Maximizing your HPC cluster investment

Cray User Group

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Agenda

• Bright Computing
• Bright Cluster Manager
  • What’s new in 8.1
  • Workload Accounting and Reporting
• Bright for Data Science
We launched our software in 2009 because managing clustered IT infrastructure was hard and we thought it should be easy.

Nine years later, we are deployed in hundreds of IT environments worldwide, including several of the world’s largest supercomputers.
About Bright & Cray

• Long history between Cray and Bright
  • Between ~2010 - ~2016: Bright used on cluster alongside XC systems for login nodes, storage nodes, data mover nodes
  • Since 2017: Bright standard on all CS systems

• The largest active Bright cluster is a Cray CS500 (almost 8500 nodes)

• Ambition still exists to expand from CS to XC series
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Bright Cluster Manager saves time and money by making it easy to deploy and manage Linux clusters.
Bright makes it easy to ...

Deploy
Compute, data, storage clusters

Manage
Users, clusters, and clouds

Monitor
From a single pane of glass

... with a powerful, integrated, and intuitive platform.
Easy to Deploy
Flexible and Easy to Extend

Bright Cluster Manager

HPC

Bright openstack.

docker

kubernetes

GPU

GPU

GPU

GPU

GPU

GPU

GPU

GPU

GPU

Linux

Linux

Linux

Linux

Linux

Linux

Linux

Linux

Linux

Linux

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Single Pane of Glass

![Diagram showing HPC, Bright Cluster Manager, docker, and OpenStack integrated with Amazon and Microsoft Azure services. The diagram includes symbols for GPUs and Linux operating systems.]
Easy to Manage
Wizards for setting up
Easy to Monitor
Dynamic Data Center

HPC

Bright

openstack.

docker

kubernetes

Bright Cluster Manager

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux

GPU

Linux
Dynamic Data Center
Dynamic Data Center

- HPC
- Bright
- openstack
- docker
- kubernetes
- Cluster Manager
- GPUs
- Linux
- VM
- Amazon Web Services
- Microsoft Azure
Dynamic Data Center
Dynamic Data Center

HPC

Bright

openstack

docker

kubernetes

GPU

Linux

HPC

VM

VM

VM

VM

Cluster Manager

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Includes…..

- Integration with WorkLoad Managers
  - SLURM, PBS Pro, Torque, Moab, Maui, Univa Grid Engine etc

- GPU Support
  - NVIDIA
  - AMD
  - Integration with WorkLoad Managers

- CUDA and OpenCL libraries

- Hundreds of popular HPC libraries
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What’s new in 8.1

• Workload management accounting & reporting
  • Job based metrics
• Bursting to OpenStack
  • Bright OpenStack supported
  • Select OpenStack public clouds supported
  • And still AWS and Azure
• OpenStack Pike integration
• AMD GPU support
  • GPU settings, metrics, healthchecks, clean software stack deployment
Smaller 8.1 Features and Changes

• Lightweight CMDaemon
  • Implements monitoring API
  • Portable (100% Python code; Python 2.7.5+ required)

• Kubernetes 1.9.2
  • Ncurses & Bright View wizard

• Docker 1.12.6
  • Ncurses & Bright View wizard

• Ceph Luminous
  • Ncurses & Bright View wizard
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What do we want to know?

• Who is using the resources?
• Who is using them poorly?
• How was the system behaving in a particular moment in the past?
• Are all the components of the system being used?
  • Are the jobs CPU bound or I/O bound?
  • Do we have enough network bandwidth?
  • What is the utilization on GPUs?
How do we do it?

• PromQL is a functional expression language
• Allows to select and aggregate time series data in real time
• Features
  • Labels selection
  • Arithmetic and comparison operators
  • Aggregation
  • Joins
  • Statistical functions
  • Sorting
  • etc...
Examples (I)

Memory usage by users

- Aggregate memory metrics by user
- Plot them over a period of time
Examples (II)

Current jobs' waiting time

<table>
<thead>
<tr>
<th>job_id</th>
<th>job_name</th>
<th>user</th>
<th>group</th>
<th>job_waiting_time</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>pi</td>
<td>bob</td>
<td>dev</td>
<td>69034 s</td>
</tr>
<tr>
<td>6</td>
<td>my_mpi_job</td>
<td>mike</td>
<td>ds</td>
<td>360 s</td>
</tr>
<tr>
<td>15</td>
<td>pi</td>
<td>bob</td>
<td>dev</td>
<td>10 s</td>
</tr>
</tbody>
</table>

- Single metric
- Take the last value
- Sorting
- Show them in a table
Examples (III)

CPU wall clock time used over the last week by account

<table>
<thead>
<tr>
<th>account</th>
<th>account_cpu_time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling</td>
<td>15300 CPU s</td>
</tr>
<tr>
<td>Seismic</td>
<td>360 CPU s</td>
</tr>
<tr>
<td>Modeling</td>
<td>369034 CPU s</td>
</tr>
</tbody>
</table>

- Aggregating over time
- Grouping by account
Examples (IV)

Power consumption of Bob's jobs over the last week

- Aggregation over time
- Filtering by a particular user
- Single number as a result

```
power_usage
231 kWh
```
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Bright for Data Science makes it easy to use a Bright cluster for AI
Without Bright

- Not installable from OS repos
- Time-consuming, manual installation of deep learning libraries and frameworks
- 60+ top-level dependencies must be satisfied
- Versions must work together

This [solution] will be a powerful productivity multiplier for customers because these software modules take days to download and install if using the open source repositories.

— a Bright user
# yum install tensorflow cm-jupyterhub

# yum --installroot=/cm/images/ai-image \
install cm-ml-distdeps

- 1st command installs frameworks into a shared directory on the head node. It is immediately available on every node in cluster.
- Yum installs all dependencies for tensorflow and cm-jupyterhub, and all the Python dependencies
- 2nd command installs all library dependencies into ai-image
Bright for Data Science
DS Ecosystem
- Apache Drill
- Apache Ignite
- Flink
- HBase
- Alluxio

Caffe
- PyTorch
- Caffe2
- TensorFlow
- MXNet
- Theano
- Chainer
- DMLC

Bright Cluster Manager
- OpenCV
- cuDNN
- Protobuf
- OpenBLAS
- NCCL
- NVIDIA CUDA
- Open MPI
- Intel MKL-DNN
- GPU Direct

- Ubuntu
- Red Hat
- Samsung
- ARM
- Siemens
- Microsoft
- CNTK
- Keras
- Spark
- MLib
- Accumulo
- Hadoop
Bright offers a complete platform to get insights on your infrastructure...
Thank you

https://www.brightcomputing.com