed</a>                 | Apache License 2.0                                                                                             |
| nss_ldap                 | 253                      | <a href="https://github.com/PADL/nss_ldap">https://github.com/PADL/nss_ldap</a>                                         | GNU Library General Public License v2 or later                                                                 |
| opensm                   | 3.3.17                   | <a href="http://www.openfabrics.org/">http://www.openfabrics.org/</a>                                                   | BSD 2-clause "Simplified" License                                                                              |
| pGina                    | Plugin Bundle 05-11-2006 | <a href="http://pgina.org/">http://pgina.org/</a>                                                                       | MIT License                                                                                                    |
| pam_radius               | release_2_0_0            | <a href="http://freeradius.org/pam_radius_auth/">http://freeradius.org/pam_radius_auth/</a>                             | GNU General Public License v2.0 only                                                                           |
| protovis                 | 3.3.1                    | <a href="http://mbostock.github.io/protovis/">http://mbostock.github.io/protovis/</a>                                   | BSD 3-clause "New" or "Revised" License                                                                        |
| root-project             | 5-13-04e                 | <a href="https://root.cern">https://root.cern</a>                                                                       | (GNU Lesser General Public License v2.1 or later AND MIT License AND GNU General Public License v2.0 or later) |

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|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| rsyslog                                                                       | sysklogd-141-import                                                                                                            | <a href="https://www.rsyslog.com/">https://www.rsyslog.com/</a>                                     | GNU General Public License v2.0 or later                                                       |
| rtems-libbsd                                                                  | 5.1                                                                                                                            | <a href="http://git.rtems.org/rtems-libbsd.git/">http://git.rtems.org/rtems-libbsd.git/</a>         | Apache License 2.0                                                                             |
| rtl8186 - toolchain                                                           | 0.5.5_src                                                                                                                      | <a href="http://rtl8186.sourceforge.net">http://rtl8186.sourceforge.net</a>                         | GNU General Public License v2.0 or later                                                       |
| snake-os                                                                      | 0.9                                                                                                                            | <a href="http://code.google.com/p/snake-os/">http://code.google.com/p/snake-os/</a>                 | GNU General Public License v2.0 or later                                                       |
| ssmtp                                                                         | 2.61                                                                                                                           | <a href="http://packages.qa.debian.org/s/ssmtp.html">http://packages.qa.debian.org/s/ssmtp.html</a> | GNU General Public License v2.0 or later                                                       |
| <a href="svn://svn.tug.org/texlive/trunk">svn://svn.tug.org/texlive/trunk</a> | texlive-2009.0                                                                                                                 | <a href="http://www.tug.org/texlive/">http://www.tug.org/texlive/</a>                               | LaTeX Project Public License - Version Unspecified                                             |
| util-linux                                                                    | 2.11q, 2.11w, 2.12a, 2.13-pre1                                                                                                 | <a href="https://en.wikipedia.org/wiki/Util-linux">https://en.wikipedia.org/wiki/Util-linux</a>     | GNU General Public License v2.0 or later                                                       |
| videolan/vlc                                                                  | 0.5.0                                                                                                                          | <a href="https://github.com/videolan/vlc">https://github.com/videolan/vlc</a>                       | (GNU Lesser General Public License v2.1 or later AND GNU General Public License v2.0 or later) |
| wakame-vdc                                                                    | v13.06.0                                                                                                                       | <a href="http://wakame.axsh.jp/">http://wakame.axsh.jp/</a>                                         | Unknown License                                                                                |
| wpa_supplicant - IEEE 802.1X, WPA, WPA2, RSN, IEEE 802.11i                    | 0.5.0, 0.5.3, 0.5.5, 0.5.6, 0.5.8, 0.6.0, 0.6.10, 0.6.2, 0.6.3, 0.6.4, 0.6.8, 0.7.0, 0.7.1, 0.7.2, 0.7.3, 1, 2, 2.1, 2.2, 2.3, | <a href="http://w1.fi/wpa_supplicant/">http://w1.fi/wpa_supplicant/</a>                             | BSD 3-clause "New" or "Revised" License                                                        |

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|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
|                | 2.4, 2.5, 2.6, 2.7,<br>2.7+git20190108+<br>11ce7a1,,<br>2.7~git20180504+<br>60a5737,<br>2.7~git20180606+<br>b915f2c,<br>2.7~git20180706+<br>420b5dd |                                                                                                                                                                                                                                                                                   |                                          |
| xorp.ct        | 1.5, xorp-1-7                                                                                                                                       | <a href="http://www.candelatech.com/xorp.ct">http://www.candelatech.com/xorp.ct</a>                                                                                                                                                                                               | MIT License                              |
| zeroconf       | 0.9                                                                                                                                                 | <a href="https://files.pythonhosted.org/packages/20/d7/418ff6c684ace0f5855ec56c66cfa99ec50443c41693b91e9abcccfa096c/zeroconf-0.20.0.tar.gz">https://files.pythonhosted.org/packages/20/d7/418ff6c684ace0f5855ec56c66cfa99ec50443c41693b91e9abcccfa096c/zeroconf-0.20.0.tar.gz</a> | GNU General Public License v2.0 or later |

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