

### Managing complex cluster architectures with Bright Cluster Manager

**Christopher Huggins** 

1

## **About ClusterVision**

### dustervision

- Specialists in Compute, Storage & Database Clusters (Tailor-Made, Turn-Key)
- Unique position in Europe (EMEA)
- Offices in Amsterdam, Gloucester, Munich, Paris, Milan, Geneva, Madrid, Oslo
- 55 Staff, most technical, all specialised in clusters
- Hardware brand independent (Dell, IBM, Cray, Supermicro, Asus)
- Background in Science, Research, Engineering
- At forefront of clustering technology
- Award winning (Intermediair, Vosko, NBCC, Deloitte Rising Star)
- ISO9001:2008 certified
- Financially strong, profitable, growing



## **HPC Services**



- HPC Problem Solving
- Cluster Design
  - Start with Existing Environment
  - User Requirements
  - Application Benchmarking
  - Power & Space Constraints
  - Personal Hardware & Software Preferences
  - Total Cost of Ownership
  - Future Environment
- Cluster Delivery & Installation
  - Speed
  - Professional Project Management
  - Personal Training
- Support Tailored to Your Needs
  - Hardware
  - Software
  - System administration (onsite/remote)
  - User helpdesk
  - First point-of-contact / Single point-of-contact





# Bright Cluster Manager





# Bright Cluster Manager

Linux-based cluster management and user environment

### Goals

- 1. Make it really easy to install, manage and use clusters
- Be suitable for very large clusters
   thousands of nodes
- 3. Be complete





## The Toolkit Approach



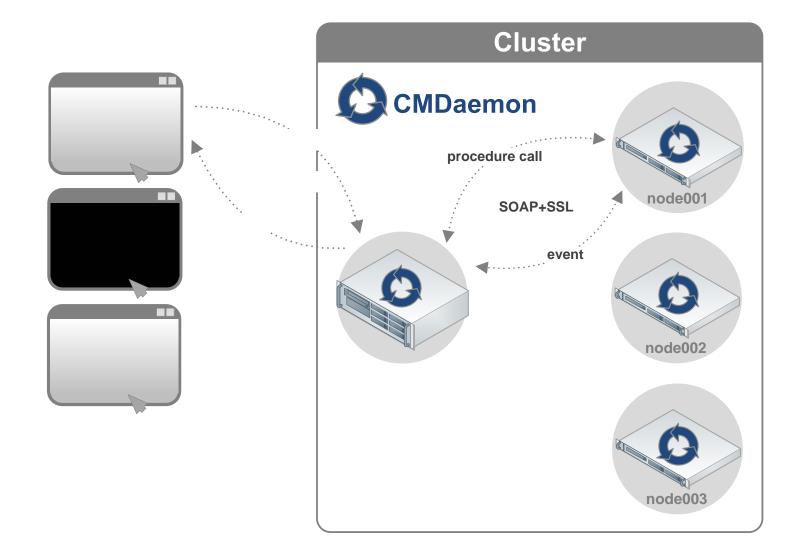
- Most cluster management solutions use the "toolkit" approach (Linux distro + tools)
  - Examples: Rocks, PCM, OSCAR, UniCluster, xCAT, etc.
  - Tools typically used: Ganglia, Cacti, Nagios, Cfengine, System Imager, etc.
- Issues with the "toolkit" approach:
  - Tools rarely designed to work together
  - Tools rarely designed for HPC
  - Tools rarely designed to scale
  - Each tool has its own command line interface and GUI
  - Each tool has its own daemon and database
  - Roadmap dependent on developers of the tools
- Making a collection of unrelated tools work together
  - Requires a lot of expertise and scripting
  - Rarely leads to a really easy-to-use and scalable solution

## **Bright Cluster Manager**



- Bright Cluster Manager takes a much more fundamental & integrated approach
  - Designed and written from the ground up
  - Single cluster management daemon provides all functionality
  - Single, central database for configuration and monitoring data
  - Single CLI and GUI for ALL cluster management functionality
- Which makes Bright Cluster Manager ...
  - Extremely easy to use
  - Extremely scalable
  - Complete
  - Flexible

## Architecture — CMDaemon





## **Bright - Elements**

dustervision

- Cluster Management Daemon
- Cluster Management Shell
- Cluster Management GUI
- Linux distribution, with many enhancements
  - Red Hat & SUSE Enterprise
  - CentOS & Scientific Linux
- Node provisioning system
- Workload management system
  - Sun Grid Engine, Torque/Maui
  - MOAB, PBS Pro, LSF
- HPC user environment
- Cluster management & monitoring functionality
- Years of HPC expertise
- Consistent integration of all the above

+ +

### Bright Cluster Manager

### **HPC User Environment**

- Let users focus on performing computations
- Rich collection of HPC software
  - Compilers (GNU, Intel\*, Portland\*, Open64, etc.)
  - Parallel middleware (MPI libraries, threading libraries, OpenMP, Global Arrays, etc.)
  - Mathematical libraries (ACML, MKL\*, LAPACK, BLAS, GOTO, etc.)
  - Development tools (debuggers, profilers, etc.)
  - Environment modules
- NVIDIA CUDA, OpenCL & GPGPU drivers
- Intel Cluster Ready Compliant Compliant applications run out of the box





### Management Interface

### Graphical User Interface (GUI)

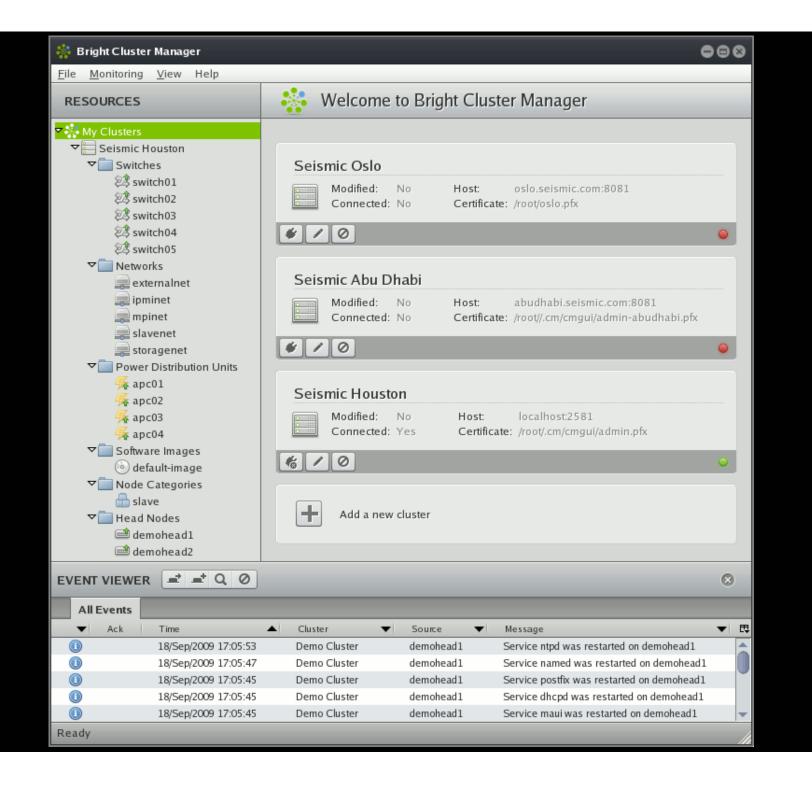
- Standalone desktop application
- Runs on Linux, Windows, MacOS X
- Built on top of Mozilla XUL engine
- Offers administrator full cluster control
- Manages multiple clusters simultaneously

### Command Line Interface (CLI)

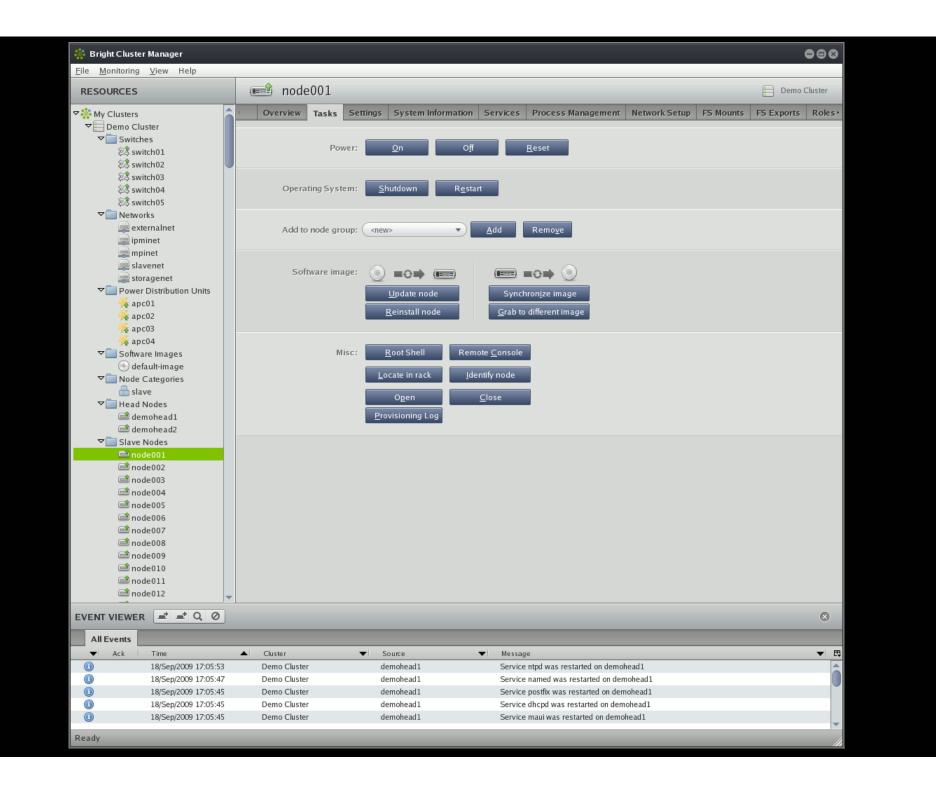
- All GUI functionality also available through Command Line Interface (CLI)
- Interactive and scriptable in batch mode

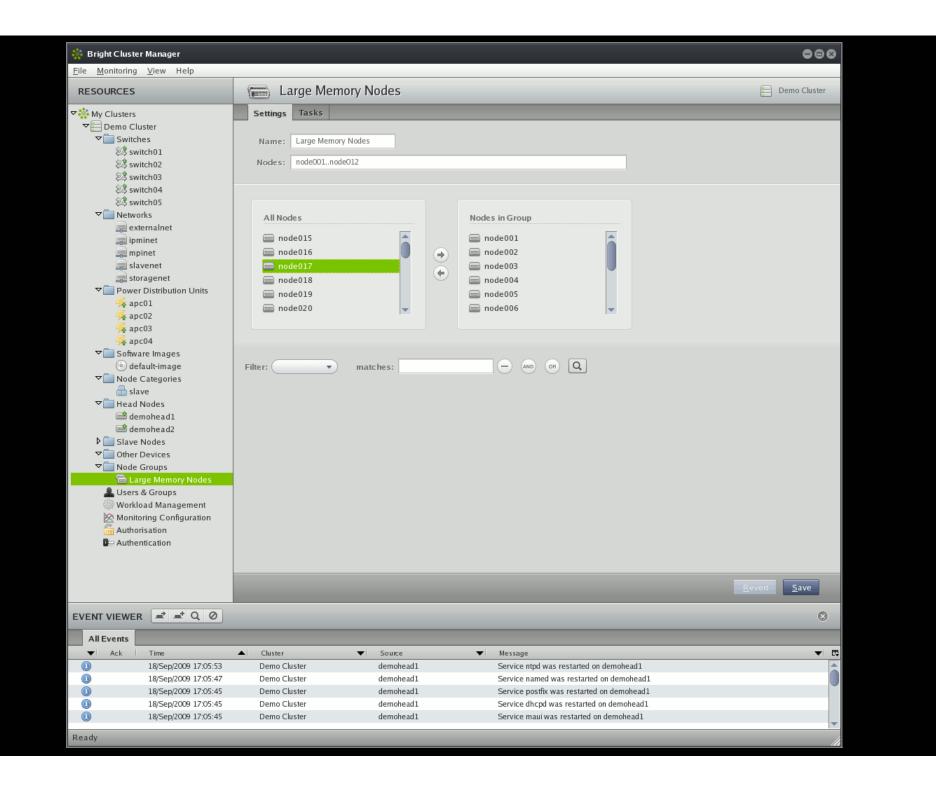






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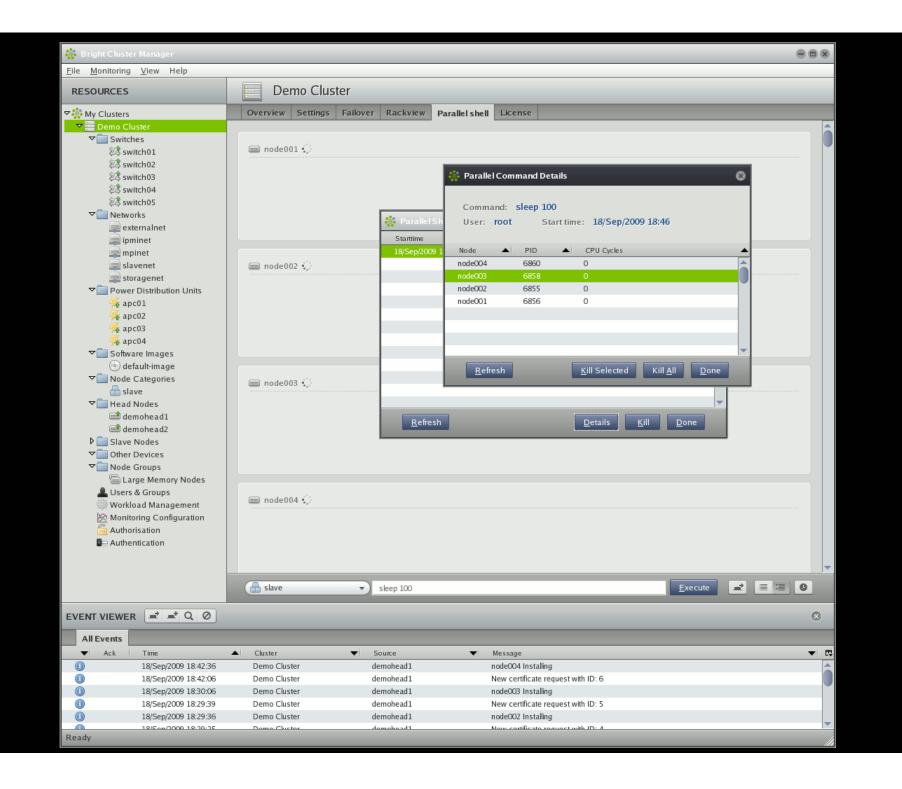


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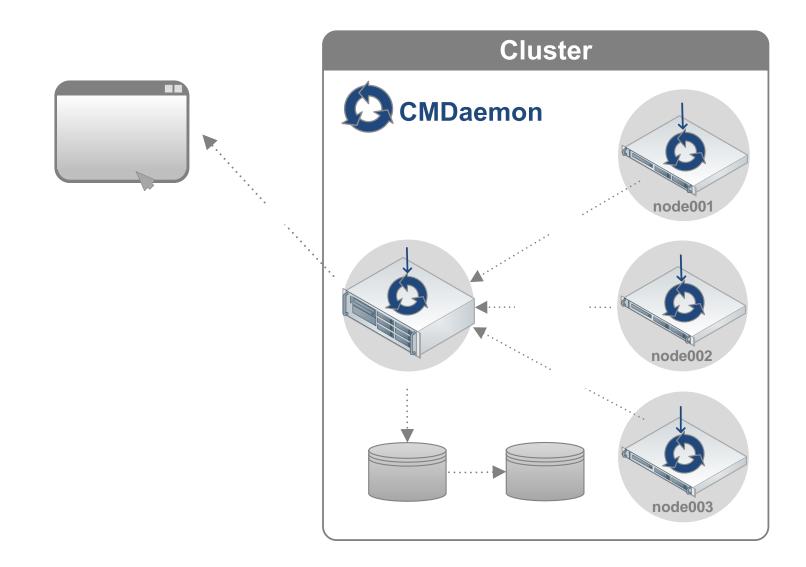
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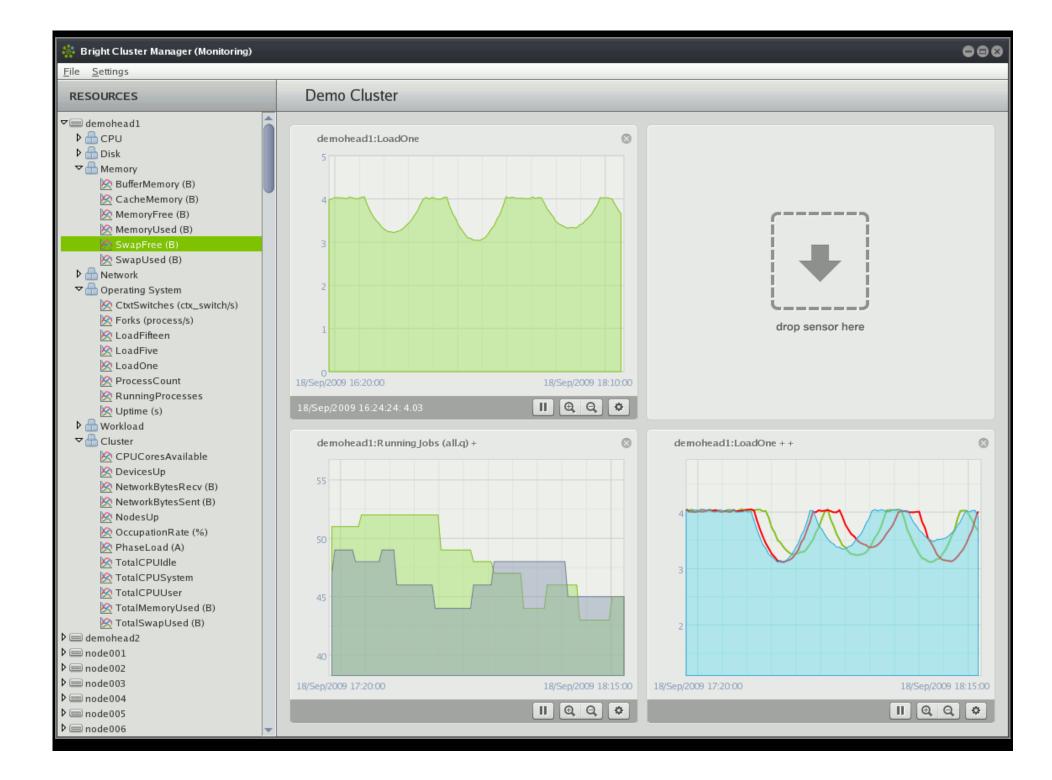
### **Architecture — Monitoring**

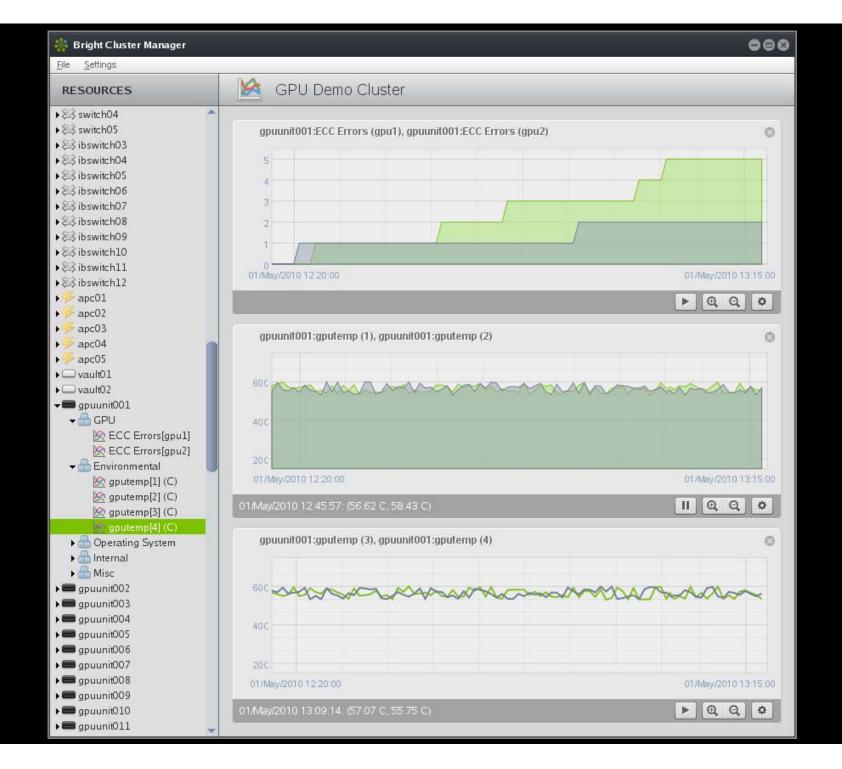




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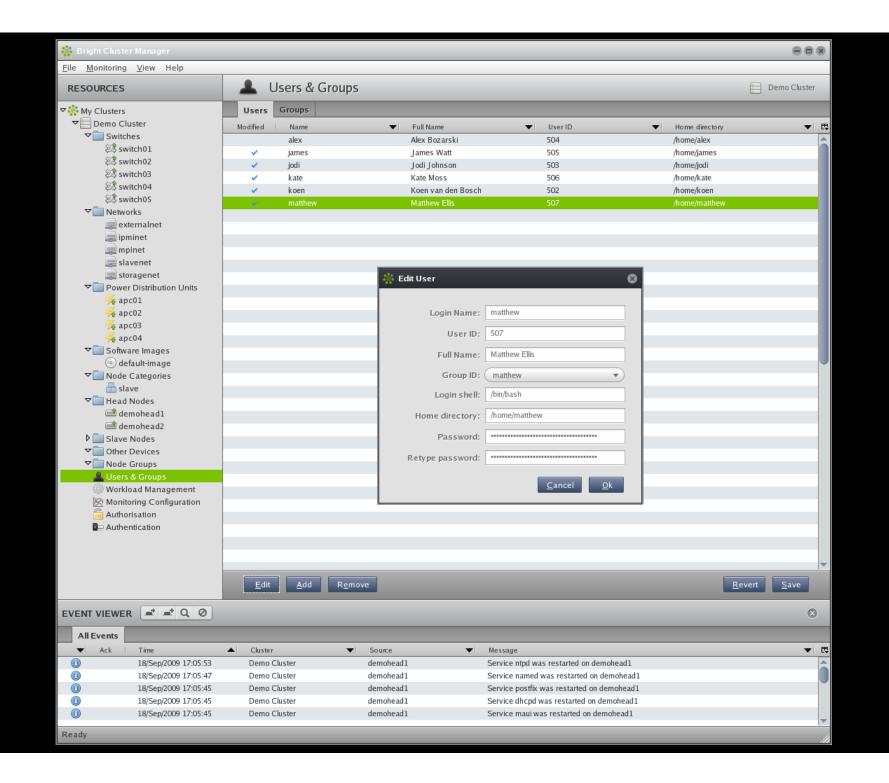
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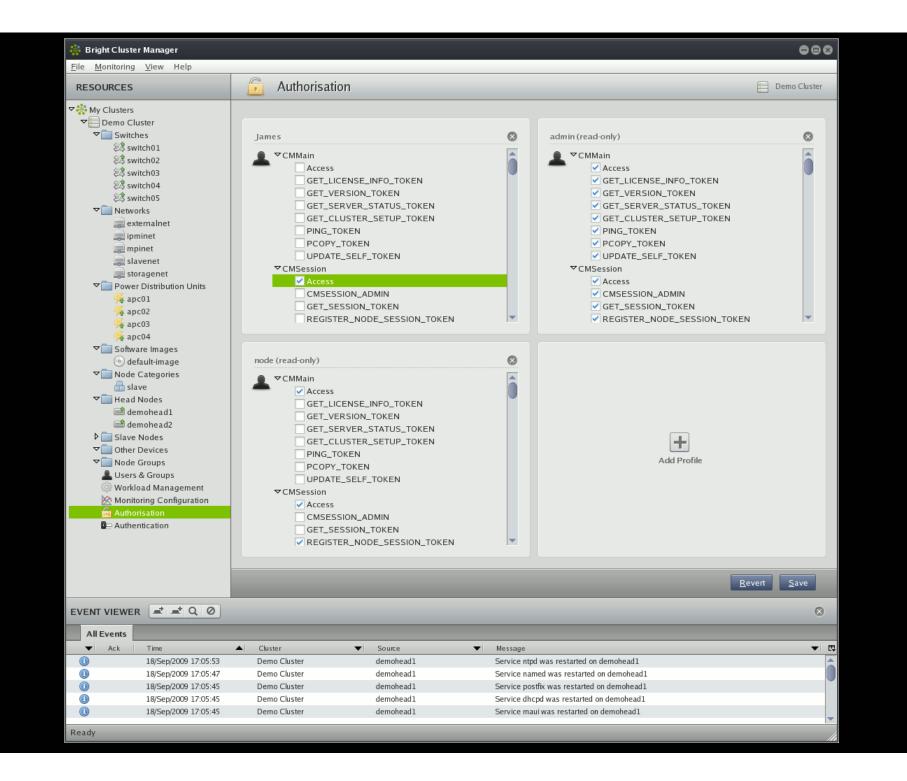
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✓ Other Devices							272
✓ Other Devices ✓ Node Groups			078				
Lusers & Groups			079		195 196		276
Workload Management	25 015	050	080	133 13			278
Monitoring Configuration	26 016	051	081	135 13			280
Authorisation	27 017	052	082	137 13			282
Authentication	28 018	053	083	139 14	0 203 204	4 283	284
	29 019	054	084	141 14	2 📖 205 🚺 206	5 285	285
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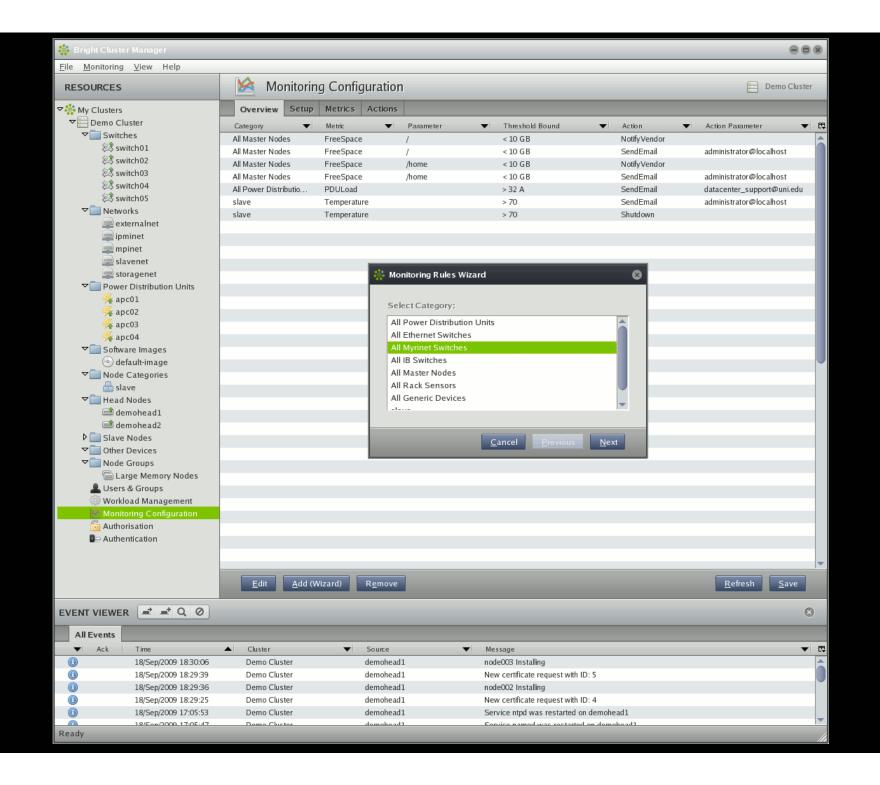
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- This supercomputer is called "LOEWE-CSC"
  - 20,784 processor cores

**University of Frankfurt** 

- 772 GPGPU hardware accelerators
- Theoretical peak performance of 599 TeraFLOPs (599 trillion calculations per second) in double precision, 2259 TeraFLOPS in single precision
- On today's TOP500 list of fastest computers in the world, LOEWE-CSC could rank amongst the top 15
  - Some of the reasons for which Bright Cluster Manager was chosen...



# **Bright Cluster Manager**

### **Advanced Features**

- Redundant head nodes
- Cluster health checking
  - Health checks before jobs are run
  - Frequently scheduled health checks
  - Hardware burn-in environment
- Daemon with low resource consumption
- Multiple, load-balanced provisioning nodes
  - Allows scaling to thousands of nodes
- Node discovery using Ethernet switch port detection
- Live & incremental image updates
- Automated BIOS updates and configurations

### Customers — Industry





#### clustervision Customers — Academia UNIVERSITEIT ÉCOLE POLYTECHNIQUE vrije Universiteit amsterdam **GENT** FÉDÉRALE DE LAUSANNE UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA TU/e GOETHE UNIVERS UNIVERSITEIT VAN AMSTERDAM FRANKFURT AM MAIN Sciences Technologies **T**UDelft **UNIVERSITY OF** MANCHESTER \*\*\*\* UNIVERSITÉ DE FRANCHE-COMTÍ CAMBRIDGE 1824 **ESIEE** UNIVERSITY OF DXFORD Friedrich-Schiller-Universität Jena AMIENS Universität University of Zurich technische universität Stuttgart dortmund

"We chose ClusterVision based on their proven expertise and experience, their comprehensive cluster management environment and their professional approach."



clustervision

"The engineers from ClusterVision did an excellent job in delivering the cluster."

— Daniel Schmode, Germanischer Lloyd

**clustervision** 

"We would like to thank you for your help and support during your Aramco visit."

- "It's been a real pleasure working with dedicated professionals like you in this project."
- Manager at Saudi Aramco





"Our partnership with ClusterVision has greatly helped us to set-up our new cluster in a fast time frame."



- "I appreciate their reactivity and availability; this is a key point for our activity."
- Dr Christian Fauchier, CD-adapco



"We have chosen ClusterVision as a repeat supplier based on their technical expertise and the value and service they have delivered."



"We know we can rely on their professional approach to sales, performance and support."

 Professor John Chew, University of Surrey

### Conclusions

- Bright Cluster Manager
  - Fundamental & integrated approach
  - Easy installation, management and use
  - Suitable for small to very large clusters
- Available through ClusterVision, which can also provide you with:
  - Tailor made clusters
  - Tailor made services
  - Tailor made support
  - HPC related consultancy & advice











# **Questions?**

# The End