UNIVERSITÀ DI PISA

Bright Computing Cluster Management

Presented By

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Mission Statement

- Bright Cluster Manager offers fast deployment and end-to-end management for heterogeneous high-performance computing (HPC) and AI server clusters at the edge, in the data center, and in multi/hybrid-cloud environments.

- It automates provisioning and administration for clusters ranging in size from a couple of nodes to hundreds of thousands, supports CPU-based and NVIDIA GPU-accelerated systems, and enables orchestration with Kubernetes.

Bright Computing Inc

- Bright Computing, Inc. is a developer of software for deploying and managing high-performance (HPC) clusters, Kubernetes clusters, and OpenStack private clouds in on-premises data centers as well as in the public cloud.

- It was bought by NVIDIA in January 2022

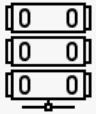
Building an HPC Cluster is Hard

- Most cluster management solutions use the “toolkit” approach (Linux distro + tools)
  - Tools typically used: Gangalia, Cacti, Nagios,xCAT, Chef, Puppet, Warewulf etc
- The problem with the “toolkit” approach :
  - Tools need to be glued together
  - Steep learning curve
  - Limited scalability
  - Tools use too many resources
  - Tools rarely designed for HPC
  - Hard to update the stack
- Making a collection of unrelated tools work together requires a lot of expertise and

Quickly Build and Manage Heterogeneous Clusters

Automates the Building and Management of Clusters

Heterogeneous high-performance Linux clusters can be quickly built and managed with NVIDIA Bright Cluster Manager, supporting HPC, machine learning, and analytics applications that span from core to edge to cloud.



Cross-Platform and Optimized for Accelerated Computing

NVIDIA Bright Cluster Manager is ideal for heterogeneous environments, supporting Arm® and x86-based CPU nodes, and is fully optimized for accelerated computing with NVIDIA GPUs and NVIDIA DGX™ systems.

Management Software that is Proven and Supported

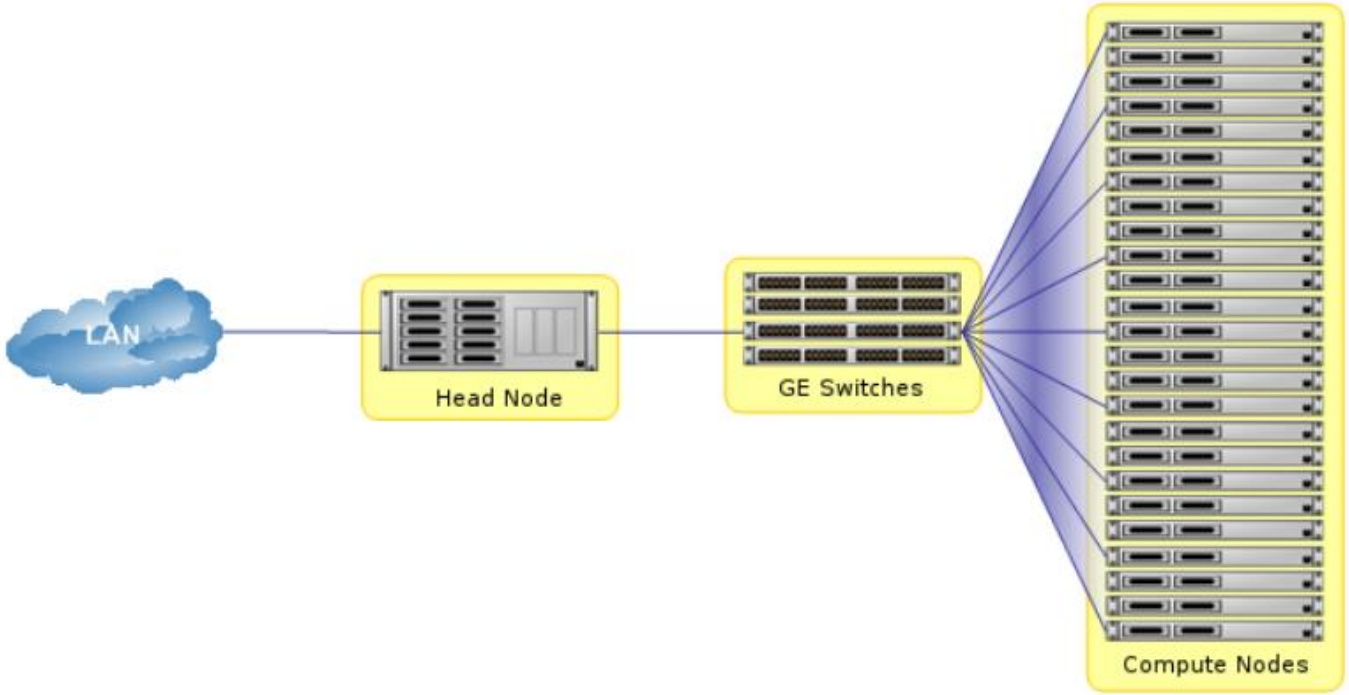
With thousands of deployments and enterprise support, NVIDIA Bright Cluster Manager is an ideal choice for deploying and managing HPC and AI clusters in production environments.

About Bright Cluster Manager

- Bright Cluster Manager takes a much more fundamental & integrated approach
  - Single cluster management
  - Single database for configuration and monitoring data
  - Single CLI and GUI for all cluster management functionality

- Which makes Bright Cluster Manager
  - Easier to use, more scalable, secure, reliable, flexible and maintainable

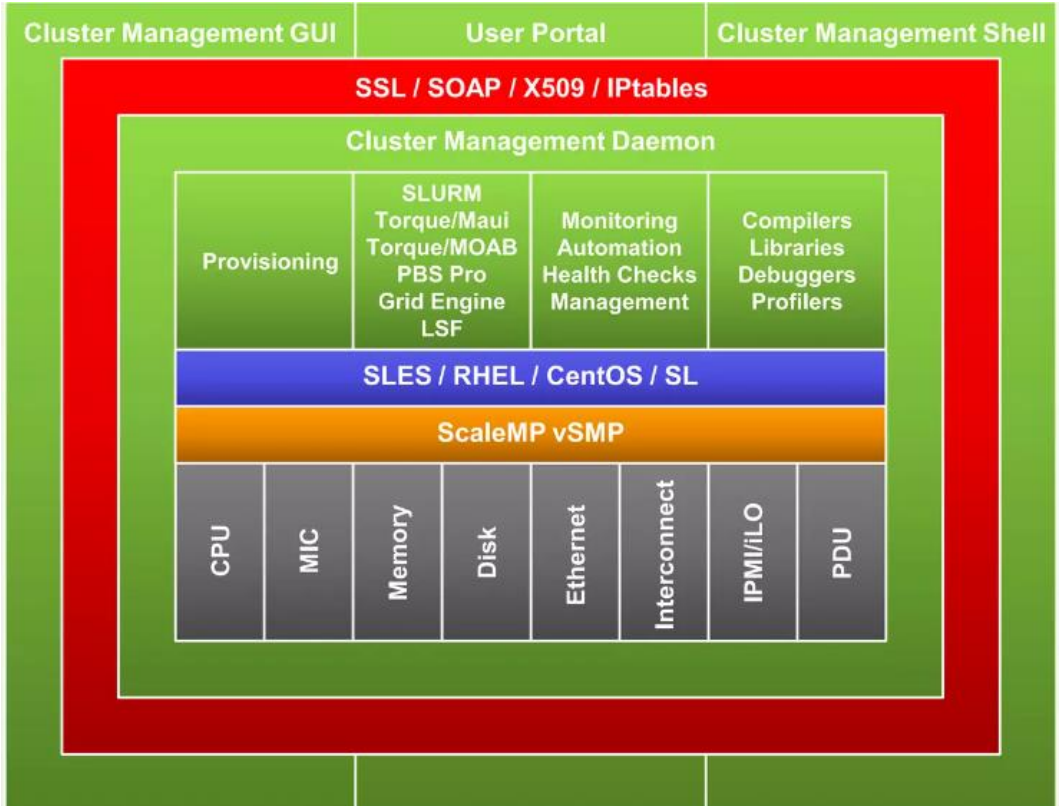
Cluster Structure



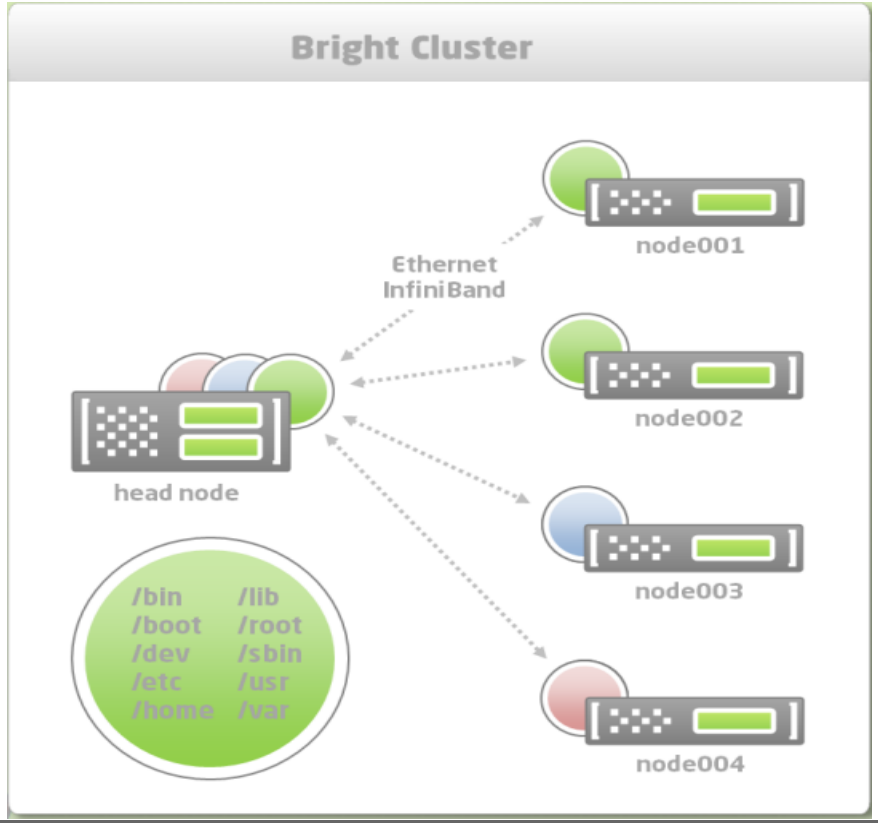
Minimal Hardware Requirements

- **Head Node**
  - x86-64 or Power8 CPU
  - 4GB RAM
  - 80GB diskspace
  - 2 Gigabit Ethernet NICs (for the most common Type 1 topology (section 3.3.6))
  - DVD drive or USB drive
- **Compute Nodes**
  - x86-64 or Power8 CPU
  - 1GB RAM (at least 4GB is recommended for diskless nodes)
  - 1 Gigabit Ethernet NIC

Bright Cluster Manager - Elements



Provisioning



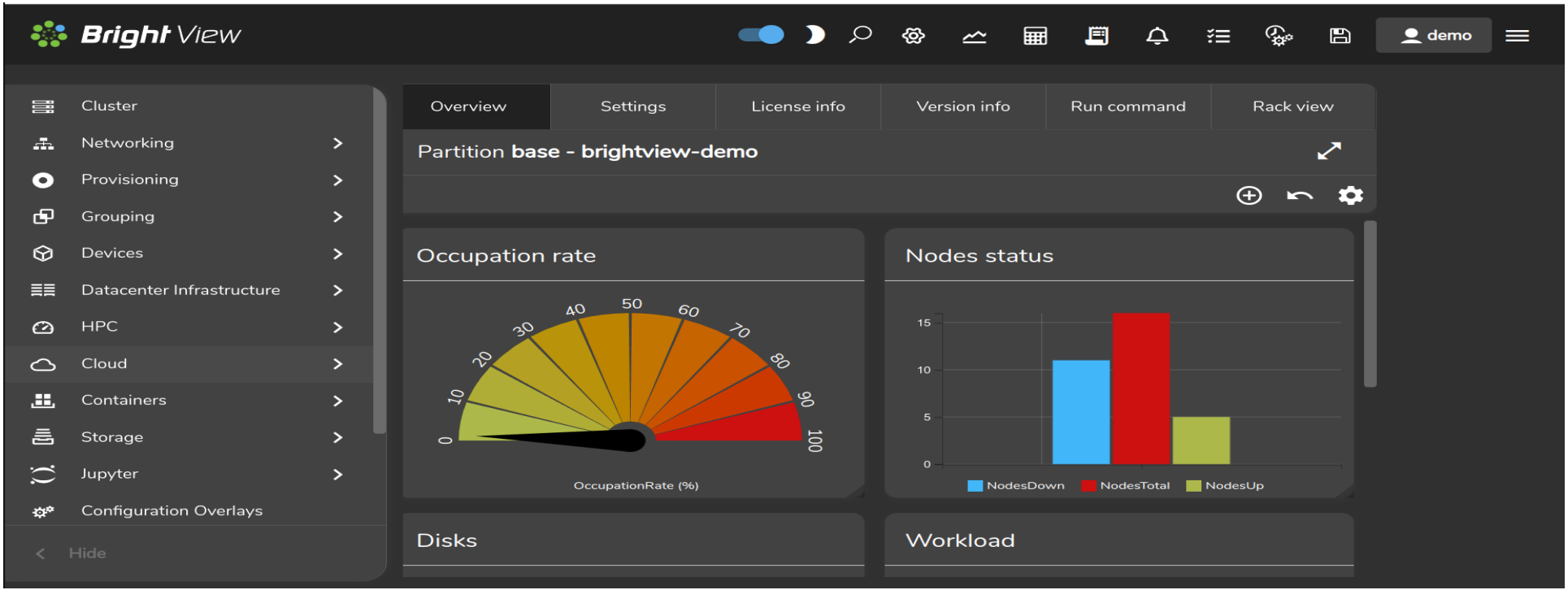
- Features
  - Create: clone, from server
  - Modify: rpm –root
  - Yum –installroot chroot
  - Sync:to and from
  - Where: to HDD,diskless or VM
  - How: update,full install,sync install
  - Scalability: off-loadable, linear scaling

Management Interface

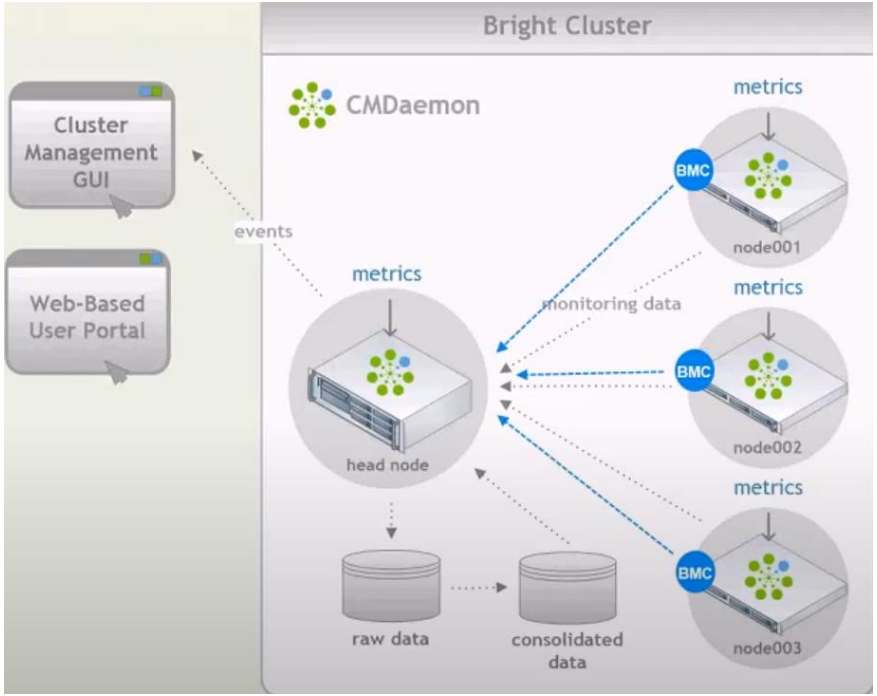
- **Graphical User Interface(CMGUI)**
  - Offers admins full cluster control
  - Standalone desktop application
  - Manages multiple clusters simultaneously
  - Runs natively on Linux, Windows and MacOSX

- **Cluster Management Shell(CMSH)**
  - All GUI functionality also available through Cluster Management Shell
  - Interactive and scriptable in batch mode

GUI Demo

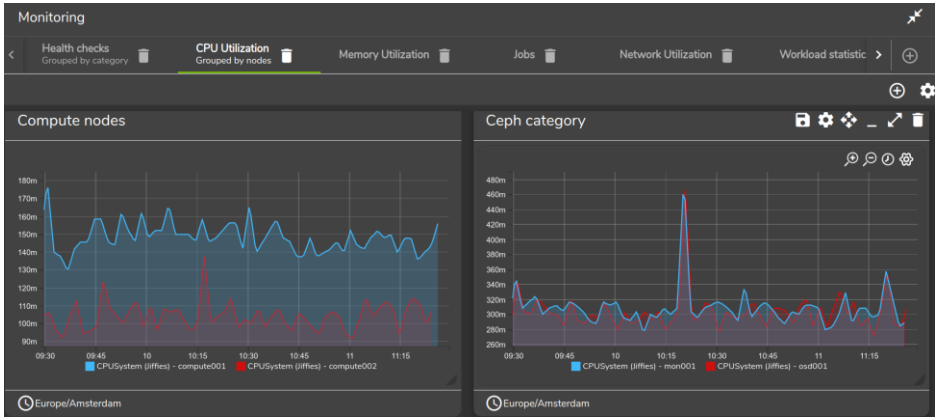

Bright View
demo
Cluster
Networking
Provisioning
Grouping
Devices
Datacenter Infrastructure
HPC
Cloud
Containers
Storage
Jupyter
Configuration Overlays
Hide
Overview
Settings
License info
Version info
Run command
Rack view
Partition base - brightview-demo
Occupation rate
0
10
20
30
40
50
60
70
80
90
100
OccupationRate (%)
Nodes status
15
10
5
0
NodesDown
NodesTotal
NodesUp
Disks
Workload

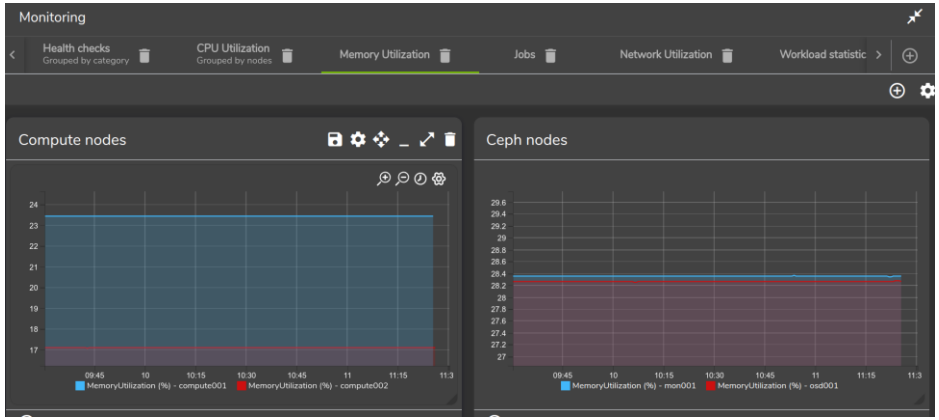
Comprehensive Monitoring



- Monitor, visualize, and analyze a comprehensive set of hardware and software metrics with ease.

Metrics


Monitoring
Health checks
Grouped by category
CPU Utilization
Grouped by nodes
Memory Utilization
Jobs
Network Utilization
Workload statistic
Compute nodes
CPUSystem (jiffies) - compute001
CPUSystem (jiffies) - compute002
Europe/Amsterdam
Ceph category
CPUSystem (jiffies) - mon001
CPUSystem (jiffies) - osd001
Europe/Amsterdam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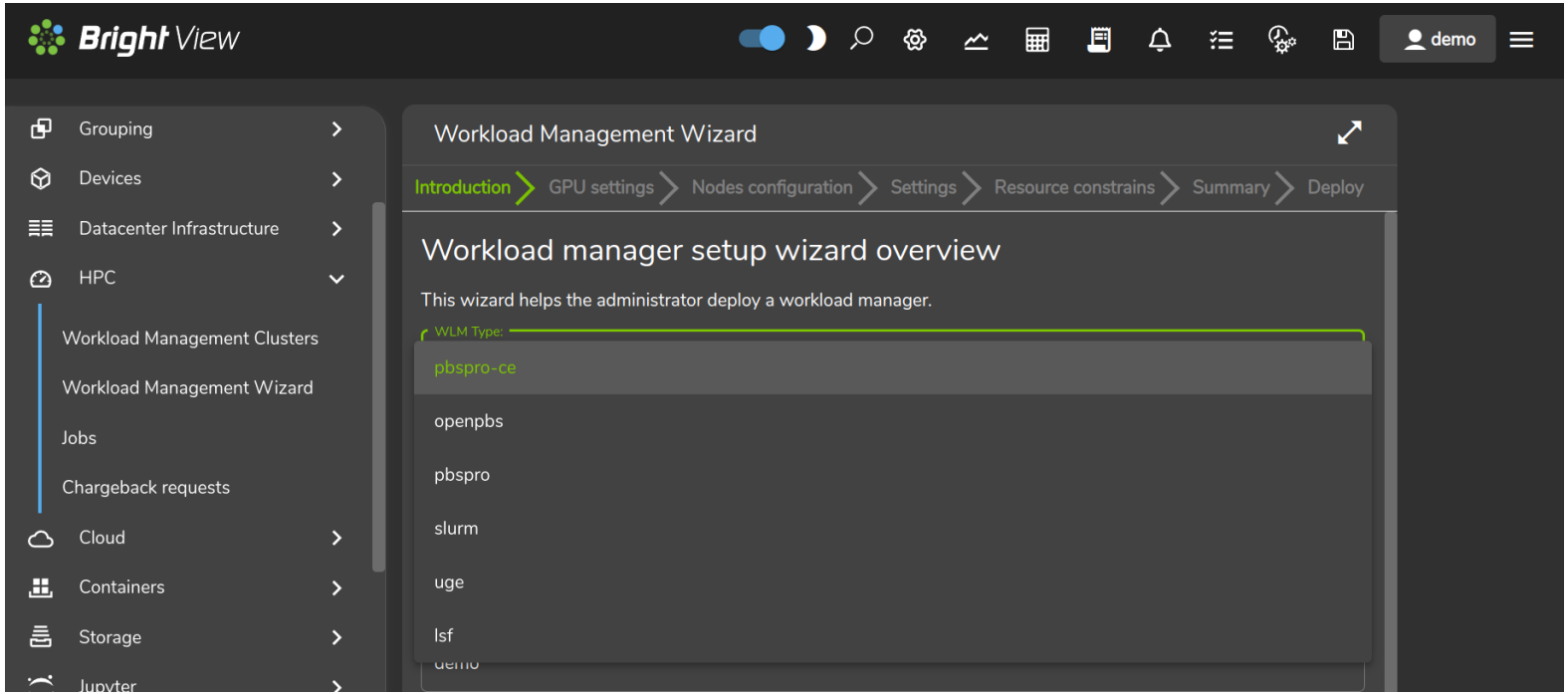
Workload statistic
Compute nodes
MemoryUtilization (%) - compute001
MemoryUtilization (%) - compute002
Ceph nodes
MemoryUtilization (%) - mon001
MemoryUtilization (%) - osd001

Workload Manager Integration

- Automatic installation
- Automatic configuration
- Sampling, analysis and visualization of workload manager statistics
- Consistent GUI, User Portal and CLI front-end to workload manager
- Numeric GPU resource created
- Failover of workload manager
- Health checking
- Power saving through auto-power on/off based on workload

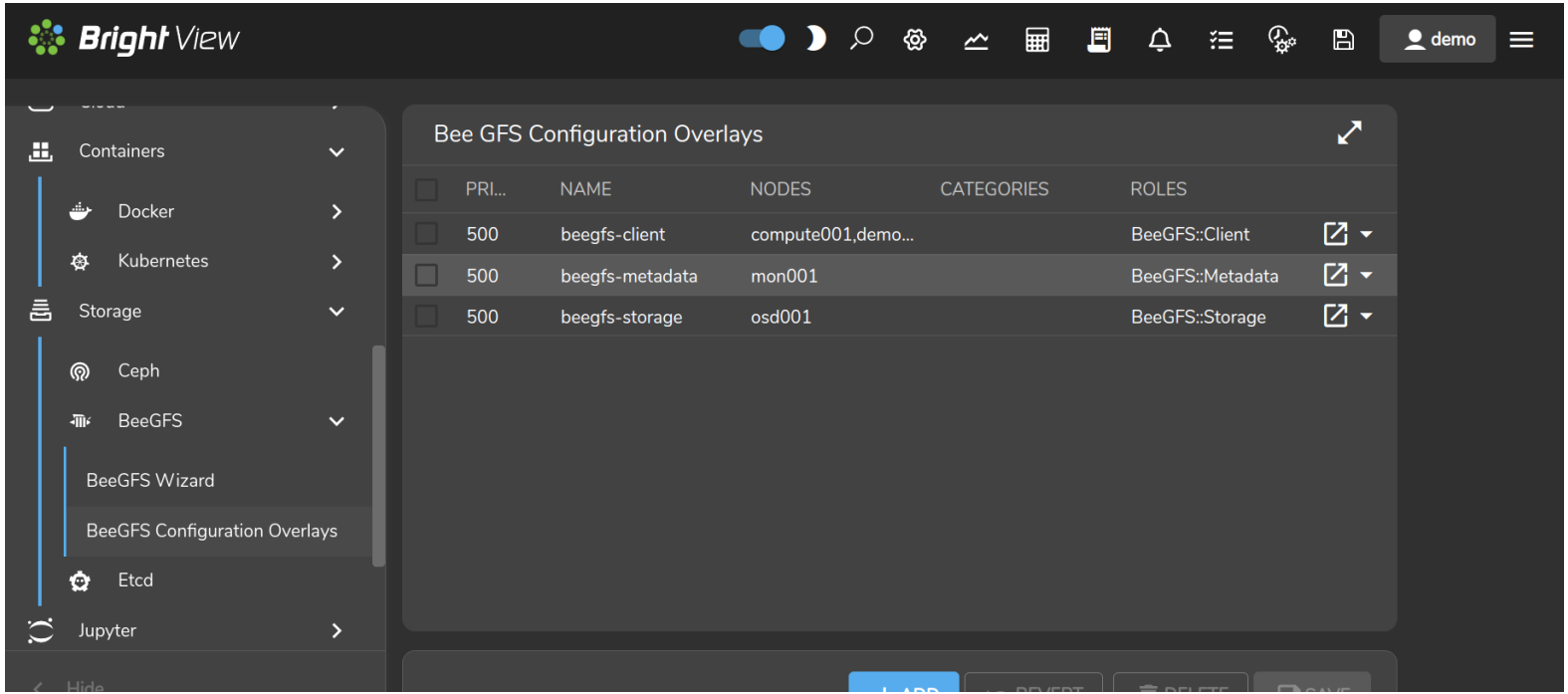
HPC Workload Manager



Storage Management – BeeGFS

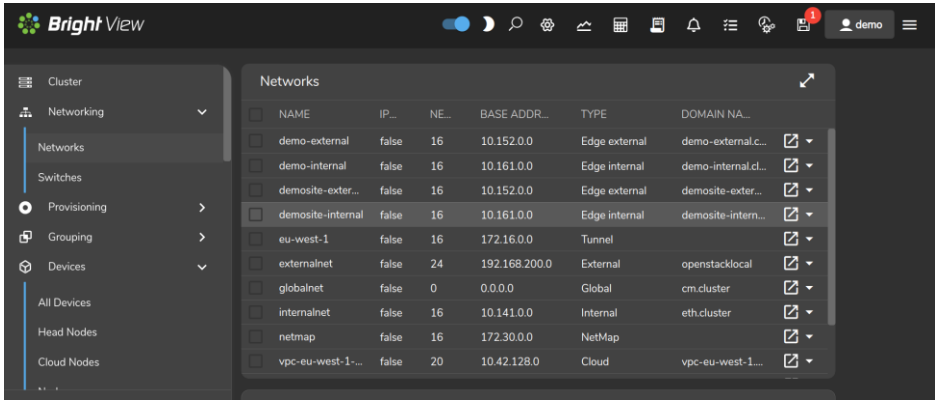
- BeeGFS is a high-performance parallel file system, developed for HPC and optimized for intensive I/O.
- It uses a distributed metadata architecture designed for scalability and flexibility.
- Bright Cluster Manager provides packages to allow BeeGFS to be deployed, managed, and monitored on a Bright cluster.
- A BeeGFS cluster consists of a management server, one or more metadata servers and one or more storage servers.

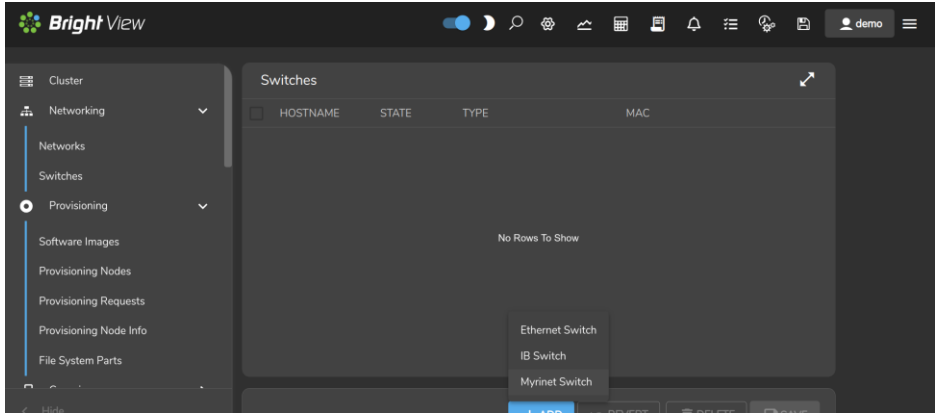
BeeGFS Integration



Networking Management

- Support various network setups (VLAN, VxLAN, flat, etc.)





Comparisons with OpenHPC

- Functionality
- Ease of use
- Customization and flexibility
- Support and community
- Cost

Conclusions

- **Bright Cluster Manager** provides a comprehensive, user-friendly solution for managing HPC clusters, covering both hardware and software aspects.
- **OpenHPC,** on the other hand, focuses on providing an open-source software stack for HPC environments, allowing for more customization but require more expertise.
- “The choice between the two depends on the specific needs, expertise, and resources available within an organization.”

Thank
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