Advanced Cluster Management Made Easy

Bright Cluster Manager® removes the complexity from the installation, management and use of HPC clusters. With Bright Cluster Manager, an administrator can easily install, manage and use multiple clusters simultaneously, without the need for expert knowledge of Linux or HPC.

The Bright Advantage

Bright Cluster Manager offers many advantages that lead to improved productivity, uptime, scalability, performance and security, while reducing total cost of ownership:

Rapid Productivity Gains
- Easy to learn and use, with an intuitive GUI.
- Quick installation: from bare metal to a cluster ready to use, in less than an hour.
- Fast, flexible provisioning: incremental, live, disk-full, disk-less, provisioning over InfiniBand, auto node discovery.
- Comprehensive monitoring: on-the-fly graphs, rackview, multiple clusters, custom metrics.
- Powerful automation: thresholds, alerts, actions.
- Complete GPU support: NVIDIA, AMD ATI, CUDA, OpenCL.
- On-demand SMP: instant ScaleMP virtual SMP deployment.
- Powerful cluster management shell and SOAP API for automating tasks and creating custom capabilities.
- Seamless integration with leading workload managers: PBS Pro, Moab, Maui, SLURM, GridEngine, Torque, LSF.
- Integrated (parallel) application development environment.
- Easy maintenance: automatically update your cluster from Linux and Bright Computing repositories.
- Web-based user portal.
- Cloud-readiness at no extra cost, with support for “Cluster-on-Demand” and “Cluster-Extension” scenarios.

Maximum Uptime
- Unattended, robust head node failover to spare head node.
- Powerful cluster automation functionality allows pre-emptive actions based on monitoring thresholds.
- Comprehensive cluster monitoring and health checking framework, including automatic sidelining of unhealthy nodes to prevent job failure.

Scalability from Deskside to TOP500
- Off-loadable provisioning for maximum scalability.
- Proven on some of the world’s largest clusters.

Minimum Overhead / Maximum Performance
- Single lightweight daemon drives all functionality.
- Daemon heavily optimized to minimize effect on operating system and applications.
- Single database stores all metric and configuration data.

Top Security
- Automated security and other updates from key-signed repositories.
- Encrypted external and internal communications (optional).
- X509v3 certificate-based public-key authentication.
- Role-based access control and complete audit trail.
- Firewalls and secure LDAP.
Bright Cluster Manager – easy-to-use, complete and scalable

Bright Cluster Manager® removes the complexity from the installation, management and use of HPC clusters, without compromising performance or capability. With Bright Cluster Manager, an administrator can easily install, use and manage multiple clusters simultaneously, without the need for expert knowledge of Linux or HPC.

A Unified Approach

Other cluster management offerings take a “toolkit” approach in which a Linux distribution is combined with many third-party tools for provisioning, monitoring, alerting, etc. This approach has critical limitations because those separate tools were not designed to work together, were not designed for HPC, and were not designed to scale. Furthermore, each of the tools has its own interface (mostly command-line based), and each has its own daemon(s) and database(s). Countless hours of scripting and testing from highly skilled people are required to get the tools to work for a specific cluster, and much of it goes undocumented.

Bright Cluster Manager — easy-to-use, complete and scalable

Bright Cluster Manager takes a much more fundamental, integrated and unified approach. It was designed and written from the ground up for straightforward, efficient, comprehensive cluster management. It has a single lightweight daemon, a central database for all monitoring and configuration data, and a single CLI and GUI for all cluster management functionality.

This approach makes Bright Cluster Manager extremely easy to use, scalable, secure and reliable, complete, flexible, and easy to maintain and support.

Ease of Installation

Bright Cluster Manager is easy to install. Typically, system

By selecting a cluster node in the tree on the left and the Tasks tab on the right, the administrator can execute a number of powerful tasks on that node with just a single mouse click.

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“Bright met our demanding requirements straight out of the box.”
— Dr Tommy Minyard, Director of Advanced Computing at TACC
The Overview tab provides instant, high-level insight into the status of the cluster. Administrators can install and test a fully functional cluster from "bare metal" in less than an hour. Configuration choices made during the installation can be modified afterwards. Multiple installation modes are available, including unattended and remote modes. Cluster nodes can be automatically identified based on switch ports rather than MAC addresses, improving speed and reliability of installation, as well as subsequent maintenance. All major hardware brands are supported: Dell, IBM, HP, Supermicro, Acer, Asus and more.

Ease of Use

Bright Cluster Manager is easy to use. System administrators have two options: the intuitive Cluster Management Graphical User Interface (CMGUI) and the powerful Cluster Management Shell (CMSH).

The CMGUI is a standalone desktop application that provides a single system view for managing all hardware and software aspects of the cluster through a single point of control. Administrative functions are streamlined as all tasks are performed through one intuitive, visual interface. Multiple clusters can be managed simultaneously. The CMGUI runs on Linux, Windows and MacOS (coming soon) and can be extended using plugins. The CMSH provides practically the same functionality as the Bright CMGUI, but via a command-line interface. The CMSH can be used both interactively and in batch mode via scripts.

Either way, system administrators now have unprecedented flexibility and control over their clusters.

Support for Linux and Windows

Bright Cluster Manager is based on Linux and is available with a choice of pre-integrated, pre-configured and optimally the same functionality as the Bright CMGUI, but via a command-line interface. The CMSH can be used both interactively and in batch mode via scripts.

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mized Linux distributions, including SUSE Linux Enterprise Server, Red Hat Enterprise Linux, CentOS and Scientific Linux. Dual-boot installations with Windows HPC Server are supported as well, allowing nodes to either boot from the Bright-managed Linux head node, or the Windows-managed head node.

Extensive Development Environment
Bright Cluster Manager provides an extensive HPC development environment for both serial and parallel applications, including the following (some optional):

- Compilers, including full suites from GNU, Intel, AMD and Portland Group.
- Debuggers and profilers, including the GNU debugger and profiler, TAU, TotalView, Allinea DDT and Allinea OPT.
- GPU libraries, including CUDA and OpenCL.
- MPI libraries, including OpenMPI, MPICH, MPICH2, MPICH-MX, MPICH2-MX, MVAPICH and MVAPICH2; all cross-compiled with the compilers installed on Bright Cluster Manager, and optimized for high-speed interconnects such as InfiniBand and Myrinet.
- Mathematical libraries, including ACML, FFTW, GMP, GotoBLAS, MKL and ScaLAPACK.
- Other libraries, including Global Arrays, HDFS, IIPP, TBB, NetCDF and PETSc.

Bright Cluster Manager also provides Environment Modules to make it easy to maintain multiple versions of compilers, libraries and applications for different users on the cluster, without creating compatibility conflicts. Each Environment Module file contains the information needed to configure the shell for an application, and automatically sets these variables correctly for the particular application when it is loaded. Bright Cluster Manager includes many preconfigured module files for many scenarios, such as combinations of compilers, mathematical and MPI libraries.

Powerful Image Management and Provisioning
Bright Cluster Manager features sophisticated software image management and provisioning capability. A virtually unlimited number of images can be created and assigned to as many different categories of nodes as required. Default or custom Linux kernels can be assigned to individual images. Incremental changes to images can be deployed to live nodes without rebooting or re-installation.

The provisioning system propagates only changes to the images, minimizing time and impact on system performance and availability. Provisioning capability can be assigned to any number of nodes on-the-fly, for maximum flexibility and scalability. Bright Cluster Manager can also provision over InfiniBand and to ramdisk.

Comprehensive Monitoring
With Bright Cluster Manager, system administrators can collect, monitor, visualize and analyze a comprehensive set of metrics to gain insight into the performance and status of the cluster.

The parallel shell allows for simultaneous execution of commands or scripts across node groups or across the entire cluster.

The status of cluster nodes, switches, other hardware, as well as up to six metrics can be visualized in the Rackview. A zoom-out option is available for clusters with many racks.

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“I am very impressed with the efficiency achieved with Bright Cluster Manager. Our cluster was up and running within a few hours, ready for integration into our HPC environment. Now it is continuing to save our system administrators valuable time.” — Prof. Lennart Johnsson, Director of the TLC² and the Advanced Computing Research Laboratory at the University of Houston
of metrics. Practically all software and hardware metrics available to the Linux kernel, and all hardware management interface metrics (IPMI, iLO, etc.) are sampled.

Examples include CPU and GPU temperatures, fan speeds, switches, hard disk SMART information, system load, memory utilization, network statistics, storage metrics, power systems statistics, and workload management statistics. Custom metrics can also easily be defined.

Metric sampling is done very efficiently — in one process, or out-of-band where possible. System administrators have full flexibility over how and when metrics are sampled, and historic data can be consolidated over time to save disk space.

Cluster Management Automation

Cluster management automation takes preemptive actions when predetermined system thresholds are exceeded, saving time and preventing hardware damage. System thresholds can be configured on any of the available metrics. The built-in configuration wizard guides the system administrator through the steps of defining a rule: selecting metrics, defining thresholds and specifying actions. For example, a temperature threshold for GPUs can be established that results in the system automatically shutting down an overheated GPU unit and sending an SMS message to the system administrator’s mobile phone. Several predefined actions are available, but any Linux command or script can be configured as an action.

Comprehensive GPU Management

Bright Cluster Manager radically reduces the time and effort of managing GPUs, and fully integrates these devices into the single view of the overall system. Bright includes powerful GPU management and monitoring capability that leverages functionality in NVIDIA® Tesla™ GPUs. System administrators can easily assume maximum control of the GPUs and gain instant and time-based status insight. In addition to the standard cluster management capabilities, Bright Cluster Manager monitors the full range of GPU metrics, including:

- GPU temperature, fan speed, utilization.
- GPU exclusivity, compute, display, persistence mode.
- GPU memory utilization, ECC statistics.
- Unit fan speed, serial number, temperature, power usage, voltages and currents, LED status, firmware.

“Bright Cluster Manager is a key component of our solution. Bright’s image management capabilities make it easy for Cray to test new images in a dynamic environment and rapidly deploy upgrades. We are able to just about eliminate system downtime.” — Kim Schumann, Data Management Practice Leader at Cray

- Board serial, driver version, PCI info.
- Beyond metrics, Bright Cluster Manager features built-in support for GPU computing with CUDA and OpenCL libraries. Switching between current and previous versions of CUDA and OpenCL has also been made easy.

Multi-Tasking Via Parallel Shell

The parallel shell allows simultaneous execution of multiple commands and scripts across the cluster as a whole, or across easily definable groups of nodes. Output from the executed commands is displayed in a convenient way with variable levels of verbosity. Running commands and...
The GUI provides a user-friendly interface for configuring, monitoring and managing the selected workload manager. The CMSH and the SOAP API provide direct and powerful access to a number of workload manager commands and metrics. Reliable workload manager failover is properly configured. The workload manager is continuously made aware of the health state of nodes (see section on Health Checking).

The following user-selectable workload managers are tightly integrated with Bright Cluster Manager:

- PBS Pro, Moab, Maui, LSF.
- SLURM, Grid Engine, Torque.

Alternatively, Lava, LoadLeveler or other workload managers can be installed on top of Bright Cluster Manager.

**Integrated SMP Support**

Bright Cluster Manager — Advanced Edition dynamically aggregates multiple cluster nodes into a single virtual SMP node, using ScaleMP’s Versatile SMP™ (vSMP) architecture. Creating and dismantling a virtual SMP node can be achieved with just a few clicks within the CMGUI or a single command in the cluster management shell. Workload management queues can be viewed and configured from the GUI, without the need for workload management expertise. Scripts can be killed easily if necessary. The parallel shell is available through both the CMGUI and the CMSH.

**Integrated Workload Management**

Bright Cluster Manager is integrated with a wide selection of free and commercial workload managers. This integration provides a number of benefits:

- The selected workload manager gets automatically installed and configured.
- Many workload manager metrics are monitored.

**Maximum Uptime with Head Node Failover**

Bright Cluster Manager — Advanced Edition allows two head nodes to be configured in active-active failover mode. Both head nodes are on active duty, but if one fails, the other takes over all tasks, seamlessly.

**Maximum Uptime with Health Checking**

Bright Cluster Manager — Advanced Edition includes a powerful cluster health checking framework that maximizes system uptime. It continually checks multiple health indicators for all hardware and software components and proactively initiates corrective actions. It can also automatically perform a series of standard and user-defined actions.

"With Bright Cluster Manager now offering full support for ScaleMP vSMP Foundation, setting up and managing an SMP cluster has never been so easy.” – Shai Fultheim, CEO of ScaleMP
tests just before starting a new job, to ensure a successful execution.

Examples of corrective actions include autonomous bypass of faulty nodes, automatic job requeuing to avoid queue flushing, and process “jailing” to allocate, track, trace and flush completed user processes. The health checking framework ensures the highest job throughput, the best overall cluster efficiency and the lowest administration overhead.

Web-Based User Portal
The web-based user portal provides read-only access to essential cluster information, including a general overview of the cluster status, node hardware and software properties, workload manager statistics and user-customizable graphs. The User Portal can easily be customized and expanded using PHP and the SOAP API.

User and Group Management
Users can be added to the cluster through the CMGUI or the CMSH. Bright Cluster Manager comes with a pre-configured LDAP database, but an external LDAP service, or alternative authentication system, can be used instead.

Role-based Access Control and Auditing
Bright Cluster Manager’s role-based access control mechanism allows administrator privileges to be defined on a per-role basis. Administrator actions can be audited using an audit file which stores all their write action.

Top Cluster Security
Bright Cluster Manager offers an unprecedented level of security that can easily be tailored to local requirements. Security features include:

- Automated security and other updates from key-signed Linux and Bright Computing repositories.
- Encrypted internal and external communications.
- X509v3 certificate based public-key authentication to the cluster management infrastructure.
- Role-based access control and complete audit trail.
- Firewalls and secure LDAP.
- Secure shell access.

Multi-Cluster Capability
Bright Cluster Manager is ideal for organizations that need to manage multiple clusters, either in one or in multiple locations. Capabilities include:

- All cluster management and monitoring functionality available for all clusters through one GUI.
- Selecting any set of configurations in one cluster and export them to any or all other clusters with a few mouse clicks.
- Making node images available to other clusters.
Cloud Bursting
Bright Cluster Manager supports two cloud bursting scenarios: “Cluster-on-Demand” — running stand-alone clusters in the cloud; and “Cluster Extension” — adding cloud-based resources to existing, onsite clusters and managing these cloud nodes as if they were local. Both scenarios can be achieved in just a few mouse clicks. Every Bright cluster is automatically cloud-ready, at no extra cost.

Standard and Advanced Editions
Bright Cluster Manager is available in two editions: Standard and Advanced. The table on this page lists the differences. You can easily upgrade from the Standard to the Advanced Edition as your cluster grows in size or complexity.

Documentation and Services
A comprehensive system administrator manual and user manual are included in PDF format. Customized training and professional services are available. Services include various levels of support, installation and consultancy.