

PDR Deterministic Plugin

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### Overview

The PDR deterministic plugin, overseen by the UFM, is a docker container that isolates malfunctioning ports, and then reinstates the repaired links to their previous condition by lifting the isolation. The PDR plugin uses a specific algorithm to isolate ports, which is based on telemetry data from the UFM Telemetry. This data includes packet drop rate, BER counter values, link down counter, and port temperature. Any decisions made by the plugin will trigger an event in the UFM for tracking purposes.

The PDR plugin performs the following tasks:

- 1. Collects telemetry data using UFM Dynamic Telemetry
- 2. Identifies potential failures based on telemetry calculations and isolates them to avert any interruption to traffic flow
- 3. Maintains a record of maintenance procedures that can be executed to restore an isolated link
- 4. After performing the required maintenance, the system verifies if the ports can be de-isolated and restored to operational status (brought back online).

The plugin can simulate port isolation without actually executing it for the purpose of analyzing the algorithm's performance and decision-making process in order to make future adjustments. This behavior is achieved through the implementation of a "dry\_run" flag that changes the plugin's behavior to solely record its port "isolation" decisions in the log, rather than invoking the port isolation API. All decisions will be recorded in the plugin's log.

## **Schematic Flow**



## Deployment

To deploy the plugin, follow these steps:

- 1. Download the ufm-plugin-pdr\_deterministic-image from the **Docker Hub**.
- 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:



3. 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.

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## **Isolation Decisions**

## **NDR Link Validation Procedure**

Verify ports that are in INIT, ARMED or ACTIVE states only. Track the SymbolErrorsExt of every such link for at least 120m. If polling period is Pm, need to keep N=(125+Pm+1)/Pm samples. Also, two delta samples are computed: number of samples covering 12 minutes S12m = (12 + Pm + 1)/Pm and S125m = (125 + Pm + 1)/Pm. 12m\_thd = LinkBW\_Gbps\*1e9\*12\*60\*1e-14 (2.88 for NDR) and

125m\_thd = LinkBW\_Gbps\*1e9\*125\*60\*1e-15 (3 for NDR).

Check the following conditions for every port in the given set:

1. If the Delta(LinkDownedCounterExt) port is > 0 and the Delta(LinkDownedCounterExt) remote port is > 0, add it to the list of bad\_ports. This condition should be ignored if the -- no\_down\_count flag is provided.

- 2. If the symbol\_errors[now\_idx] symbol\_errors[now\_idx S12m] is > 12m\_thd, add the link to the list of bad\_ports, and continue with next link.
- 3. If the symbol\_errors[now\_idx] symbol\_errors[now\_idx S125m] is > 125m\_thd, add the link to the list of bad\_ports, continue with next linkPacket drop rate criteria

When packet drops due to the link health are detected, isolate the problematic link. To achieve this, a target packet\_drop/packet\_delivered ratio can be employed to include TX ports with a receiver exceeding this threshold in the list of bad\_ports. However, the drawback of this method is that such links may fluctuate between bad/good state since their BER may be normal. Therefore, it is advisable to track their statistics over time and refrain from reintegrating them after their second or third de-isolation.

### **Return to Service**

Continuously monitoring the collection of bad\_ports, the plugin persistently assess their Bit Error Rate (BER) and determines their reintegration when they successfully pass the 126m test without errors.

# Configuration

The following parameters are configurable via the plugin's configuration file. (pdr\_deterministic.conf)

Name	Description	Default Value
INTERVAL	Interval for requesting telemetry counters, in seconds.	300
MAX_NUM_ISOLATE	Maximum ports to be isolated. max(MAX_NUM_ISOLATE, 0.5% * fabric_size)	10
ТМАХ	Maximum temperature threshold	70 (Celsius)
D_TMAX	Maximum allowed Temperature Delta	10
MAX_PDR	Maximum allowed packet drop rate	1e-12

Name	Description	Default Value
CONFIGURED_BER_C HECK	If set to true, the plugin will isolate based on BER calculations	True
CONFIGURED_TEMP_ CHECK	If set to true, the plugin will isolate based on temperature measurements	True
LINK_DOWN_ISOLATI ON	If set to true, the plugin will isolate based on LinkDownedCounterExt measurements	False
SWITCH_TO_HOST_IS OLATION	If set to true, the plugin will isolate ports connected via access link	False
DRY_RUN	Isolation decisions will be only logged and will not take effect	False
DEISOLATE_CONSIDE R_TIME	Consideration time for port de-isolation (in minutes)	5
DO_DEISOLATION	If set to false, the plugin will not perform de-isolation	True
DYNAMIC_WAIT_TIM E	Seconds to wait for the dynamic telemetry session to respond	30

## **Calculating BER Counters**

For calculating BER counters, the plugin extracts the maximum window it needs to wait for calculating the BER value, using the following formula:

 $seconds = \frac{max\_BER\_target^{-1}}{min\_port\_rate}$ 

#### Example:

Rate		BER Target	Minimum Bits	Minimum Time in Seconds	In Minutes
HDR	2.00E+11	1.00E-12	1.00E+12	5	0.083333
HDR	2.00E+11	1.00E-13	1.00E+13	50	0.833333
HDR	2.00E+11	1.00E-14	1.00E+14	500	8.333333

Rate		BER Target	Minimum Bits	Minimum Time in Seconds	In Minutes
HDR	2.00E+11	1.00E-16	1.00E+16	50000	833.3333

BER counters are calculated with the following formula:

 $BER = \frac{error \ bits_i - error \ bits_{i-1}}{total \ bits_i - total \ bits_{i-1}} = \frac{error \ bits_i - error \ bits_{i-1}}{Link \ data \ rate*(time_i - time_{i-1})}$ 

### **Ports Exclusion List**

You can designate specific ports to be excluded from PDR analysis, isolation, or deisolation for an indefinite or limited period. Already excluded ports can also be removed from this list.

Ports are added to or removed from the exclusion list via the PDR plugin's REST API.

To add ports to the exclusion list (to be excluded from analysis), run:

curl -k -i -u <user:password> -X PUT 'https://<host\_ip>/ufmRest/plugin/pdr\_deterministic/excluded' -d ' [<formatted\_ports\_list>]' -H "Content-Type: application/json"

Optionally, you can specify a TTL (time to live in the exclusion list) following the port after the comma. If zero or not specified, the port is excluded. For example:

-d '[["9c0591030085ac80\_45"],["9c0591030085ac80\_46",300]]'

To remove ports from the exclusion list:

curl -k -i -u <user:password> -X DELETE 'https://<host\_ip>/ufmRest/plugin/pdr\_deterministic/excluded' - d '[<comma\_separated\_port\_names>]' -H "Content-Type: application/json"

Example:

-d '["9c0591030085ac80\_45","9c0591030085ac80\_46"]'

#### To retrieve ports and their remaining exclusion times from the exclusion list:

curl -k -i -u <user:password> -X GET 'https://<host\_ip>/ufmRest/plugin/pdr\_deterministic/excluded'

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