Clusters - Prince

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Overview

Prince is the main NYU HPC cluster. The Mercer cluster was decommissioned on May 19th, 2017

Hardware Specifications

<table>
<thead>
<tr>
<th>System Name</th>
<th>HPC Cluster Prince</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor</td>
<td>Dell</td>
</tr>
</tbody>
</table>
| Network     | • Infiniband by Mellanox for MPI and access to file systems (home (ZFS), scratch (Luster and BeeGFS), and archive)  
• 10Gbit Management Network (node provisioning and configuration)  
• 1 Gb Ethernet Service Network for IPMI/DRAC access  
• 10Gbit access to the public NYU Network (only available on the Prince login nodes and selected management nodes) |
| Operating System | CentOS 7.4 |
| Login Nodes | 2 login nodes: prince0 and prince1.hpc.nyu.edu  
Each login node has 2 Intel Xeon E5-2680v4 2.4GHz CPUs ("Broadwell", 14 cores/socket, a total of 28 cores/login node) and 128 GB memory |
Compute Nodes

- **Standard Compute Nodes**
  - 4 nodes (Dell PowerEdge C6420 in a 6400 chassis enclosure) each will 2 Intel Xeon Gold 6148 2.4GHz CPUs (“Skylake”, 20 cores/socket, 40 cores/node) and 187GB memory, EDR interconnects. Nodes: c42-0[1-4]
  - 68 nodes each with 2 Intel Xeon E5-2690v4 2.6GHz CPUs (“Broadwell”, 14 cores/socket, 28 cores/node) and 125GB memory, EDR interconnects
  - 32 nodes each with 2 Intel Xeon E5-2660v3 2.6GHz CPUs (“Haswell”, 10 cores/socket, 20 cores/node) and 62 GB memory. The 32 nodes are M630 Blade servers on 2 M1000e chassis and are interconnected via FDR Infiniband
  - 64 nodes each with 2 Intel Xeon E5-2690v2 3.0GHz CPUs (“Ivy Bridge”, 10 cores/socket, 20 cores/node) and 62GB memory. The 64 nodes are M620 Blade servers on 4 M1000e chassis and are interconnected via FDR Infiniband (used to be Mercer chassis 0, 1, 2, 3)
  - 112 nodes each with 2 Intel Xeon E-2690v2 3.0GHz CPUs (“Ivy Bridge”, 10 cores/socket, 20 cores/node) and 62GB memory. The 112 nodes are M620 Blade servers on 7 M1000e chassis and are interconnected via QDR Infiniband (Mercer chassis 14-20)
  - 48 nodes each with 2 Intel Xeon E-2690v2 3.0GHz CPUs (“Ivy Bridge”, 10 cores/socket, 20 cores/node) and 189GB memory. The 48 nodes are M620 Blade servers on 3 M1000e chassis and are interconnected via QDR Infiniband (Mercer chassis 21-23)

- **Nodes equipped with NVIDIA GPUs**
  - 6 nodes each with 2 Intel Xeon Gold 6148 2.4GHz CPUs (“Skylake”, 20 cores/socket, 40 cores/node) and 384GB memory, EDR interconnects, each node equipped with 4 NVIDIA V100 SXM2 GPUs (16GB) connected with NVLink
  - 1 node with 2 Intel Xeon Gold 6148 2.4GHz CPUs (“Skylake”, 20 cores/socket, 40 cores/node) and 192GB memory, EDR interconnects, each node equipped with 2 NVIDIA V100 PCIe GPUs (16GB) connected via PCIe
  - 8 nodes each with 2 Intel Xeon E5-2690v4 2.6GHz CPUs (“Broadwell”, 14 cores/socket, 28 cores/node) and 256GB memory, EDR interconnects, each node equipped with 4 NVIDIA P100 GPUs (16GB)
  - 24 nodes each with 2 Intel Xeon E5-2690v4 2.6GHz CPUs (“Broadwell”, 14 cores/socket, 28 cores/node) and 256GB memory, EDR interconnects, each node equipped with 4 NVIDIA P40 GPUs (24GB)
  - 9 nodes each with 2 Intel Xeon E5-2690v4 2.6GHz CPUs (“Broadwell”, 14 cores/socket, 28 cores/node) and 256GB memory, EDR interconnects, each node equipped with 2 NVIDIA K80 GPUs (24GB, split between 2 GPU cards)
  - 8 nodes each with 2 Intel Xeon E5-2670v2 2.5GHz CPUs (“Ivy Bridge”, 10 cores/socket, 20 cores/node) and 128 GB memory, FDR interconnects, each node equipped with 4 NVIDIA K80 GPUs
  - 4 nodes each with 2 Intel Xeon E5-2690v4 2.6GHz CPUs (“Broadwell”, 14 cores/socket, 28 cores/node) and 128GB memory, EDR interconnects, each node equipped with 4 NVIDIA GTX 1080 GPUs (8 GB)

- **Nodes with INTEL Xeon Phi processors**
  - 2 nodes (DELL C6320P) with “Knights Landing” Intel Xeon Phi processor 7210 1.3 GHz 64 cores, 16GB MCDRAM, 188 GB DDR4 memory, EDR interconnects.

- **Medium Memory Node**
  - 4 nodes each with 2 Intel Xeon E5-2687Wv3 3.1GHz (“Haswell”, 10 cores/socket, 20 cores/node), 512GB memory, FDR interconnects.

- **High Memory Nodes**
  - 2 nodes each with 4 Intel Xeon E7-8857v2 3.0GHz (“Ivy Bridge”, 12 cores/socket, 48 cores/node), 1.5TB of memory, FDR interconnects.

<table>
<thead>
<tr>
<th>Total Nodes</th>
<th>430 (428 Compute Nodes + 2 Login Nodes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU cores</td>
<td>10,084 CPU cores on compute nodes + 56 CPU cores on login nodes</td>
</tr>
<tr>
<td>GPUs</td>
<td>26 NVIDIA V100 (16GB)</td>
</tr>
<tr>
<td></td>
<td>32 NVIDIA P100 (16GB)</td>
</tr>
<tr>
<td></td>
<td>96 NVIDIA P40 (24GB)</td>
</tr>
<tr>
<td></td>
<td>50 NVIDIA K80 (24GB)</td>
</tr>
<tr>
<td></td>
<td>16 NVIDIA GTX 1080 (8GB)</td>
</tr>
<tr>
<td>INTEL PHI</td>
<td>128 Xeon Phi 7210 “Knights Landing” physical cores</td>
</tr>
</tbody>
</table>
## File Systems

The table below shows the File Systems available on the Prince Cluster.

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>Storage Capacity (User Quota)</th>
<th>FS Type</th>
<th>Backed up?</th>
<th>Flushed?</th>
<th>Availability</th>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>/home</td>
<td>43 TB</td>
<td>ZFS</td>
<td>Yes</td>
<td>No</td>
<td>All Prince nodes (login, compute)</td>
<td>$HOME</td>
<td>/home/$USER</td>
</tr>
<tr>
<td></td>
<td>(20 GB / user)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/scratch</td>
<td>1.1 PB</td>
<td>Lustre</td>
<td>NO</td>
<td>YES</td>
<td>All Prince nodes (login, compute)</td>
<td>$SCRATCH</td>
<td>/scratch/$USER</td>
</tr>
<tr>
<td></td>
<td>(5 TB / user)</td>
<td></td>
<td></td>
<td>Files unused for 60 days are deleted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/beegfs</td>
<td>500TB</td>
<td>BeeGFS</td>
<td>NO</td>
<td>YES</td>
<td>All nodes (login, compute)</td>
<td>$BEEGFS</td>
<td>/beegfs/$USER</td>
</tr>
<tr>
<td></td>
<td>(2 TB / user)</td>
<td></td>
<td></td>
<td>Files unused for 60 days are deleted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/archive</td>
<td>700 TB</td>
<td>ZFS</td>
<td>Yes</td>
<td>No</td>
<td>Only on login nodes</td>
<td>$ARCHIVE</td>
<td>/archive/$USER</td>
</tr>
<tr>
<td></td>
<td>(2 TB / user)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/state/partition1</td>
<td>Varies, mostly &gt;100GB</td>
<td>ext3</td>
<td>NO</td>
<td>YES</td>
<td>Separate local filesystem on each compute node</td>
<td>$SLURM_JOBTMP</td>
<td>/state/partition1/$SLURM_JOBID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>at the end of each job</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>