NVIDIA Magnum IO GPUDirect Storage

Release Notes
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Chapter 1. Introduction

Release information for NVIDIA® GPUDirect® Storage (GDS) for developers and users.

NVIDIA® Magnum IO GPUDirect® Storage (GDS) is one of the members of the GPUDirect family of technologies. GDS enables a direct data path for direct memory access (DMA) transfers between GPU memory and storage. This direct path increases IO bandwidth, decreases IO latency and reduces the utilization load on the host CPU.

GDS is generally available on third party storage solutions from DDN EXAScaler®, Dell Isilon, IBM Spectrum Scale, NetApp ONTAP, BeeGFS, WekaFS™, VAST NFS, Dell Isilon, NVmesh Excelero, ScaleFlux, Micron, and Pavilion Data. GDS documents and online resources provide additional context for the optimal use of and understanding of GPUDirect Storage.

Refer to the following guides for more information about GDS:

- GPUDirect Storage Design Guide
- GPUDirect Storage Overview Guide
- cuFile API Reference Guide
- GPUDirect Storage Best Practices Guide
- GPUDirect Storage Installation and Troubleshooting Guide
- GPUDirect Storage O_DIRECT Requirements Guide

To learn more about GDS, refer to the following posts:

- GPUDirect Storage: A Direct Path Between Storage and GPU Memory
- The Magnum IO blog series.
Chapter 2. New Features

The following features have been added in v1.2.1:

Chapter 3. MLNX_OFED and Filesystem Requirements

The following are the MLNX_OFED and filesystem requirements for GDS:

- MLNX_OFED 5.3 and later, which supports NVMe NVMeoF, NFSoRDMA (VAST) on Linux kernel 4.15.x and 5.4.x. MLNX_OFED 5.4 is preferred.

MLNX_OFED must be installed before installing GDS. Refer to Installing GPUDirect Storage for more information about installing MLNX_OFED.

Note: MOFED 5.5.x has been tested with NVMe, NVMeOF, NFS. For other DFS file systems support, check with the respective vendor.
Chapter 4. Support Matrix

GDS has been tested on following NVIDIA GPUs: T10x, T4, A10, Quadro P6000, A100, and V100. For a full list of GPUs that GDS works with, refer to the Known Limitations section.

<table>
<thead>
<tr>
<th>Partner Company</th>
<th>Partner Product Version</th>
<th>Compatible GDS Version</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetApp</td>
<td>ONTAP 9.10.1</td>
<td>1.0 and higher</td>
<td>Jan 2022</td>
<td>See ONTAP release notes</td>
</tr>
<tr>
<td>NetApp</td>
<td>BeeGFS Tech Preview</td>
<td>1.1.1 and higher</td>
<td>TBA</td>
<td></td>
</tr>
<tr>
<td>ThinkParQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Fabrics Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM</td>
<td>Spectrum Scale 5.1.2</td>
<td>1.1 and higher</td>
<td>Nov 2021</td>
<td></td>
</tr>
<tr>
<td>DDN</td>
<td>EXAScaler 6.0</td>
<td>1.1 and higher</td>
<td>Nov 2021</td>
<td></td>
</tr>
<tr>
<td>VAST</td>
<td>Universal Storage 4.1</td>
<td>1.1 and higher</td>
<td>Nov 2021</td>
<td></td>
</tr>
<tr>
<td>WekaIO</td>
<td>WekaFS 3.13</td>
<td>1.0</td>
<td>June 2021</td>
<td></td>
</tr>
<tr>
<td>DellEMC</td>
<td>PowerScale 9.2.0.0</td>
<td>1.0</td>
<td>Oct 2021</td>
<td></td>
</tr>
<tr>
<td>Hitachi Vantara</td>
<td>HCSF</td>
<td>1.0</td>
<td>Oct 2021</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 5. GDS Enabled Libraries

GDS has been enabled in the following libraries:

- RAPIDSs cuDF: [More details]
- CLARA cuCIM: [More details]
- DALI: [More details]
- Spark: [More details]
Chapter 6. Included Packages

The GDS package contains the following Debian packages:

- gds-tools-11-6_*.deb
- libcufile-11-6_*.deb
- libcufile-dev-11-6_*.deb
- nvidia-fs_2.10_*.deb
- nvidia-fs-dkms_2.10_*.deb
- nvidia-gds-11-6_*.deb
- nvidia-gds_11.6_*.deb

Note: Each component has a README file. For example, for gds-tools, the README file is in the /usr/local/CUDA-11.6/gds/tools/ directory.
Chapter 7. Known Issues

The following are known issues in this release of GDS.

- WekaFS does not support newer MLNX_OFED versions 5.3.x and above with GDS. `nvidia-peer-memory-dkms=1.1-0-nvidia2` is required for GDS support with WekaFS. Please follow the instructions in Installing GDS.
- For DDN EXAScaler filesystem:
  - With stripe count > 1, `cuFileRead` and `cuFileWrite` do not work with poll mode enabled for versions older than 2.12.5_ddn10.
  - With 2.12.5_ddn10, any reads beyond EOF causes a BUG_ON inside nvidia-fs.
- RHEL8.3 does not have default udev rules for detecting RAID members, which disables GDS on RAID volumes. Refer to the section Adding udev Rules for RAID Volumes in the GPUDirect Storage Installation and Troubleshooting Guide.
- On DGX OS:
  - For log collection, use `gds_log_collection.py` described in Sending Relevant Data to Customer Support.
  - For package installation for releases earlier than CUDA 11.4, use the online instructions in Preparing the OS instead of the README included as part of the GDS package.
Chapter 8. Known Limitations

This section provides information about the known limitations in this release of GDS.

- Data Center and Quadro (desktop) cards with compute capability > 6 listed here - [https://developer.nvidia.com/cuda-gpus#compute](https://developer.nvidia.com/cuda-gpus#compute) are supported in GDS mode. All other cards are supported only in compatibility mode.
- With any NVIDIA software components installed, downgrading from RHEL 8.4 to RHEL 8.3 is not supported.
- For DDN EXAScaler, checksum is disabled in the read/write IO path.
- For WekaFS, checksum is disabled in the read/write IO path.
- cuFile APIs are not supported with applications using the `fork()` system call.
- GDS Compatibility mode works on GDS qualified file systems: EXAScaler, XFS, ext4, IBM Spectrum Scale, VAST, and WekaFS.
- GDS with IOMMU enabled or ACS enabled are not guaranteed to work functionally or in a performant way with all non-DGX based platforms.
- Refer to the following documentation for IBM Spectrum Scale Limitations with GDS: [http://www.ibm.com/support/pages/node/6444075](http://www.ibm.com/support/pages/node/6444075)
- The following are the known limitations of cuFile Batch APIs:
  - Batch I/Os will be supported mainly by either the local file systems which are hosted on NVMe or NVMeOF devices or by the native file system that supports Linux AIO. Following table provides an overview of the cuFile batch API support with respect to different file systems.

<table>
<thead>
<tr>
<th>File System</th>
<th>GDS Batch Mode</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext4/XFS</td>
<td>Read/Write support</td>
<td></td>
</tr>
<tr>
<td>DDN EXAScaler</td>
<td>Read/Write support</td>
<td></td>
</tr>
<tr>
<td>NFS</td>
<td>Read/Write support</td>
<td></td>
</tr>
<tr>
<td>IBM Spectrum Scale</td>
<td>Not available</td>
<td>Will work in compat mode</td>
</tr>
<tr>
<td>Weka</td>
<td>Not available</td>
<td>Will work in compat mode</td>
</tr>
<tr>
<td>BeeGFS</td>
<td>Not available</td>
<td>Will work in compat mode</td>
</tr>
</tbody>
</table>

- Batch APIs only support 4096 bytes aligned sizes and offsets
- Batch APIs do not support I/Os through unregistered buffers. In other words, the caller must call `cuFileBufRegister` to register the buffer prior to doing any I/Os using batch APIs.
Mix of read and write in a single batch request vector is not supported.
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