Urika®-GX System Administration Guide (1.1.UP00) S-3016

Contents

1 About the Urika-GX System Administration Guide

This publication contains administrative information about using the Cray® Urika®-GX system. This publication addresses version `1.1.UP00` of the Urika-GX system.

Typographic Conventions

`Monospace`	Indicates program code, reserved words, library functions, command-line prompts, screen output, file/path names, key strokes (e.g., `Enter` and `Alt-Ctrl-F`), and other software constructs.
`Monospaced Bold`	Indicates commands that must be entered on a command line or in response to an interactive prompt.
`Oblique` or *`Italics`*	Indicates user-supplied values in commands or syntax definitions.
Proportional Bold	Indicates a graphical user interface window or element.
\ (backslash)	At the end of a command line, indicates the Linux® shell line continuation character (lines joined by a backslash are parsed as a single line). Do not type anything after the backslash or the continuation feature will not work correctly.

Scope and Audience

The audience of this publication is system administrators of the Urika®-GX system. This publication is not intended to provide detailed information about open source products used in the system. References to online documentation are included where applicable.

Record of Revision

Date	Addressed Release
March 2016	`0.5UP00`
August 2016	`1.0UP00`
December 2016	`1.1UP00`

New Information

- Addition of the Spark Thrift server to the list of ports.
- Addition of Tableau related content.
- Addition of the Spark Thrift server's log file to the list of log file locations and default log settings.
- Additions to the list of error messages returned by the system.
- Additions of some notes related to Grafana and NFS.

- Additions of procedures for updating the InfluxDB security settings and data retention policies.
- Addition of procedure to update the secret of a Mesos framework.
- Addition of tips and cautions related to NFS and Grafana.
- Addition of procedure to start and/or stop the Spark Thrift Server.
- Addition of Cray Data Virtualization Service (DVS) related content.

Updated Information

Following is a summary of changes included with this publication version:

- Updates to the System Management UI section to reflect changes made to this UI in this release.
- Updates to the security section, which now provides instructions for enabling SSL for Tableau's authentication.
- Updates to the Urika CLI section to reflect addition of the Spark Thrift server. This section now also includes the sequence in which the `urika-start` and `urika-stop` commands need to be executed.
- Updates to the service to node mapping section to incorporate addition of the Spark Thrift server.
- Updates to the power up and power down procedures.
- Updates to the list of system accounts.
- Updates to the list of authentication mechanisms to include authentication mechanisms for HiverServer2 and Spark Thrift Server.
- Minor updates to the Grafana sections to reflect timezone related information and other editorial changes.
- Minor updates to the default system configurations.

Other changes include reorganization of some sections for better readability.

Feedback

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Trademarks

2 The Urika-GX System

The Urika-GX system is a big data analytics platform optimized for analytic workflows. It combines a highly advanced hardware platform with a comprehensive analytic software stack to help derive optimal business value from data. The Urika-GX platform provides the tools required for capturing and organizing a wide variety of data types from different sources and enables analyzing big data and discovering hidden relationships.

The Urika-GX system also features a number of workload management tools as well as an optimized system administration tool for performing monitoring and management tasks.

For a list of features of the Urika-GX system, see S-3017, "*Urika®-GX System Overview*".

2.1 Administrative Components of Urika-GX

Urika-GX platforms have been developed by tightly integrating commodity hardware components, open-source software, and Cray proprietary hardware, to provide users a high performance, scalable and open compute platform.

Major administrative components of Urika-GX include:

- **System Management Workstation (SMW)** - The SMW is a server that acts as a single-point interface to a system administrator's environment. It provides an interface for performing administrative and monitoring capabilities.
    - **Hardware Supervisory System (HSS)** - HSS is an integrated system of hardware and software components that are used for managing and monitoring the system.
    - **Cray System Management Software (CSMS)** - CSMS is a system management tool that is based upon OpenStack. It interfaces with HSS to provide image and node and management capabilities on the Urika-GX system.
- **Rack Controller (RC)** - The RC monitors the environmental sensors within the rack and manages communication between the SMW and other physical system components, including the rack, sub-rack and dANC (Dual Aries Network Card).
- **Intelligent Subrack Control Board (iSCB)** - The iSCB status command can be used to monitor the physical attributes of the sub-rack, such as the power supply, amperage, fan status, and temperature.
- **Aries Network Card Controller (ANCC)** - Each sub-rack chassis of the Urika-GX system contains two dANCs (dual Aries Network Cards). Each dANC contains 2 Aries chips, an Advanced RISC Machines (ARM) processor, and a number of environmental sensors to help monitor the system.
- **Integrated Dell Remote Access Controller (iDRAC)** - The iDRAC is a hardware that provides advanced agentless system management functionality for the SMW. It operates independently of the SMW's CPU and operating system. The version of iDRAC used on the Urika-GX system is iDRAC8.
- **System Monitoring and Performance Analysis Tools** - Urika-GX ships with Grafana, which enables monitoring system resources and viewing performance statistics of various system components. For more information, see S-3015, *Urika®-GX Analytic Applications Guide*.

- **Data Analytic Components** - Urika-GX features a number of data analytic tools that help perform analytic tasks, including managing and monitoring clusters, executing Hadoop and SPARK jobs, etc. For more information, see S-3015, *Urika®-GX Analytic Applications Guide*.

2.2 Urika-GX Network Components

There are 3 networks deployed on the Urika®-GX platform:

- **Aries High Speed Network (HSN)** - The Aries HSN provides high speed application and data network connectivity between nodes. This network provides node interconnect via high bandwidth, low latency DMA access. The hardware to support this network consists of an Aries Interface Board (AIB) connected to an available PCIe slot on each Urika-GX node and integrated into the node chassis assembly. The AIB is connected to the dANC integrated in the Urika-GX sub-rack. Copper cables provide an all-to-all connection of all dANCs in the system.
- **Operational Ethernet network**- The operational Ethernet network is used for ingesting user data. This network is comprised of a single unit 48-port GigE switch that provides dual 1GigE and/or dual 10GigE interfaces to the site network. Urika-GX's login nodes do not route through this switch and need to be directly connected to the site network. The operational network allows node connectivity externally from Urika-GX to the site network. The Urika-GX compute and I/O nodes are connected to a single managed Brocade ICX 6450-48, 48 port switch with a single power supply. Connectivity of this network to the site network is made possible by two available Gigabit Ethernet ports and/or two 10 Gigabit Ethernet ports on the ICX 6450-48 switch.
- **Management Ethernet network** - The management Ethernet network is primarily used for system management, and not for user data. The management Ethernet network is comprised of two stacked 1U 48-port switches, which are located at the top of the Urika-GX rack, and can optionally contain redundant switch power supplies. These switches provide GigE management Ethernet connectivity to every node, System Management Workstation (SMW), Rack Controller (RC), Intelligent Subrack Control Board (iSCB), Power Distribution Units (PDUs), Dual Aries Network Cards (dANCs) and to the operational network that connects to the nodes.

  The Urika-GX system also contains the following subnets:

  - SMW subnet, which provides connectivity to the SMW and the RC.
  - Rack subnet, which provides connectivity to the dANCs and iSCB module.

  This network is supported by two managed Brocade ICX 6450-48, 48 port switches stacked together with two 10gigE optical interconnects. Each switch contains a single power supply, and can optionally contain redundant switch power supplies. The following VLANs are defined for this network to support management network traffic:

  - VLAN 102 - Uses ports 1-5 on each ICX 6450-48 switch. This is a dual-mode (tagged dual-mode for VLAN 102 and tagged for VLAN 103) VLAN. Untagged traffic on these ports belongs to VLAN 102. Traffic can be tagged for VLAN 103. The SMW HSS interface, the RC for a given rack, and the PDUs for a given rack are connected to these ports.
  - VLAN 103 Ports 6-12 on each ICX 6450-48 switch. Untagged traffic on these ports belongs to VLAN 103. The iSCBs and dANC cards are connected to these ports.
  - VLAN 104 Ports 13-48 on each ICX 6450-48 switch.

    NOTE: Traffic on this VLAN may be reduced if VLAN 105 is needed for storage as long as each compute node is connected to VLAN 104

Untagged traffic on these ports belongs to VLAN 104. The compute nodes and the SMW node-side network are connected to these ports.

- ○ VLAN 105 Some number of Ports 13-48 on each ICX 6450-48 switch, as needed for storage management. Untagged traffic on these ports belongs to VLAN 105. The Storage Management Ports are connected to these ports.
- ○ VLAN 1 (default) is unused.

Traffic from the SMW to the subcomponents in the rack subnet, and vice versa, is routed through the corresponding RC.

For additional information, see the *Urika®-GX Hardware Guide*.

2.3 Urika-GX File Systems

Supported file system types on Urika-GX include:

- **Internal file systems**
  - Hadoop Distributed File System (HDFS) - Hadoop uses HDFS for storing data. HDFS is highly fault-tolerant, provides high throughput access to application data, and is suitable for applications that have large data sets. Urika-GX also features tiered HDFS storage. HDFS data is transferred over the Aries network.
  - Network File System (NFS) - The Urika-GX SMW hosts NFS, which is made available to every node via the management network.
- **External file system**

  Urika-GX currently supports Lustre as an external file system. On the Urika-GX system, Cray Lustre clients and a Lustre server is included to support:

  - Direct Attach Lustre (DAL) - In a DAL configuration, the Urika-GX I/O nodes are directly attached to an external block storage device and configured as Lustre servers, whereas all the other node are configured as Lustre clients.
  - Cray Sonexion storage system - When a Urika-GX system uses the Cray Sonexion as its external storage system, the Sonexion system is attached to Urika-GX I/O nodes as Lustre clients. In this type of configuration, the I/O nodes act as LNET routers to serve Lustre to all other nodes in the system.
  - Cray Data Virtualization Service (DVS) - Cray has successfully experimented with connecting Urika-GX to GPFS and NFS filesystems via Cray DVS. For more information and guidance, please contact Cray Support.

  The Lustre file system is served over the Aries network when the DAL or Sonexion configuration type is used.

File Locations

- Home directories are mounted on (internal) NFS, with limited space
- Distributed filesystem (Lustre), if provisioned, is mounted at `/mnt/lustre` and is suitable for larger files.

⚠ **CAUTION:** Avoid using NFS for high data transfer and/or large writes as this will cause the network to operate much slower or timeout. NFS, as configured for Urika-GX home directories, is not capable of handling large parallel writes from multiple nodes without data loss. Though It is possible to configure NFS to handle parallel writes, it would require a hard mount, which would have undesired consequences.

2.4 Urika-GX System Nodes

Each Urika-GX node is a logical grouping of a processor, memory, and a data routing resource. Nodes can be categorized as compute, I/O, and login nodes.

Table 1. Node Types and Descriptions

Node Type	Description
Compute nodes	Compute nodes run application programs.
I/O nodes	I/O nodes facilitate connecting to the supported external storage system.
Login nodes	Users log in to the Urika-GX system via login nodes. Login nodes store users' local files and facilitate launching jobs from the command line. They also offer the environment for users to build, compile, and monitor analytics applications.

All Urika-GX nodes run the CentOS operating system (version 7.2) as well as portions of the Cray Linux Environment (CLE).

2.5 Restrictions on Use

Hardware Considerations

The following items should be kept under consideration when using Urika-GX hardware:

- High speed network/management network switches must not be modified as this network is internal to Urika-GX.
- Moving the system from the rack Cray supplies to customer provided racks is not supported.
- Hardware configurations of the sub-racks and System Management Workstation (SMW) must not be changed.
- PCIe devices should not be modified.
- Hardware and drivers installed on the SMW and nodes should not be modified.
- PDUs installed on the system should not be replaced.

NOTE: Contact Cray Support if it is required to swap nodes between slots.

The following options are supported:

- Connecting to the internal PDU power switches.
- Changing the hosts names of login nodes and the SMW.
- The single top of rack switch used for the operational network may be modified to meet site-specific needs. This switch is expected to be used to enable a direct connection from the site network to the compute and I/O nodes to support data ingestion and streaming analytics. This network may be modified to reflect site-specific IP addresses and node names that would be directly exposed to the site network.

- The available space in the rack can be used for additional hardware, however proper power and cooling for that gear needs to be ensured.

Contact Cray Support for information related to:

- Optionally switching to higher bandwidth NICs on the login nodes or SMW connections to the site network.
- Changing the internal range of Cray's IP addresses in case there is a conflict.

Software Considerations

The following items should be kept under consideration when using Urika-GX software:

- OpenStack CLI commands other than those documented in S-3016, *Urika®-GX Administration Guide* should not be executed, as doing so may cause damage to the system. Contact Cray Support for additional information.
- None of the default OpenStack application user accounts should be deleted or modified. For more information, see *Default Urika-GX System Accounts* on page 182
- Intelligent Subrack Control Board (iSCB) CLI commands other than the `status` command should NOT be executed on the Urika-GX system (unless advised by Cray Support) as they may interfere with performance of Cray System Management Software (CSMS). Instead, the Urika-GX management system UI should be used for monitoring. For more information, contact Cray Support.
- Modifying the iSCB firmware is not supported.
- Modifying switch firmware (both Ethernet/Infiniband) is not supported.
- Modifying node BIOS settings is not supported.
- Modifying the kernel and/or kernel modules is not supported.
- Deleting any factory installed software is not supported.
- Changing the default configurations of Mesos, Marathon, `mrun`, and Grafana is not supported.

  IMPORTANT: Before installing any additional software on the Urika-GX system, a ticket should be opened with Cray Support to verify that the software will have no impact on the system.

The following options are supported:

- Adding CentOS 7 packages that do not cause dependency issue with the Cray installed software. However, only Cray-provided Linux updates and YUM repositories should be used.
- Installing additional HDP 2.4 compliant packages and modifying these packages for integrating into the existing software stack.
- Tuning Hadoop and Spark configuration parameters listed in section "*Tunable Hadoop and Spark Configuration Parameters* " of S-3015, "*Urika®-GX Analytic Applications Guide*".

  NOTE: Contact Cray Support if you need to modify additional software configurations.

2.6 Service to Node Mapping

The list of services installed on each type of Urika-GX node is listed in the following table:

Table 2. Urika-GX Service to Node Mapping (2 Sub-rack System)

Node ID(s)	Service(s) Running on Node /Role of Node
`nid00000`	● ZooKeeper ● ncmd ● Mesos Master ● Marathon ● Primary HDFS NameNode ● Hadoop Application Timeline Server ● Collectl
`nid000[01-07, 09-13, 17-29]`	● Collectl ● Mesos Slave ● Data Node ● YARN Node Manager (if running)
`nid00008`	● ZooKeeper ● Secondary HDFS NameNode ● Mesos Master ● Oozie ● HiveServer2 ● Spark Thrift Server ● Hive Metastore ● WebHCat ● Postgres database ● Marathon ● YARN Resource Manager ● Collectl
`nid00014` (Login node 1)	● HUE ● HA Proxy ● Collectl ● Urika-GX Applications Interface UI ● Cray Application Management UI ● Jupyter Notebook ● Service for flexing a YARN cluster ● Documentation and Learning Resources UI
`nid00015`, `nid00031` (I/O nodes)	These are nodes that run Lustre clients
`nid00016`	● ZooKeeper

Node ID(s)	Service(s) Running on Node /Role of Node
	● Mesos Master ● Marathon ● Hadoop Job History Server ● Spark History Server ● Collectl
`nid00030` (Login node 2)	● HUE ● HA Proxy ● Collectl ● Service for flexing a YARN cluster ● Grafana ● InfluxDB

Table 3. Urika-GX Service to Node Mapping (3 Sub-rack System)

Node ID(s)	Service(s) Running on Node /Role of Node
`nid00000`	● ZooKeeper ● ncmd ● Mesos Master ● Marathon ● Primary HDFS NameNode ● Hadoop Application Timeline Server ● Collectl
`nid00001-nid00015`, `nid00017-nid00029`, `nid00033-nid00045`	● Collectl ● Mesos Slave ● Data Node ● YARN Node Manager (if running)
`nid00016`	● ZooKeeper ● Mesos Master ● Marathon ● Hadoop Job History Server ● Spark History Server ● Collectl
`nid00030` (Login node 1)	● HUE ● HA Proxy

Node ID(s)	Service(s) Running on Node /Role of Node
	- Collectl - Urika-GX Applications Interface UI - Jupyter Notebook - Service for flexing a YARN cluster - Documentation and Learning Resources UI
`nid00031`, `nid00047` (I/O nodes)	These are nodes that run Lustre clients
`nid00032`	- ZooKeeper - Secondary NameNode - Mesos Master - Oozie - HiveServer 2 - Hive Metastore - WebHcat - Postgres database - Marathon - YARN Resource Manager - Collectl - Spark Thrift Server
`nid00046` (Login node 2)	- HUE - HA Proxy - Collectl - Grafana - InfluxDB - Service for flexing a YARN cluster

For additional information, use the `urika-inventory` command as root on the SMW to view the list of services running on node, as shown in the following example:

```
# urika-inventory
```

For more information, see the `urika-inventory` man page.

3 System Management

3.1 Urika-GX Component Naming Conventions

The following table contains the component naming format for Urika®-GX systems:

Table 4. Urika-GX Component Naming Conventions

Component/Subject	Naming Pattern	Range
System Management Workstation (SMW)	s0	N/A
Wild card, similar to s0.	all	N/A
Wild card, which refers to all compute nodes	all_comp	N/A
Wild card, which refers to all service nodes	all_serv	N/A
Partition of a machine	p*P*	p0
Rack	r*R*	*R*:0 to 161
Sub-rack. There are up to 4 sub-racks per rack. Each sub-rack contains up to 2 dual Aries Network Card (dANC) cards, up to 16 compute nodes, and up to 2 Intelligent Subrack Control Boards (iSCBs)	r*R*s*S*	*S*:0 to 3
Intelligent Subrack Control Board (iSCB)	r*R*s*S*i*I*	*I*:0 to 1
Dual Aries Network Card (dANC). There are up to 2 dANCs per sub-rack, accommodating up to 16 nodes	r*R*s*S*c*C*	*C*:0 to 1
High Speed Network (HSN) cable. The "j" name is visible on the cable connector face plate	r*R*s*S*c*C*j*J*	*J*:0-15
Aries ASIC within a dANC card	r*R*s*S*c*C*a*A*	*A*:0 to 1

Component/Subject	Naming Pattern	Range
Aries link control block within an Aries ASIC.	rRsScCaAlRC	R:0 to 5 C:0 to 7
Network Interface Controller (NIC) within an Aries ASIC	rRsScCaAnN	N:0 to 3
Node within a dANC card	rRsScCnN	N:0 to 7
Accelerator within a node	rRsScCnNaA	A:0 to 7
Board Management Control (BMC) within a node	rRsScCnNbB	B:0

3.2 System Management Workstation (SMW)

The System Management Workstation (SMW) is the system administrator's console for managing a Cray system. The SMW is a server that runs the CentOS (version 7.2) operating system, Cray developed software, and third-party software. The SMW is also a point of control for the Hardware Supervisory System (HSS). The HSS data is stored on an internal hard drive of the SMW.

The SMW provides shell, and web access via CSMS, to authorized users to perform administrative and monitoring tasks.

Most system logs are collected and stored on the SMW. The SMW plays no role in computation after the system is booted. From the SMW an administrator can initiate the boot process, access the database that keeps track of system hardware, analyze log messages, and perform standard administrative tasks.

CAUTION:

The SMW is a critical system component, which facilitates the operation of other hardware and software components. Therefore, it is important that all instructions in this publication be followed before making any changes/reconfigurations to the SWM, as well as before restarting the SMW.

3.2.1 Power On the System Management Workstation (SMW)

The SMW can be turned on by:

- Physically turning the SMW on via the power button.
- Using the iDRAC.

CAUTION:

The SMW is a critical system component, which facilitates the operation of other hardware and software components. Therefore, it is important that all instructions in this publication be followed before making any changes/reconfigurations to the SWM, as well as before restarting the SMW.

3.2.2 About the Integrated Dell Remote Access Controller (iDRAC)

The iDRAC is a systems management hardware and software solution that provides remote management capabilities, crashed system recovery, and power control functions for the System Management Workstation (SMW). The iDRAC alerts administrators to server issues, helps them perform remote server management, and reduces the need for physical access to the server. The iDRAC also facilitates inventory management and monitoring, deployment and troubleshooting. To help diagnose the probable cause of a system crash, the iDRAC can log event data and capture an image of the screen when it detects that the system has crashed.

For more information about the iDRAC, refer to online documentation at *http://www.dell.com*.

3.2.3 Change the Default iDRAC8 Password

About this task

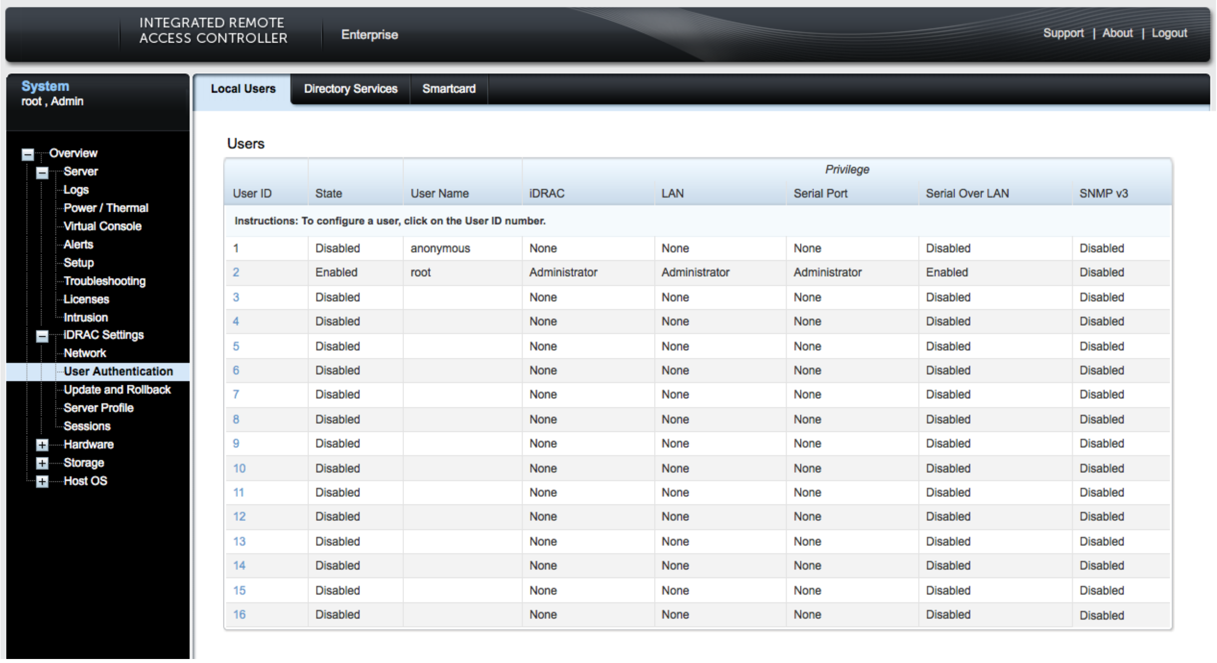
After accessing the iDRAC8's web interface, it is recommended to change the default password using the following instructions:

Procedure

1. Bring up a web browser.
2. Go to: `https://`*`cray-drac`*, where *cray-drac* is used as an example for the iDRAC's name, such as https://*system-smw-ras*

   The iDRAC's login screen appears.
3. Enter `root` and `initial0` as the default user name and password on the iDRAC's log in screen.
4. Select the **Submit** button
5. Select **iDRAC settings** from the left navigation menu bar.
6. Select **User Authentication**
7. Select the **User ID** for the user that needs to have the password changed.

Figure 1. Change the Default Password Interface

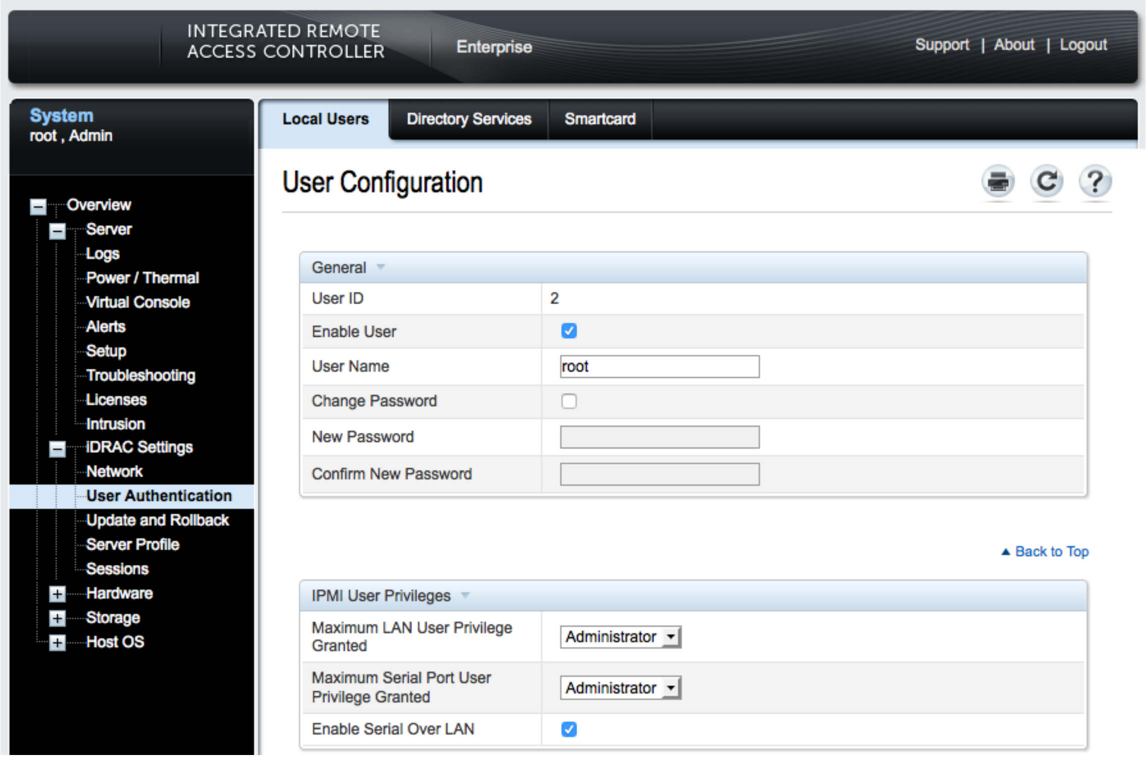


Users

			Privilege				
User ID	State	User Name	iDRAC	LAN	Serial Port	Serial Over LAN	SNMP v3
Instructions: To configure a user, click on the User ID number.							
1	Disabled	anonymous	None	None	None	Disabled	Disabled
2	Enabled	root	Administrator	Administrator	Administrator	Enabled	Disabled
3	Disabled		None	None	None	Disabled	Disabled
4	Disabled		None	None	None	Disabled	Disabled
5	Disabled		None	None	None	Disabled	Disabled
6	Disabled		None	None	None	Disabled	Disabled
7	Disabled		None	None	None	Disabled	Disabled
8	Disabled		None	None	None	Disabled	Disabled
9	Disabled		None	None	None	Disabled	Disabled
10	Disabled		None	None	None	Disabled	Disabled
11	Disabled		None	None	None	Disabled	Disabled
12	Disabled		None	None	None	Disabled	Disabled
13	Disabled		None	None	None	Disabled	Disabled
14	Disabled		None	None	None	Disabled	Disabled
15	Disabled		None	None	None	Disabled	Disabled
16	Disabled		None	None	None	Disabled	Disabled

8. Select the **Next** button on the next interface

9. Select the **Change Password** check-box on the **User Configuration** interface.



User Configuration

General	
User ID	2
Enable User	☑
User Name	root
Change Password	☐
New Password	
Confirm New Password	

IPMI User Privileges	
Maximum LAN User Privilege Granted	Administrator
Maximum Serial Port User Privilege Granted	Administrator
Enable Serial Over LAN	☑

10. Enter the new password in the **New Password** and **Confirm New Password** fields.

11. Select **Apply** to complete the password change.

3.2.4 Change the Default System Management Workstation (SMW) Passwords

Prerequisites

Ensure that the SMW is accessible. This procedure requires root access.

About this task

After logging on to the SMW for the first time, Cray recommends changing the default passwords, as described in the following instructions.

Procedure

1. Log in to SMW as root.
2. Change default passwords on the SMW by executing the following commands.

   ```
   smw# passwd root
   ```

   ```
   smw# passwd crayadm
   ```

   ```
   smw# passwd mysql
   ```

3. Update the password in the same manner on all the nodes.

For rack-mount SMWs, such as that used in the Urika-GX system, it is also necessary to change the default iDRAC password.

3.2.5 Control System Management Workstation (SMW) Power with the iDRAC8 Web Console

Prerequisites

Ensure that the SMW is up and running.

About this task

Use the iDRAC's web console to start up and shut down the System Management Workstation (SMW).

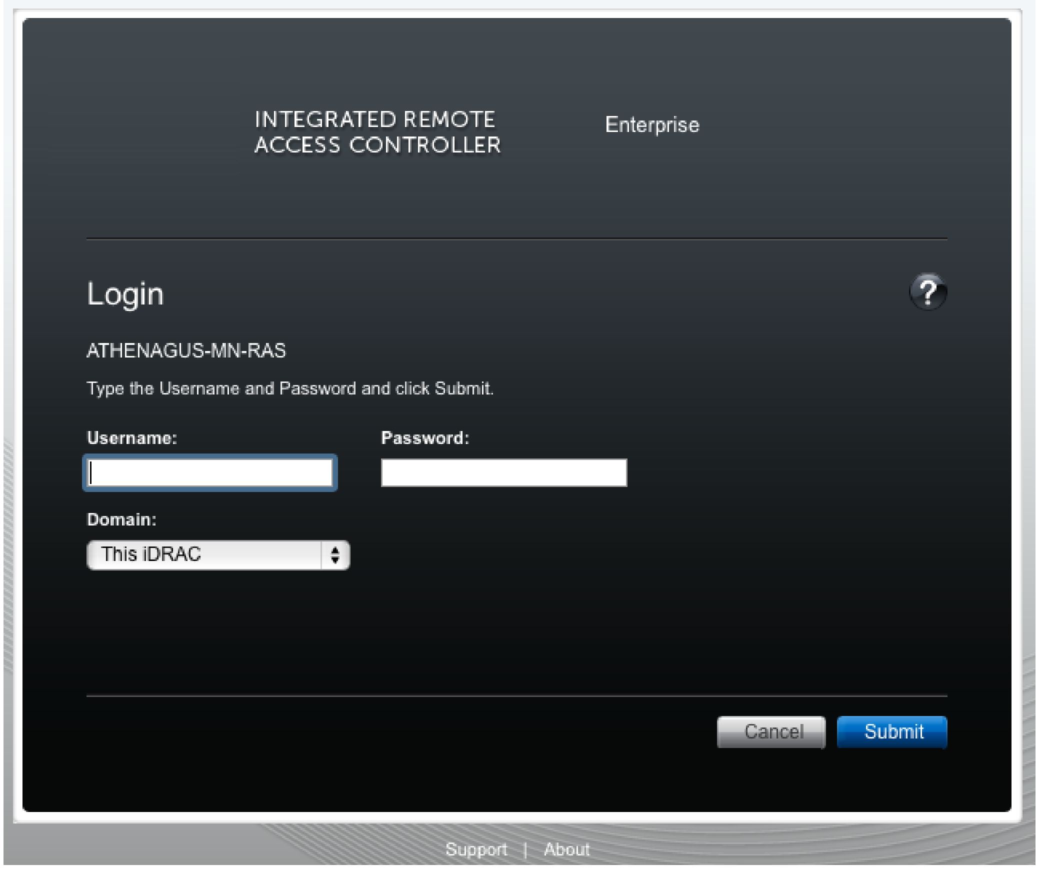
Procedure

1. Point your browser to your site-specific iDRAC IP address, such as https://*system-smw-ras*

   The iDRAC console's login screen appears.

2. Enter `root` and `initial0` in the **Username** and **Password** fields respectively. These are the default credentials that should only be used if the default credentials have not been changed.

Figure 2. iDRAC Login Screen



INTEGRATED REMOTE ACCESS CONTROLLER

Enterprise

Login

ATHENAGUS-MN-RAS

Type the Username and Password and click Submit.

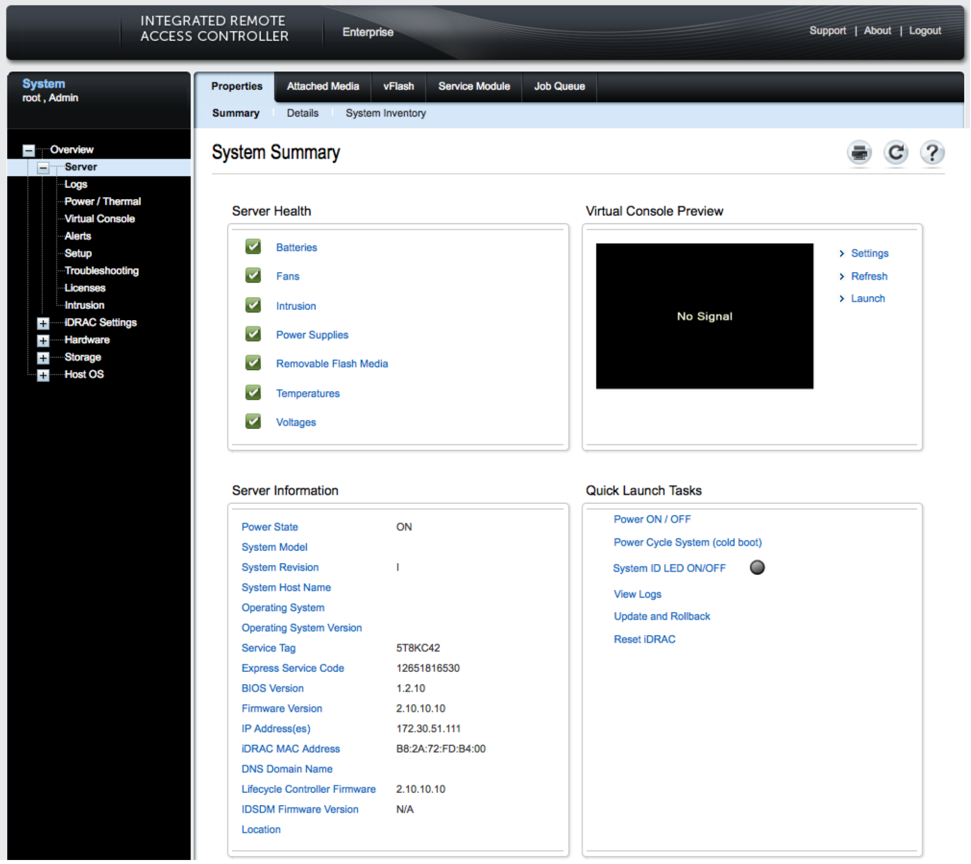
Username:

Password:

Domain: This iDRAC

3. On the **Quick Launch Tasks** section of the iDRAC UI, click on **Power ON/ OFF** link to control the SMW's power.

Figure 3. iDRAC Console



Power State	ON
System Model	
System Revision	I
System Host Name	
Operating System	
Operating System Version	
Service Tag	5T8KC42
Express Service Code	12651816530
BIOS Version	1.2.10
Firmware Version	2.10.10.10
IP Address(es)	172.30.51.111
iDRAC MAC Address	B8:2A:72:FD:B4:00
DNS Domain Name	
Lifecycle Controller Firmware	2.10.10.10
IDSDM Firmware Version	N/A
Location	

For more information about the iDRAC, visit *http://www.dell.com*

3.2.6 Synchronize the System Management Workstation (SMW) to the Site NTP Server

Prerequisites

This procedure requires root privileges.

About this task

The components of the Cray system synchronize time with the System Management Workstation (SMW) through Network Time Protocol (NTP). By default, the NTP configuration of the SMW is configured to stand alone; however, the SMW can optionally be configured to synchronize with a site NTP server. Follow this procedure to configure the SMW to synchronize to a site NTP server.This procedure is for SMWs that run the CentOS 7.2 operating system, such as Urika-GX.

Procedure

1. Log on to the SMW as root.

2. Stop the NTP server by issuing the `systemctl stop ntpd` command.

```
smw:~ # systemctl stop ntpd
```

3. Edit the `/etc/ntp.conf` file on the SMW to point to the new server.

4. Update the clocks

```
smw:~ # ntpdate timeserver
```

5. Restart the NTP server by issuing the `systemctl start ntpd` command:

```
smw:~ # systemctl start ntpd
```

   The SMW can continue to update the rest of the system by proxy. By default, the SMW qualifies as a stratum 3 (local) NTP server. For more information about NTP, refer to the Linux documentation.

6. Sync the hardware clock

```
smw:~ # hwclock --systohc
```

7. Verify that the SMW has jitter from the NTP server

```
smw:~ # ntpq -p
```

3.2.7 Synchronize Time of Day on System Nodes

Prerequisites

This procedure needs to be carried out as root.

About this task

Follow this procedure to configure Urika-GX compute nodes to synchronize to a site NTP server. This procedure is speicific to a 48 node system.

Procedure

1. Stop the NTP server by issuing the `systemctl stop ntpd` command.

```
# pdsh -w nid000[00-47] " systemctl stop ntpd"
```

2. Edit the `/etc/ntp.conf` file on the SMW to point to the new server.

3. Update the clocks

```
#  pdsh -w nid000[00-47] " ntpdate -s smw"
```

4. Sync the hardware clock

```
# pdsh -w nid000[00-47] "hwclock --systohc "
```

5. Restart the NTP server by issuing the `systemctl start ntpd` command:

```
# pdsh -w nid000[00-47] " systemctl start ntpd"
```

3.2.8 Reboot a Stopped System Management Workstation (SMW)

About this task

The SMW is an integral player in monitoring and maintaining optimal High Speed Network (HSN) traffic. If the SMW is down or being rebooted (i.e., not fully working), the Aries Network Card Controllers (ANCCs) will automatically throttle the high-speed network because the ANCCs are no longer hearing SMW heartbeats. This is done in order to prevent possible network congestion, which normally requires the SMW to be up in order to respond to such congestion. Once the SMW is up again, the ANCCs will unthrottle the network. (No attempt is made to prevent loss of data or to carry out operations that occur when the SMW is offline). The consequences of throttling are that the network will perform much more slowly than normal.

When the SMW comes up, it restarts, establishes communications with all external interfaces, restores the proper state in the state manager, and continues normal operation without user intervention.

For a scheduled or unscheduled shutdown and reboot of the SMW, it is necessary to have a backup of configuration files so that if one or more of the files in use becomes corrupted, a clean set of files is available with which to reboot.

Procedure

1. Ensure that there are no resiliency actions taking place (by executing `tail -f /var/opt/cray/log/p0-default/nlrd-YYYYMMDD`) at the time of a graceful SMW shutdown, otherwise wait until the action is finished.

   ```
   # tail -f /var/opt/cray/log/p0-default/nlrd-YYYYMMDD
   ```

2. Boot the SMW.

3.3 Hardware Supervisory System (HSS)

HSS is an integrated system of hardware and software that monitors the hardware components of the system and proactively manages the health of the system. HSS communicates with nodes and management processors over an internal (private) Ethernet network that operates independently of the Cray Aries High Speed Network (HSN).

HSS includes the following components:

- HSS network
- HSS Command Line Interface (CLI)
- Aries Network Card Controllers (ANCCs)
- Rack controllers
- HSS daemons
- HSS database
- Various logs

HSS performs a number of administrative tasks, such as:

- Monitoring certain hardware system components

- Managing hardware and software failures
- Starting up and shutting down nodes
- Managing the High Speed Network (HSN)
- Maintaining system component states
- Managing the hardware inventory

HSS Command Line Interface

HSS has a command-line interface to manage and view the system from the SMW. For complete usage information, see the `xtcli(8)` man page.

Dual Aries Network Card (dANC) Controllers and Rack Controllers

A dANC control processor is hierarchically the lowest component of the monitoring system. The dANC Cray network card contains two Aries ASICs and an ANCC. There are 2 dANC cards per sub-rack, and hence 4 Aries ASICs, which support 16 nodes. The dANC monitors the general health of components, including items such as voltages, temperature, and various failure indicators. A version of Linux optimized for embedded controllers runs on each dANC controller.

Each rack has a rack control processor (*rack controller*) that monitors and controls the rack power and communicates with all dANC controllers in the rack. It sends a periodic heartbeat to the SMW to indicate rack health.

The rack controller connects to the dANC controllers via the Ethernet switch on each blade by an Ethernet cable and routes HSS data to and from the SMW. RC runs the same version of embedded Linux as the dANCs. The SMW, rack controllers, iSCBs, and ANCCs are all interconnected via Ethernet

The monitoring system uses periodic heartbeats. Processes send heartbeats within a time interval. If the interval is exceeded, the system monitor generates a fault event that is sent to the state manager. The fault is recorded in the event log, and the state manager sets an alert flag for the component (dANC controller or rack controller) that spawned it.

The rack and dANC controllers use NTP to keep accurate time with the SMW.

HSS Daemons

HSS daemons on the SMW and the controllers act to monitor and control the state of the system, and to respond to incidents such as hardware failures. The data path between the HSS CLI and the various daemons is via HSS events.

Cray System Network Routing Utility

The `rtr` command performs a variety of routing-related tasks for the High Speed Network (HSN). Tasks include:

- Generating and applying HSN routes
- Verifying that routes can be generated for the current configuration
- Verifying that generated routes are free of cyclic dependencies
- Dumping out a variety of routing-related and link-related information

HSS Database

The HSS database is a MariaDB relational database that contains the state of all the physical system components, including the System Management Workstation (SMW), Rack Controller (RC), Intelligent Subrack Control Board (iSCB), nodes, and the Aries Network Card Controller (ANCC). The state manager reads and writes the system state to the HSS database. The state manager keeps the database up-to-date with the current state of components and retrieves component information from the database when needed.

Log Files

Event Logs The event router records events to the event log in the `/var/opt/cray/log/event-`*`yyyymmdd`* file.

Log rotation takes place at specific time intervals. By default, one file is generated per day.

Dump Logs The `xtdumpsys` writes logs into the`/var/opt/cray/dump` directory by default.

SMW Logs SMW logs are stored in `/var/opt/cray/log/p0-`*`default`* on the SMW, and include logs for `xtconsole`, `xtconsumer`, `xtnlrd`, etc.

3.3.1 Hardware Supervisory System (HSS) Architecture Overview

HSS hardware on the Urika-GX system consists of a System Management Workstation (SMW), which is a rack-mounted Intel-based server running CentOS 7.2, along with an Ethernet network that connects the SMW to a rack controller (RC) via a switch. The RC connects to one Aries Network Card Controller (ANCC) on each dual Aries Network Card (dANC) and consists of a mini PC running Linux. The ANCC has a 32-bit processor. Each hardware component in the HSS system runs a version of Linux with the relevant HSS software installed. RC is used to route data downstream from the SMW to the ANCCs and Intelligent Subrack Control Boards (iSCBs), and upstream from the ANCCs and iSCBs to the SMW.

HSS control and monitoring is performed by the SMW over the HSS Ethernet via a stacked managed switch, which uses VLANs to connect the SMW to the ANCCs, RC, and iSCBs.

The Urika-GX system can consist of 1, 2 or 3 sub-racks per rack, and 2 dANCs per sub-rack, resulting in a maximum of 6 dANCs per rack. Each dANC has 2 Aries ASICs, each of which has 4 NICs to support a single node per NIC connected by PCIe Gen 3.

HSS infrastructure software stack executes on the RC, SMW, and the ANCC to control and monitor the Aries ASIC.

Resiliency Communication Agent (RCA)

RCA is a messaging service that connects compute nodes to the HSS event and messaging system, and allows compute nodes to subscribe to and inject HSS events and messages.

Inventory Management

HSS keeps track of hardware inventory to identify which hardware components are up and running. It uses the `xthwinv` command to retrieve hardware component information.

Hardware Discovery

HSS plays an integral role in system hardware discovery. HSS components that play a role in this process include the HSS database and the `xtdiscover` command. For more information, see the `xtdiscover(8)` man page.

Hardware Supervisory System (HSS) Ethernet/Management Network

The HSS network provides interconnectivity between the System Management Workstation (SMW), Rack Controllers (RCs), and dual Aries Network Cards (dANCs) in a hierarchical fashion.

3.3.2 The xtdiscover Command

The `xtdiscover` command automatically discovers the hardware components on a Cray system and creates entries in the system database to reflect the current hardware configuration. The `xtdiscover` command identifies missing or non-responsive cabinets and empty or non-functioning Dual Aries Network Cards (dANCs). The `xtdiscover` command and the state manager ensure that the system status represents the real state of the hardware. When `xtdiscover` has finished, a system administrator can use the `xtcli` command to display the current configuration. No previous configuration of the system is required; the hardware is discovered and made available. Modifications can be made to components after `xtdiscover` has finished creating entries in the system database.

The `xtdiscover` interface steps a system administrator through the discovery process.

Prior to performing component discovery, the `xtdiscover` command will need to make sure that the Hardware Supervisory System (HSS) networking is set up properly, using a user-provided block of IP address space. This information is used to create the `/etc/hosts` file and DHCP entries for the HSS network. This setup typically only needs to be done once unless the address block is moved, or a new rack is added.

> **TIP:** Simply adding an additional rack within an existing address block will not affect the address assignments for the existing racks. If it is intended to add additional racks in the future, it is better to configure networking for all of them all at once. The `xtdiscover` command will automatically detect whether each rack is presently in the system and will set the system state accordingly. HSS IP configuration is separate from that used by Cray System Management Software (CSMS) for setting up networking to the compute and service nodes. The two IP ranges provided **must not** overlap each other.

If there are changes to the system hardware, such as populating a previously empty dANC, or adding an additional rack, then `xtdiscover` must be executed again, and it will perform an incremental discovery of the hardware changes. A full-system `xtdiscover` is not intended to be run while the High Speed Network (HSN) is actively routing traffic. When new blades are added during system operation with `xtwarmswap`, however, a mini-`xtdiscover` is automatically run to make the required updates to the database.

For more information, see the `xtdiscover(8)` man page.

3.3.3 Hardware Supervisory System (HSS) Component Location Discovery

Each Urika®-GX system rack is numbered starting at `0`. Each sub-rack within a rack has a dip switch that can set the rack and sub rack number. The iSCB conveys the rack and sub-rack numbers to the Aries Network Cards (ANCs) via an I^2C bus. The Dual Aries Network Card (dANC) blade has a slot-sense bit which tells it which dual dANC number it is within the sub-rack (`0` or `1`). The dANC uses the rack, sub-rack, and dANC number to construct its hostname. The Rack Controller (RC) determines its rack number from the location of the Intelligent Subrack Control Board (iSCB), encoded in a DHCP request sent by the iSCB and seen by RC.

3.3.4 Hardware Supervisory System (HSS) Daemons

HSS daemons and applications exchange information with the event router. They are located at: `/opt/cray/hss/default/bin` and are started when the System Management Workstation (SMW) boots.

They can be managed via systemd and can be stopped and started via systemctl stop hss and systemctl start hss respectively. HSS daemons are configured dynamically by executing the xtdaemonconfig command.

Key HSS daemons include:

- State manager daemon (state_manager) - Performs HSS system hardware state management.
- Event router daemon (erd) and (erdh) - Performs HSS message routing.
- Node ID manager daemon (nid_mgr) - Manages node IDs and NIC addresses for every node in the system.

State Manager

HSS maintains the state of all components that it manages. The state manager, state_manager, runs on the SMW and uses a relational database (also referred to as the *HSS database*) to maintain/store the system state. The state manager keeps the database up-to-date with the current state of components and retrieves component information from the database when needed. Thus, the dynamic system state persists between SMW boots. The state manager uses the Lightweight Log Manager (LLM). The log data from state manager is written to: /var/opt/cray/log/sm-*yyyymmdd*. The default setting for state manager is to enable LLM logging. The state manager performs the following functions:

- Updates and maintains component state information
- Monitors events to update component states
- Detects and handles state notification upon failure
- Provides state and configuration information to HSS applications.

The state manager performs the aforementioned tasks on behalf of:

- System nodes
- Aries chips
- Aries HSN Links
- dual Aries Network Card (dANC)
- Rack controller (RC)
- Intelligent Subrack Control Board (iSCB)

In summary, the state manager subscribes to and listens for HSS events, records changes of states, and shares those states with other daemons.

The Event Router (erd)

HSS functions are event-driven. The event router daemon, erd runs on the SMW, rack controllers, and dANC controllers. HSS commands and daemons subscribe to events and inject events into the HSS system by using the services of the erd. The event router starts as each of the devices (SMW, rack controller, dANC controller) are started.

When the event router on the SMW receives an event from either a connected agent or from another event router in the hierarchy, the event is logged and then processed. HSS CLI commands use events to query and control HSS daemons.

Node ID (NID) Manager

The nid_mgr generates a list of mapping between node logical IDs and physical Network Interface Controller (NIC) IDs and distributes this information to the blade controllers. Along with the ability to assign NIDs automatically, the nid_mgr supports a mechanism that allows an administrator to control the NID assignment; this is useful for handling unique configurations. Administrator-controlled NID assignment is accomplished through the NID assignment file, nids.ini.

⚠ **CAUTION:** The nids.ini file can have a major impact on the functionality of a Cray system and should only be used or modified at the recommendation of Cray support personnel. Setting up this file incorrectly can make the Cray system unroutable.

Typically after a NID mapping is defined for a system, this mapping is used until some major event occurs, such as a hardware configuration change. This may require the NID mapping to change, depending on the nature of the configuration change. Adding additional racks does not typically result in a new mapping.

Since the operating system always uses NIDs, HSS converts these to NIC IDs when sending them on to the HSS network and converts them to NIDs when forwarding events from HSS network to a node.

3.3.5 Hardware Supervisory System (HSS) Administration and Diagnostic Commands Supported on Urika-GX

The following HSS commands are supported on Urika®-GX and need to be invoked from the System Management Workstation (SMW) to control HSS operations. Usage information for all of these commands can be viewed using the -h option, man pages are available where noted.

Table 5. HSS Administration Commands

Command	Description
capmc	Cray advanced power monitoring and control utility. See the capmc(8) man page for more information.
hss_make_default_initrd.athena.rc	Creates the Rack Controller (RC) image.
hss_make_default_initrd.athena.danc	Creates the dual Aries Network Card (dANC) image.
hssbootlink	Links a Linux kernel bzImage file, an initramfs file, and a parameters file so that they can be booted on a Controller by using PXE boot on an SMW.
hssclone	Clones the master image directory.
hssds_init	Creates the Hardware Supervisory System (HSS) data store; ensures the proper HSS data store user credentials are created and that the data store is ready for operation.
hsspackage	Facilitates creation of controller boot images.
make_node_inventory	Generates an inventory of Urika-GX nodes.
nid2nic	Prints all *nid*-to-*nic_address* mappings. See the nid2nic(8) man page for more information.

Command	Description
`rtr`	Performs system routing. See the `rtr(8)` man page for more information.
`xtagent`	Generic agent for accessing the event router.
`xtalive`	Checks for life of HSS daemons. See the `xtalive(8)` man page for more information.
`xtbounce`	Initializes Aries and HSN links. Powers down nodes as needed. See the `xtbounce(8)` man page for more information.
`xtcablecheck`	Compares the link endpoint pairs as known to the routing software with the link ID values set in MMRs in each LCB in the Aries ASIC to insure the HSN is cabled correctly.
`xtccpasswd`	Changes the password for all Rack Controllers (RCs), Dual Aries Network Card Controllers (dANCCs), and Intelligent Subrack Control Boards (iSCBs) on Urika-GX. It must be run as root.
`xtcc-ssh-keys`	Creates and modifies the `authorized_keys` file for Rack Controllers (RCs) and dANCCs.
`xtchecklink`	Checks HSN and PCIe link health.
`xtclass`	Displays the network topology class for this system.
`xtclear`	Clears component flags in the State Manager. For more information, see the `xtclear(8)` man page.
`xtcli`	Controls dANC and node power, displays status and sets administrative component status. See the `xtcli(8)` man page for more information.
`xtcon`	Provides a two-way connection to the console of a node. For more information, see the `xtcon(8)` man page.
`xtconsole`	Displays console text from one or more nodes.
`xtconsumer`	Displays HSS events.
`xtdaemonconfig`	Configures HSS daemons dynamically.
`xtdiscover`	Discovers and configures the Cray system hardware. This command is also used to populate the HSS database and set up HSS IP networking. For more information, see the `xtdiscover(8)` man page.
`xtdumpsys`	Gathers information when a system node stops responding or fails.
`xterrorcode`	Displays event error codes.
`xtfileio`	Performs file transfer to/from HSS controllers.

Command	Description
`xtfile2mem/xtmem2file`	Reads CPU or Aries memory and saves it in a file. Performs binary file-to-MMR/node memory and vice versa.
`xtgenid`	Generates HSS physical IDs.
`xtgenevent`	Injects arbitrary HSS events into the event stream.
`xthwerrlog`	Displays hardware errors retrieved from `xthwerrlogd` in user-friendly format.
`xthwerrlogd`	Monitors HW error log messages sent by the ANCC and by nodes.
`xtlogfilter`	Filters information from event router log files.
`xtmemio`	Performs reads or writes to Aries MMRs or node memory.
`xtnetwatch`	Watches the Cray system interconnection network for link control block (LCB) and router errors.
`xtnid2str`	Converts node identification numbers to physical names. See the `xtnid2str(8)` man page for more information.
`xtnlrd`	Responds to fatal Aries and HSN errors by rerouting the system.
`xtnmi`	Sends a non-maskable interrupt to target nodes. See the `xtnmi(8)` man page for more information.
`xtpcimon`	Monitors health of PCIe channels for Urika-GX systems.
`rackfw`	Flashes all devices in the Urika-GX system via out-of-band (OOB). See the `rackfw(8)` man page for more information.
`xtshow`	Shows components with selected characteristics. See the `xtshow(8)` man page for more information.
`xtsignal`	Sends a signal number or software interrupt to a remote process.
`xtwarmswap`	Allows Cray dANC cards or high-speed network cables to be warm swapped. See the `xtwarmswap(8)` man page for more information.
`xthwinv`	Retrieves hardware component information for selected modules.
`xtls`	Generates a summary of HSN link errors.
`xtpe`	Generates a summary of PCIe link errors.

There are a number of HSS diagnostics commands supported on Urika-GX. These commands need to be run from a compute node.

⚠ **WARNING:** All HSS diagnostics commands are intended for use by Cray Service Personnel only. Improper use of these restricted commands can cause serious damage to the system.

Table 6. HSS Diagnostic Commands

Command	Description
`xtbte_ata`	Perform system stress test to ensure that all logical endpoints go to all other end points using BTE put and/or get transactions.
`xtbte_ato`	Runs a number of applications individually or collectively as a suite to ensure that a system is ready for executing jobs after hardware or software upgrades or after power cycles.
`xtfma_ata`	Ensures that all logical endpoints go to all other end points using FMA put and/or get transactions.
`xtfma_ato`	Ensures that all logical endpoints target one end point using FMA Put and/or Get transactions. A round robin approach is used to step through each end point in the configuration.
`xtfma_amo`	Checks all AMO operations using an All-to-All algorithm. It tests AMOs with PUT (non-fetching) and GET (fetching) attributes.
`xtfbc`	Ensures that both the FMA and BTE logic blocks are tested. The test relies on the Generic Network Interface (GNI) API to directly communicate with the Cray network application-specific integrated circuit (ASIC).
`xtbte_perf`	Determines the one hop connections between nodes. It then performs BTE transfers over these one hop connections and determines the time taken to do so. The time duration is checked against an expected value for the link type. The actual data transferred is also verified.

3.3.6 Hardware Supervisory System (HSS) Environments

The HSS infrastructure environment is composed of a number of daemons, processes, and commands that help control and monitor physical system components.

HSS daemons supported on Urika-GX are listed in the following tables:

Table 7. ANCC HSS Daemons

Daemon	Description
Aries Network Card Controller (ANCC) System Daemon (`anccsysd`)	Controls power and state of the dual Aries Network Card (dANC) components, including Aries initialization and health monitoring.
ANCC Router Daemon (`anccrtrd`)	Handles requests from `rtr` on the System Management Workstation (SMW) to stage or install Aries Routes.
ANCC Bandwidth Throttle Daemon (`anccbwtd`)	Monitors High Speed Network (HSN) traffic and reports congestion indicators, assists in controlling congestion.

Daemon	Description
ANCC Network Daemon (`anccnwd`)	Monitors the Aries HSN link status, and reports soft and fatal errors.
ANCC PCIe Monitor Daemon (`anccpcimond`)	Monitors the Aries PCIe errors and status.
ANCC User-space Driver Daemon	Acts as the ANCC JTAG/MMR/Node Memory access driver.
ANCC Environment Monitor Daemon (`anccmond`)	Monitors various environmental sensors.
ERD File System Client (`erfsc`)	Acts as the `ERFS` dANC-level client.
Event Router Daemon (`erd`)	Performs HSS message routing
Controller Vitality Check Daemon (`cvcd`)	Monitors memory consumption, CPU utilization, file system usage, etc.

Table 8. Rack Controller HSS Daemon

Daemon	Description
Rack Controller System Daemon (`rcsysd`)	Monitors ANCC heartbeats, emits heartbeat for the State Manager, controls dANC power operations, and monitors the iSCB's health.
Controller Vitality Check Daemon (`cvcd`)	Monitors memory consumption, CPU utilization, file system usage, etc.
ERD File System Client (`erfsc`)	Acts as the `ERFS` RC-level client.
ERD File System Daemon (`erfsd`)	Facilitates the ERD file system
Event Router Daemon (`erd`)	Performs HSS message routing

Table 9. SMW HSS Daemons

Daemon	Description
State Manager (`state_manager`)	Performs HSS system hardware state management.
`ERD` File System daemon (`erfsd`)	Facilitates the ERD file system.
Event Router Daemon (`erd`)	Performs HSS message routing
NID Manager (`nid_mgr`)	Manages node IDs and NIC addresses for every node in the system.

NOTE: SMW HSS daemons are started and stopped via the `systemctl start hss` and `systemctl stop hss` commands respectively.

Additional Supporting HSS Daemons

The following supporting HSS daemons are started via the `systemctl start hss` command and log to `/var/opt/cray/log/p0-default` on the SMW.

Table 10. Supporting HSS Daemons

Daemon	Description
Network Link Resiliency Daemon (`xtnlrd`)	Assists in manual and automatic hardware swap-in/ swap-out.
Event Monitor (`xtconsumer`)	Monitors and logs a configurable set of HSS events.
HSN Error Monitor (`xtnetwatch`)	Monitors HSN hardware for errors and logs them.
PCIe Link Error Monitor (`xtpcimon`)	Monitors for PCIe errors on various devices.
Hardware Error Logger (`xthwerrlogd`)	Monitors HW error log messages sent by the ANCC and by nodes.
Node Console Logger (`xtconsole`)	Records node console output for every node in the system.

3.3.7 High Speed Network (HSN) Management

The Cray HSN is composed of a number of custom components developed by Cray that provide high-bandwidth, low-latency communication between all the compute processing elements of the system.

The HSN, which interconnects Aries chips, is configured by executing the `xtbounce` command to initialize the Aries and HSN links, followed by the `rtr` command to calculate Aries routes.

Aries chips are auto-initialized by the `anccsysd` daemon when the dANC powers on, or whenever `anccsysd` restarts.

3.3.8 Create Direct Connection between the System Management Workstation (SMW) and a Compute Node Console

The `xtcon` command is a console interface for system nodes. When it is executing, the `xtcon` command provides a two-way connection to the console of any running node.

Connect SMW to node `r0s0c1n0`

For this example, connect the SMW to the console of node `r0s0c1n0`:

```
smw:~> # xtcon r0s0c1n0
--- Console for component r0s0c1n0.  Use ^] to quit ---

CentOS release 6.5 (Final)
Kernel 2.6.32-431.el6_1.0000.8835-cray_ari_athena_c_cos on an x86_64

nid00008 login: root
Password:
```

```
Last login: Wed Sep 23 17:44:55 on ttyS0
[root@nid00008 ~]#
```

See the `xtcon(8)` man page for additional information.

3.3.9 Display and Change Hardware System Status

A system administrator can execute commands that look at and change the status of the hardware.

CAUTION: Execute commands that change the status of hardware only when the operating system is shut down.

3.3.10 Disable Hardware Components

If links, nodes, or Cray ASICs have hardware problems, the system administrator can direct the system to ignore the components with the `xtcli disable` command.

By default, when enabling a component, this command takes into consideration the hierarchy of components, performs the action upon the identified component(s), and cascades that action to any subcomponent of the identified component(s), unless the `-n` option is specified.

The `xtcli disable` command has the following form, where *`idlist`* is a comma-separated list of components (in cname format) that the system is to ignore. The system disregards these links or nodes.

```
xtcli disable [{-t type [-a] } | -n] [-f] idlist
```

IMPORTANT: The `-n` option with the `xtcli disable` command must be used carefully because this may create invalid system state configurations.

NOTE: The force option (`-f`) in some cases may cause issues with network resiliency operations.

Disabling of a rack, chassis, or dual Aries Network Card (dANC) will fail if any nodes under the component are in the `ready` state, unless the force option (`-f`) is used. An error message will indicate the reason for the failure. If the system is currently routed and the nodes are running, blades should not be disabled unless they are first removed from the high-speed network via the `xtwarmswap` with the `--remove` option. For this reason, the disabling will fail if any Aries LCBs are currently in the `on` state. The nodes must be shut down or halted prior to running `xtwarmswap` command with the `--remove` option.

For more information, see S-3018, "*Urika®-GX Network Resiliency Guide*".

Disabling of a node in the `ready` state will fail, unless the force option (`-f`) is used. An error message will indicate the reason for the failure.

The state of `empty` components will not change when using the `disable` command, unless the force option (`-f`) is used.

For detailed information about using the `xtcli disable` command, see the `xtcli(8)` man page.

3.3.11 Enable Hardware Components

If links, nodes, or Cray ASICs that have been disabled are later fixed, the system administrator can add them back to the system with the `xtcli enable` command.

The `xtcli enable` command has the following form, where *`idlist`* is a comma-separated list of components (in cname format) for the system to recognize.

```
xtcli enable [{-t type [-a] } | -n] [-f] idlist
```

> **IMPORTANT:** The `-n` option with the `xtcli disable` command must be used carefully because this may create invalid system state configurations.

The state of `empty` components does not change when using the `xtcli enable` command, unless the force option (`-f`) is used.

The state of `off` means that a component is present on the system. If the component is a dANC controller, node, or ASIC, then this will also mean that the component is powered off. If the administrator disables a component, the state shown becomes `disabled`. When the `xtcli enable` command is used to enable that component for use once again, its state switches from `disabled` to `off`. In the same manner, enabling an empty component means that its state switches from `empty` to `off`.

On a running/routed system, dANCs that were not enabled when the network was brought up should not be enabled with the `xtcli enable` command, as they will not be routed into the Aries High Speed Network (HSN). Instead they should be added to the HSN with the `--add` option of the `xtwarmswap` command. This will automatically enable the blade when it is successfully routed into the system.

For more information, see the `xtcli(8)` man page.

3.3.12 Set Hardware Components to `EMPTY`

Use the `xtcli set_empty` command to set a selected component to the `EMPTY` state. HSS managers and the `xtcli` command ignore empty or disabled components.

Setting a selected component to the `EMPTY` state is typically done when a component, usually a blade, is physically removed. By setting it to `EMPTY`, the system ignores it and routes around it.

Only blades that are not currently routed into the HSN (i.e. removed with the `xtwarmswap` command) should be set to empty while the system is running, and only if the plan is to then physically remove the dANC from the system, otherwise the `xtcli disable` command should be used.

> **IMPORTANT:** The `-n` option with the `xtcli disable` command must be used carefully because this may create invalid system state configurations.

For more information, see the `xtcli(8)` man page.

Set a dANC to the `EMPTY` state

```
crayadm@smw:~> xtcli set_empty -a r0s0c1n0
```

3.3.13 Stop Components Using the Hardware Supervisory System (HSS)

⚠ **WARNING:** Power down the rack(s) with software commands. Tripping the circuit breakers may result in damage to system components and to the file systems, and has an effect similar to that of abruptly powering-off any Unix system.

WARNING: Before powering down a Dual Aries Network Card (dANC) or a rack, ensure the operating system is not running on any nodes associated with dANCs.

The `xtcli power down` command powers down the specified rack and/or dANCs within the specified partition, chassis, or list of dANCs. Racks must be in the `READY` state to receive power commands. The `xtcli power down` command uses the following form, where *`physIDlist`* is a comma-separated list of racks or dANCs present on the system:

```
crayadm@smw:~> xtcli power down physIDlist
```

WARNING: Although a dANC is powered off, the Hardware Supervisory System (HSS) in the rack is alive and has power.

For information about powering down a component, see the `xtcli_power(8)` man page.

Power down a specified dANC

For this example, power down a dANC with the ID `r0s0c0`:

```
crayadm@smw:~> xtcli power down r0s0c0
```

3.3.14 Unlock Hardware Components

It may be required to unlock components when a daemon unexpectedly dies while holding a lock.

Use the HSS `xtcli lock` command to unlock components. This command is useful when a daemon unexpectedly dies while holding a lock.

The system administrator can manually check for locks with the `xtcli lock show` command and then unlock them. Unlocking a component does not print out the state manager session ID. The `-u` option must be used to unlock a component as follows:

```
crayadm@smw:~> xtcli lock -u lock_number
```

Where *`lock_number`* is the value given when initiating the lock; it is also indicated in the `xtcli lock show` query. Unlocking does nothing to the state of the component other than to release locks associated with it.

Unlock rack `r0`

```
crayadm@smw:~> xtcli -u r0
```

3.3.15 Capture and Analyze System-level and Node-level Dumps

The `xtdumpsys` command collects and analyzes information from a Cray system that is failing or has failed, has crashed, or is hung. Analysis is performed on, for example, event log data, active heartbeat probing, voltages, temperatures, health faults, in-memory console buffers, and high-speed interconnection network errors. When failed components are found, detailed information is gathered from them.

To collect similar information for components that have not failed, invoke the `xtdumpsys` command with the `--add` option and name the components from which to collect data. The HSS `xtdumpsys` command saves dump information in `/var/opt/cray/dump/`*`timestamp`* by default.

> **NOTE:** When using the `--add` option to add multiple components, separate components with spaces, not commas.

The following example shows usage of the `xtdumpsys` command:

```
crayadm@smw:~> xtdumpsys --add r0s2c1
```

The `xtdumpsys` command is written in Python and supports plug-ins written in Python. A number of plug-in scripts are included in the software release. Call `xtdumpsys --list` to view a list of included plug-ins and their respective directories. The `xtdumpsys` command also now supports the use of configuration files to specify `xtdumpsys` presets, rather than entering them via the command line.

For more information, see the `xtdumpsys(8)` man page.

3.3.16 Collect Debug Information From Hung Nodes Using the xtnmi Command

> **CAUTION:** This is not a harmless tool to use to repeatedly get information from a node at various times; only use this command when debugging data from nodes that are in trouble is needed. The `xtnmi` command output may be used to determine problems such as a core hang. `xtnmi` will stop a running node. It is best used when a node is not running correctly and debugging information is needed, or to stop a node that is running incorrectly.

The sole purpose of the `xtnmi` command is to collect debug information from unresponsive nodes. As soon as that debug information is displayed to the console, the node panics.

For additional information, see the `xtnmi(8)` man page.

An example of using the `xtnmi(8)` command is:

```
smw$ xtnmi r0s1c0n4,r0s0c1s2
The following ID(s) will be NMI'd: r0s1c0n4,r0s0c1s2.
All expected responses (1) were received.
```

3.3.17 Find Node Information

Translate Between Physical ID Names and Integer NIDs

To translate between physical ID names (rnames) and integer NIDs, generate a system map on the System Management Workstation (SMW) and filter the output, enter the following command:

```
crayadm@smw:~> rtr --system-map | grep rname | awk '{ print $1 }'
```

For more information, see the `rtr(8)` man page.

Find Node Information Using the `xtnid2str` Command

The `xtnid2str` command converts numeric node identification values to their physical names (cnames). This allows conversion of Node ID values, ASIC NIC address values, or ASIC ID values.

For additional information, see the `xtnid2str(8)` man page.

Find the physical ID for node 12

```
smw:~> xtnid2str 12
node id 0xc = 'r0s0c1n4'
```

Find the physical ID for nodes 0, 1, 2, and 3

```
smw:~> xtnid2str 0 1 2 3
node id 0x0 = 'r0s0c0n0'
node id 0x1 = 'r0s0c0n1'
node id 0x2 = 'r0s0c0n2'
node id 0x3 = 'r0s0c0n3'
```

Find Node Information Using the `nid2nic` Command

The `nid2nic` command prints the *`nid`*-to-*`nic`* address mappings, *`nic`*-to-*`nid`* address mappings, and a specific *`physical_location`*-to-*`nic`* address and *`nid`* mappings.

For information about using the `nid2nic` command, see the `nid2nic(8)` man page.

3.3.18 Request and Display System Routing

Use the HSS `rtr` command to request routing for the HSN, to verify current route configuration, or to display route information between nodes. Upon startup, `rtr` determines whether it is making a routing request or an information request.

For more information, see the `rtr(8)` man page.

Display routing information

The `--system-map` option to `rtr` writes the current routing information to `stdout` or to a specified file. This command can also be helpful for translating node IDs (NIDs) to physical ID names.

```
crayadm@smw:~> rtr --system-map
```

Route the entire system

The `rtr -R | --route-system` command sends a request to perform system routing. If no components are specified, the entire configuration is routed as a single routing domain based on the configuration information provided by the state manager. If a component list (*`idlist`*) is provided, routing is limited to the listed components. The state manager configuration further limits the routing domain to omit disabled blades, nodes, and links and empty blade slots.

```
crayadm@smw:~> rtr --route-system
```

CAUTION: The `rtr -R` command should not be executed if the system nodes have already been booted and are using the Aries network.

CAUTION: Be sure the Aries ASCIs have been initialized using the `xtbounce` command and that the HSN links have been initialized.

3.3.19 Initiate a Network Discovery Process

Use the HSS `rtr --discover` command to initiate a network discovery process.

```
crayadm@smw:~> rtr --discover
```

The discovery process must be done on the system as a whole—it cannot be applied to individual partitions. Therefore, discovery will immediately fail if the system does not have partition `p0` enabled.

The `rtr --discover` process should be used under the following circumstances:

- During an initial install, after successful execution of `xtdiscover`
- During the installation of additional cabinets in an existing installation, after the successful execution of `xtdiscover`
- During an upgrade of optical cabling in a system, after all recabling is complete

The `rtr --discover` process is NOT required under the following circumstances:

- On any single group system at any time, even those listed above
- During a warmswap operation

See the `rtr(8) man` page for additional information.

3.3.20 Power Up a Rack or Dual Aries Network Card (dANC)

IMPORTANT: Change the state of the hardware only when the operating system is not running or is shut down.

The `xtcli power up` command powers up the specified rack and/or dual Aries Network Card (dANC) within the specified partition, chassis, or list of dANCs. Racks must be in the `READY` state to receive power commands.

The `xtcli power up` command has the following form, where `physIDlist` is a comma-separated list of racks or dANCs present on the system.

```
xtcli power up physIDlist
```

For more information, see the `xtcli_power(8)` man page.

Power up dANC in `r1s2c0`

```
crayadm@smw:~> xtcli power up r1s2c0
```

3.3.21 Check the Status of System Components

Check the status of the system or a component with the `xtcli status` command on the System Management Workstation (SMW). By default, the `xtcli status` command returns the status of nodes.

The `xtcli status` command has the following form:

```
xtcli status [-n] [-m] [{-t type -a}] node_list
```

Where *type* may be: `cc`, `bc`, `cage`, `node`, `aries`, `aries_lcb`, `pdc`, or `qpdc`. The list must have component IDs only and contain no wild cards.

For more information, see the `xtcli(8)` man page.

```
crayadm@smw:~> xtcli status -t node r0s0c1n1
Network topology: class 0
Network type: Aries
           Nodeid: Service  Core Arch|  Comp state    [Flags]
------------------------------------------------------------------
         r0s0c1n1:       -       ATHE|       ready    [noflags|]
------------------------------------------------------------------
```

3.3.22 Check Compute Node High Speed Network (HSN) Connection

Use the Linux `ping` command to verify that a compute node is connected to the the HSN. The command must be run from a node, not the System Management Workstation (SMW).

For more information, see the Linux `ping(8)` man page.

Verify that a compute node is connected to the network

```
nid00007:~> ping nid00015
PING nid00015 (10.128.0.16) 56(84) bytes of data.
64 bytes from nid00015 (10.128.0.16): icmp_seq=1 ttl=64 time=0.032 ms
64 bytes from nid00015 (10.128.0.16): icmp_seq=2 ttl=64 time=0.010 ms
```

3.3.23 Monitor the Health of PCIe Channels

Processors are connected to the high-speed interconnect network (HSN) ASIC through PCIe channels.

The `xtpcimon` command runs on the SMW and is started when the system is initialized.

Any PCIe-related errors are reported to `stdout`, unless directed to a log file.

If the optional `/opt/cray/hss/default/etc/xtpcimon.ini` initialization file is present, the `xtpcimon` command uses the settings provided in the file.

3.3.24 Poll a Response from an HSS Daemon, Manager, or the Event Router

The xtalive command can be used to ensure that the HSS has connectivity to the ANCCs and that, by default, anccsysd is running and responding to events on the ANCCs.

For more information, see the xtalive(8) man page.

Check the state manager

```
crayadm@smw:~> xtalive -l smw -a sm s0
```

3.3.25 View Component Alert, Warning, and Location History

Use the xtcli comp_hist command to display component alert, warning, and location history. Either an error history, which displays alerts or warnings found on designated components, or a location history may be displayed.

Display the location history for component r1s0c1n2

```
crayadm@smw:~> xtcli comp_hist -o loc r1s0c1n2
```

For more information, see the xtcli(8) man page.

3.3.26 Display Alerts and Warnings

Use the xtshow command to display alerts and warnings.

Alerts are not propagated through the system hierarchy, only information for the component being examined is displayed. For example, invoking the xtshow --alert command for a cabinet does not display an alert for a node. Similarly, checking the status of a node does not detect an alert on a cabinet.

Show all alerts on the system

```
crayadm@smw:~> xtshow --alert
```

Alerts and warnings typically occur while the HSS xtcli command operates; these alerts and warnings are listed in the command output with an error message. After they are generated, alerts and warnings become part of the state for the component and remain set until manually cleared.

For additional information, see the xtshow(8) man page.

3.3.27 Display Error Codes

When an HSS event error occurs, the related message is displayed on the SMW. The xterrorcode command on the SMW displays a single error code or the entire list of error codes.

Display HSS error codes

```
crayadm@smw:~>  xterrorcode errorcode
```

A system error code entered in a log file is a bit mask; invoking the `xterrorcode` *`bitmask_code_number`* command on the SMW displays the associated error code.

Display an HSS error code using its bit mask number

```
crayadm@smw:~> xterrorcode 131279
Maximum error code (RS_NUM_ERR_CODE) is 447
code = 207, string = 'Node Voltage Fault'
```

3.3.28 Display Component State Information

Use the HSS `xtshow` command to identify the state of components. Commands are typed as xtshow --*`option_name`*.

Identify all nodes in the `disabled` state

```
crayadm@smw:~> xtshow --disabled
L1s that are disabled...
Cages that are disabled...
             r0s3:       -       ATHE|    disabled    [noflags|]
L0s that are disabled...
Nodes that are disabled...
Aries that are disabled...
AthenaISCBs that are disabled...
           r0s3i0:       -       ATHE|    disabled    [noflags|]
AriesLcbs that are disabled...
```

The --disabled option in the preceding example shows all the disabled hardware components. For more information, see the `xtshow(8)` man page.

3.3.29 Clear Component Flags

Use the `xtclear` command to clear system information for selected components. Type commands as `xtclear --option_name`, where *`option_name`* is `alert`, `reserve`, or `warn`.

Clear all warnings in specified cabinet

For this example, clear all warnings in cabinet `c13-2`:

```
smw:~> xtclear --warn r1
```

Alerts, reserves, and warnings must be cleared before a component can operate. Clearing an alert on a component frees its state.

For more information, see the `xtclear(8)` man page.

3.3.30 Flash Management on Urika-GX

HSS is responsible for flashing all devices in the Urika®-GX system via an out-of-band (OOB) mechanism. This can be achieved via the System Management Workstation (SMW) `rackfw` command, which is a flash tool. The SMW flash tool is used to flash firmware of the following components:

- Intelligent Subrack Control Board (iSCB) image
- Aries Network Card Controller (ANCC) image
- Dual Aries Network Card (dANC) FPGA

The `rackfw` command generates a summary output similar to the following on completion of an update or query.

Flash the dANC, iSCB image and ANCC image

```
crayadm@smw:~> rackfw
---ANCC STATUS---------------------
r0s0c0: OK
r0s0c1: OK
r0s1c0: MISMATCH
r0s1c1: OK


---ISCB STATUS---------------------
r0s0i0: OK       1.0rc4
r0s1i0: MISMATCH 1.0rc3


---SUMMARY-------------------------
   1 ANCCs out of date
   3 ANCCs current
   1 ISCBs out of date
   1 ISCBs current
```

For more information, see the `rackfw(8)` man page.

3.3.31 Create and Modify the `authorized_keys` File Using the `xtcc-ssh-keys` Command

The `xtcc-ssh-keys` command creates and modifies the `authorized_keys` file for Rack Controllers (RCs) and Dual Aries Network Card Controllers (dANCCs) on Urika-GX systems. Due to constraints on volatile memory storage, it does not update the `authorized_keys` file for the Intelligent Subrack Control Boards (iSCBs). It must be run as root.

The `xtcc-ssh-keys` command takes no options. When run, it invokes the user-selected text editor (specified by the VISUAL or EDITOR environment variables and defaulting to vi) on a file maintained by Cray HSS. This file has the format described in `sshd(8)` under the heading "`AUTHORIZED_KEYS FILE FORMAT`". Adding a public key to this file permits a user authenticating using the corresponding private key to connect to the RCs and dANCCs without using a password. Once the file has been written from within the editor, the changes will take effect on booted controllers within one minute.

For more information, see the `xtcc-ssh-keys(8)` man page.

3.3.32 Change the Passwords of RC, dANCCs and iSCB using the `xtccpasswd` Command

The `xtccpasswd` command changes the password for all Rack Controllers (RCs), Dual Aries Network Card Controllers (dANCCs), and Intelligent Subrack Control Boards (iSCBs) on Urika-GX systems. It must be run as root. This command allows an administrator to grant access to the SMW without granting access to the controller network nodes.

If `xtccpasswd` is run without options, it prompts for a new password (which will not be echoed to the screen) and then confirms it. If the two entered passwords match exactly, a salted hash of the password is written to a file maintained by Cray HSS. Within one minute, all booted controllers in the Urika-GX system will be using the new password.

For more information, see the `xtccpasswd (8)` man page.

3.3.33 Gather Troubleshooting Information Using the xtdumpsys Command

The `xtdumpsys` command collects and analyzes information from a Cray system that is failing or has failed, has crashed, or is hung. Analysis is performed on, for example, event log data, active heartbeat probing, voltages, temperatures, health faults, in-memory console buffers, and high-speed interconnection network errors. When failed components are found, detailed information is gathered from them. To collect similar information for components that have not failed, invoke the `xtdumpsys` command with the `--add` option and name the components from which to collect data.

NOTE: Only the `crayadm` account can execute the `xtdumpsys` command.

For more information, see the `xtdumpsys(8)` man page.

3.4 Dual Aries Network Card (dANC) Management

There are a number of components that are used to perform dANC management on Urika-GX.

dANC Power

By default, the dANCs power up when the rack is powered up. They can however be turned off and on via the `xtcli power` command.

⚠ **CAUTION:** Powering off a dANC on a booted and routed system will route out that card out of the Aries High Speed Network (HSN) and make all 8 nodes (served by that dANC card) unusable.

dANC uBoot

The Linux `U-boot` utility supports booting a Linux image on the ARM processor (located on the dANC controller) via net boot or flash boot.

There are 3 valid boot modes for the ANCC and iSCB, as listed below:

1. Boot from flash. This is the default mode.
2. Netboot and write image to flash . This mode is used for software upgrades

3. Netboot and do not write to flash. This is a development option.

The Urika®-GX rackfw tool enables recovery mode for dANC booting. It will also allow for initializing/setting the boot mode in NVRAM as follows:

- Set 1 of 3 ANCC boot modes listed above. If the nvRAM is uninitialized or corrupted, it is required to initialize the nvRAM.
- Set the default ANCC image location/path, or the iSCB image
- Reboot specified device (ANCC0, ANCC1, iSCB0 or iSCB1)

dANC Scrub Devices

The Urika-GX system supports scrubbing of non-volatile devices on the dANC. This includes the DANFPGA and dANC flash devices. The DANFPGA FPGA image and flash tool is included in the dANC ARM image and is flashed after the ARM has booted Linux.

dANC Monitoring

The dANC monitoring daemon, anccmond executes on the Dual Aries Network Card Controller (dANCC) and performs the following functions:

- Monitors Aries, AOC and board temperatures.
- Monitors the AOC and board power.
- Sends events to HSS ERD.
- Provides threshold warnings to iSCB via an I^{2}C bus.
- Sets up the temperature and voltages as a poll mechanism, so that the iSCB can poll for the data.

The HSS thresholds can be modified on the SMW using the HSS xtdaemonconfig command.

3.5 Analyze Node Memory Dump Using the kdump and crash Utilities on a Node

The kdump and crash utilities may be used to analyze the memory on any Urika®-GX compute node. The kdump command is used to dump node memory to a file. kdump is the Linux kernel's built-in crash dump mechanism. In the event of a kernel crash, kdump creates a memory image (also known as vmcore) that can be analyzed for the purposes of debugging and determining the cause of a crash. Dumped image of the main memory, exported as an Executable and Linkable Format (ELF) object, can be accessed either directly during the handling of a kernel crash (through /proc/vmcore), or it can be automatically saved to a locally accessible file system, to a raw device, or to a remote system accessible over the network. kdump is configured to automatically generate vmcore crash dumps on node crashes. These dumps can be found on the node in the crash partition, mounted to nid000*XX*:/mnt/crash/var/crash/*datestamp*/*, where *XX* ranges from 00-15 for a rack containing a single sub-rack, 00-31 for a rack containing 2 sub-racks, and 00-47 for a rack containing 3 sub-racks. After kdump completes, the crash utility can be used on the dump file generated by kdump. The xtdumpsys SMW utility can be used to extract vmcores from the cluster and store them on the SMW for crash analysis as well.

> **NOTE:** Cray recommends executing the kdump utility only if a node has panicked or is hung, or if a dump is requested by Cray.

On the Urika-GX compute nodes, kdump's system facing configuration files are set to have a kdump file stored on a local hard drive partition that is mounted as `/mnt/crash` so the kernel crash dumps are store in `/mnt/crash/var/crash`. Urika-GX has two local HDDs. `kdump` stores the `vmcore` collections on one of these drives. It is advised not to modify the `/etc/kdump.conf` or `/etc/sysconfig/kdump` configuration files.

Using `kdump`

- Starting `kdump` - Log on to the desired node and use the following command to start the `kdump` utility:

```
$ service kdump start
```

- Stopping `kdump` - Log on to the desired node and use the following command to stop the `kdump` utility:

```
$ service kdump stop
```

- Checking the status of `kdump` - Log on to the desired node and use the following command to check the status of the `kdump` utility:

```
$ service kdump status
```

For more information, see the `kdump(8)` and `crash(8)` man pages.

3.6 Cray Lightweight Log Management (LLM) System

The Cray Lightweight Log Management (LLM) system is the log infrastructure for Cray systems and must be enabled for systems to successfully log events. At a high level, a library is used to deliver messages to `rsyslog` utilizing the RFC 5424 protocol; `rsyslog` transports those messages to the SMW and places the messages into log files.

By default, LLM has a log trimming mechanism enabled called `xttrim`.

3.7 About CSMS

CSMS is a common systems management infrastructure that is based on OpenStack and is designed to support the diverse Cray product ecosystem and a wide variety of Cray hardware platforms. OpenStack is leveraged within CSMS to manage various components of the Cray system and to provide a common interface for system management.

3.7.1 Use OpenStack CLI Clients

OpenStack CLI clients require certain environment variables to be set in order to communicate with OpenStack services. Before using the OpenStack CLI commands, the `/root/admin.openrc` file must be sourced. If desired, this file can be copied/modified to another user’s home directory in order to use the CLI as a non-root user.

Use the following command to source the `admin.openrc` file and enter the OpenStack admin password when prompted for the OpenStack password:

```
smw1# source ~/admin.openrc
Enter OpenStack Password:
```

Following is an example of using the `list` command of the OpenStack Nova service:

```
smw1# nova list
```

Execute the following command to display a list of all CLI commands for a given OpenStack service, replacing *`service`* with the actual name of the OpenStack service:

```
smw1# service help
```

Execute the following command to retrieve usage information and options of a specific command, replacing *`service`* with the actual name of the OpenStack service:

```
smw1# service help command
```

3.7.2 OpenStack Nova Instance States

- **Nova Power State -** The power state of the physical node. The power state can have one of the following values at a given time:
  - `NO STATE`
  - `RUNNING`
  - `BLOCKED`
  - `PAUSED`
  - `SHUTDOWN`
  - `SHUTOFF`
  - `CRASHED`
  - `SUSPENDED`
  - `FAILED`
  - `BUILDING`

  The state of an instance may be displayed as `NO STATE` if it is currently transitioning to another state.
- **Nova Status -** The current status of the instance. This status is affected by the action/task performed on the instance via CLI commands or by the drop down in the **Actions** column of the UI. Nova status can have one of the following values at a given time:
  - `Deleted`
  - `Active`
  - `Shutoff`
  - `Paused`
  - `Error`
  - `SUSPENDED`
  - `resize`
  - `verify_resize`
  - `revert_resize`

  - `reboot`
  - `hard_reboot`
  - `password`
  - `rebuild`
  - `migrating`
  - `build`
  - `rescue`
  - `soft_deleted`
  - `shelved`
  - `shelved_offloaded`

    NOTE: If the instance is in the `Error` state, check the logs under `/var/log/nova` to see the underlying cause of the issue.

- **Capmc Status -** The status of the instance as returned by the HSS `capmc` command and can have one of the follow values at a given time:
  - `on`
  - `off`
  - `ready`
  - `error`
  - `halt`
  - `standby`
  - `disabled`
  - `enabled`
  - `na`
  - `empty`
  - `diag`

  NOTE: If the `capmc` status is not in the '`ready`' state, it is recommended to check the logs located at `var/opt/cray/log/` to identify the issue.

3.7.3 Using Cray System Management Software (CSMS) on Urika-GX

Urika®-GX uses CSMS for:

- **Bare metal provisioning** - Urika-GX uses the OpenStack Ironic and Heat services for provisioning bare metal nodes.
- **Image management** - Urika-GX uses the OpenStack Glance service for image management.
- **Power management**- The Urika-GX system is powered up and powered down using the OpenStack Nova service.

3.7.4 Urika-GX Node Power Management

Hardware inventory information of all nodes known to the Hardware Supervisory System (HSS) is imported into OpenStack. This includes physical characteristics of the nodes, CPU count, memory, HDD size, and the Ethernet MAC address. When the OpenStacks Nova service wishes to power on/off a node, it communicates with the OpenStack Ironic service, which in turn talks to the HSS Ironic power driver. This driver then sends the power request to the dANC associated with the node via the HSS `capmc` interface and the node is powered on or off depending on the request.

Before executing the `ux-nid-power-on` or `ux-nid-power-off` commands, or any OpenStack commands, the `admin.openrc` file needs to be sourced. Use the following command to source the `admin.openrc` file and enter `initial0` when prompted for the OpenStack password:

```
# cd /root
# source admin.openrc
Enter OpenStack Password:
```

Start Up a Single Node

Use the **`ux-nid-power-on`** command to start up a node. For example, use the following command to start up node 47:

```
$ ux-nid-power-on 47
```

Start Up All Nodes

Use the `ux-nid-power-on` script (located in the `/etc/opt/cray/openstack/ansible/heat_templates/node_specific` directory on the System Management Workstation (SMW)) to start up all the nodes at once. For more information, see the `ux-nid-power-on` man page

```
$ ux-nid-power-on
```

Stop a Single Node

Ensure that the analytics services are stopped on the node and Lustre is unmounted. Use the **`ux-nid-power-off`** command to stop a running node. For example, use the following command to stop node 47:

```
$ ux-nid-power-off 47
```

Stop All Nodes

Ensure that the analytics services are stopped on the node and Lustre is unmounted. Use the `ux-nid-power-off` script (located in the `/etc/opt/cray/openstack/ansible/heat_templates/node_specific` directory on the System Management Workstation (SMW) to stop all the nodes at once.

```
$ ux-nid-power-off
```

For more information, see the `ux-nid-power-off` man page.

Check the Status of Nodes

NOTE: The following sample output is displayed only as examples. Actual output may vary.

- Use the `ironic node-list` command to display the power and provisioning state of all the nodes.

```
# ironic node-list
+--------------------------------------+------+--------------------------------------+-------------+--------------------+-------------
+
| UUID                                 | Name | Instance UUID                        | Power State | Provisioning State | Maintenance
|
+--------------------------------------+------+--------------------------------------+-------------+--------------------+-------------
+
| 70868582-2311-495c-bf25-5462fedfc950 | None | None                                 | None        | available          | True
|
| d1608dc3-a1be-44e5-9188-f2b7f85ee1ae | None | 3481e1ff-4e02-49af-a519-caea25693050 | power on    | active             | True
|
| 5991b0e0-f455-43b1-8a5b-e6bf96e30f0c | None | d3976572-9333-41dd-940b-5a8e45b3820c | power on    | active             | True
|
| 66c1aaaa-61b0-41b3-8086-0d0f8d2324db | None | 4523b2f4-de23-4c0f-b8fa-8b15fd428924 | power on    | active             | True
|
| 6a2bdf02-3ece-42e7-abd6-563a1e893e4c | None | f36d04bd-27a2-4031-b532-e08bbca5cd45 | power on    | active             | True
|
| 73513e27-0b58-4bbb-b9dc-07522423344c | None | d5a4cd0d-833a-40cb-a644-8d52638c4932 | power on    | active             | True
|
| c508906a-c04b-4be9-9311-8f51ff195b09 | None | 07898af6-33fd-4b8c-9b03-f44127c41744 | power on    | active             | True
|
| 77a1a28a-f00d-452d-8ed7-d653085e5c93 | None | 802b4d2a-709b-4cb0-9c3b-d44ba3d90a54 | power on    | active             | True
|
| 43569f54-f7d9-47eb-a474-64a3416b9a3b | None | 3eadda4c-9cc2-431d-9f94-2d507f962857 | power on    | active             | True
|
| 470627c5-18c1-430a-8cbf-8eb1fcbba71c | None | 8dc55fac-41df-4c14-983e-91e0f8b7c0d9 | power on    | active             | True
|
| 89acd3f0-0602-4bf3-8ce3-da0e45299ec4 | None | a675116a-5bb3-4d0b-aff7-93fe3e957ea1 | power on    | active             | True
|
| c1c7ca13-3be0-4797-a044-60bf94bb99a2 | None | 16300660-9f57-4ddf-866e-7b6f23eb9a23 | power on    | active             | True
|
| 55468756-85fc-4694-8d34-b688ab2d6ba1 | None | b90c0ffc-9645-4da5-b513-b413dfd6fcb6 | power on    | active             | True
|
| a8f126c6-e726-4f98-8d24-fa1d78072e6c | None | 8d5b14fc-6f79-49d1-ba01-878349b3108f | power on    | active             | True
|
| 60b3dd24-e493-49bb-b6ba-d14170388817 | None | e493bc76-30c4-4236-91d9-c02d7db2de3e | power on    | active             | True
|
| 2ffcef51-0f77-455e-b1ee-a9ce00a39fc3 | None | 5880a8c0-38eb-4a95-883e-99f042c07a1f | power on    | active             | True
|
| 4b01c600-c64a-437d-85a4-d15ef92b617e | None | 94f5dc1f-a417-441d-a8d7-34d5f3011051 | power on    | active             | True
|
| c87f6908-8d61-4a82-b523-764b43b0036e | None | f9085f90-ff90-4ff1-a997-854f1f9a6e8b | power on    | active             | True
|
| ea22832b-b538-4407-8e8d-eda71b8f3f4a | None | 521f0aa9-0d5f-4a64-9aee-f722c3a53ed1 | power on    | active             | True
|
| 6eb8535b-8d85-433d-a7be-2698b54b186f | None | 5ef4e335-ed9d-4b60-9838-b2b7e2ecf5c4 | power on    | active             | True
|
| 2a12d048-bbbb-440e-a7db-0dbfad2168e1 | None | 70b83657-065e-435d-adfd-8fd943ed6e47 | power on    | active             | True
|
| f25622af-e6b1-4656-8d3e-93fe0346ff48 | None | efe39d28-768b-42f6-bcd6-6067c868da06 | power on    | active             | True
|
| 210be1e2-7248-4122-ae80-fc814e416aff | None | 04ebbfaf-1d35-4337-98ec-c34ee4439b98 | power on    | active             | True
|
| 0c1dac8a-056e-4410-99af-fa9c72d05c37 | None | None                                 | None        | available          | True
|
| 3681006b-6a54-4f07-a054-65db7e6aca2e | None | a107dffd-5eec-4a76-9593-9ccb8a50070b | power on    | active             | True
|
| 7ea65677-9313-4c65-80ba-b330a2129a1f | None | ac258d7d-d460-4307-af5b-86d243b61fac | power on    | active             | True
|
| 31812302-560a-45a9-b11d-fc322afdc660 | None | 37569489-6459-4688-9cbb-be8013415b48 | power on    | active             | True
|
| e372194c-bb73-43d5-8e7d-5bbfda8c6124 | None | c84a9ad4-dae2-4175-b235-4fff722d6ba3 | power on    | active             | True
|
| 98e89942-95bd-4657-829c-a3a2649067df | None | caf492dd-0511-4922-8414-07f3875d43eb | power on    | active             | True
|
| 527c654f-0ad3-472a-bf87-4a270bb0fed5 | None | 3ed3d2dc-75cc-4b26-8d1b-6e3376aeb6b9 | power on    | active             | True
|
| f2f057f6-f83b-4968-8927-a670becc51c5 | None | 7cc4df19-d710-4ea3-a2e9-aeab05a818eb | power on    | active             | True
|
| 5e0836b9-b1ed-4445-a4a4-c432902c5169 | None | 03edaf69-7c1c-413d-b517-c374e9e6dc0b | power on    | active             | True
|
| 0dabb6db-0e64-4d84-9418-43d2ea1f0d03 | None | 7bf333ee-8568-4547-9ab1-81f3922edaff | power on    | active             | True
|
| 6507cb53-d805-495b-86fb-2984eaf8f64f | None | c6db1a6e-bf1e-4898-8136-aeef02267912 | power on    | active             | True
|
| eacf56bf-aa21-4710-b2ed-4f832720b07c | None | 25952061-cd6c-4489-b3cd-607069b3e282 | power on    | active             | True
|
| e9b631e8-a2c1-437d-8c8a-20287958c1dc | None | 994e1665-703e-478c-a274-9eb562603f89 | power on    | active             | True
|
| d7430d45-1455-4529-8e76-a4a8231876c0 | None | 40b1ae06-dd48-4b5f-9337-a14757586663 | power on    | active             | True
|
| 7cded718-6d3e-4129-be28-e430b2d6f32b | None | 9f5e21ff-e635-4bc0-a5c5-c5c611577fc7 | power on    | active             | True
|
| 728d8566-2ea0-470d-a7de-0239e92e5e32 | None | 4a36a9c3-46b9-4b7e-95e1-9efd283d8f2d | power on    | active             | True
|
| b36f42e4-5e76-4446-bf15-2e747488b0ee | None | None                                 | None        | available          | True
|
| 46e5f4fd-2201-4057-b49b-53705fba9cab | None | a13d90dc-d5b1-467a-b01a-488d9d37ccff | power on    | active             | True
|
| 7300abc9-f8f2-495e-886a-0dde18baebae | None | 0b70da40-6d10-4bfa-9ca1-aa5f9a581377 | power on    | active             | True
|
| d8fa6fd3-6f67-4a28-915e-e9fc52895d1b | None | None                                 | power off   | available          | True
|
| 9836adbd-4056-43ca-a7d8-87f3c7bad5ec | None | None                                 | power off   | available          | True
|
| e2e20b25-cd16-48d4-92f4-21a2e9415f38 | None | None                                 | power off   | available          | True
|
| 564bffd8-98c6-4453-a90f-f41f43b79389 | None | None                                 | power off   | available          | True
|
| 29166474-3971-47f8-91fb-570ba7843a0d | None | None                                 | power off   | available          | True
|
| 016a6705-b58b-418b-8042-0b436baa67e5 | None | 67afc079-4444-4dbc-bf38-e7b7603c7b5c | power on    | active             | True
|
+--------------------------------------+------+--------------------------------------+-------------+--------------------+------------
+
```

As it can be seen, the provisioning state of the instance can also be viewed via the `ironic node-list` command.

- The `nova list` command can also be used to check the status of all the deployed instances.

```
# nova list
+--------------------------------------+----------+--------+------------+-------------+-------------------------+
| ID                                   | Name     | Status | Task State | Power State | Networks                |
+--------------------------------------+----------+--------+------------+-------------+-------------------------+
| 3481e1ff-4e02-49af-a519-caea25693050 | nid00001 | ACTIVE | -          | Running     | management=10.142.0.101 |
| d3976572-9333-41dd-940b-5a8e45b3820c | nid00002 | ACTIVE | -          | Running     | management=10.142.0.102 |
| 4523b2f4-de23-4c0f-b8fa-8b15fd428924 | nid00003 | ACTIVE | -          | Running     | management=10.142.0.103 |
| f36d04bd-27a2-4031-b532-e08bbca5cd45 | nid00004 | ACTIVE | -          | Running     | management=10.142.0.104 |
| d5a4cd0d-833a-40cb-a644-8d52638c4932 | nid00005 | ACTIVE | -          | Running     | management=10.142.0.105 |
| 07898af6-33fd-4b8c-9b03-f44127c41744 | nid00006 | ACTIVE | -          | Running     | management=10.142.0.106 |
| 802b4d2a-709b-4cb0-9c3b-d44ba3d90a54 | nid00007 | ACTIVE | -          | Running     | management=10.142.0.107 |
| 3eadda4c-9cc2-431d-9f94-2d507f962857 | nid00008 | ACTIVE | -          | Running     | management=10.142.0.108 |
| 8dc55fac-41df-4c14-983e-91e0f8b7c0d9 | nid00009 | ACTIVE | -          | Running     | management=10.142.0.109 |
| a675116a-5bb3-4d0b-aff7-93fe3e957ea1 | nid00010 | ACTIVE | -          | Running     | management=10.142.0.110 |
| 16300660-9f57-4ddf-866e-7b6f23eb9a23 | nid00011 | ACTIVE | -          | Running     | management=10.142.0.111 |
| b90c0ffc-9645-4da5-b513-b413dfd6fcb6 | nid00012 | ACTIVE | -          | Running     | management=10.142.0.112 |
| 8d5b14fc-6f79-49d1-ba01-878349b3108f | nid00013 | ACTIVE | -          | Running     | management=10.142.0.113 |
| e493bc76-30c4-4236-91d9-c02d7db2de3e | nid00014 | ACTIVE | -          | Running     | management=10.142.0.114 |
| 5880a8c0-38eb-4a95-883e-99f042c07a1f | nid00015 | ACTIVE | -          | Running     | management=10.142.0.115 |
| 94f5dc1f-a417-441d-a8d7-34d5f3011051 | nid00016 | ACTIVE | -          | Running     | management=10.142.0.116 |
| f9085f90-ff90-4ff1-a997-854f1f9a6e8b | nid00017 | ACTIVE | -          | Running     | management=10.142.0.117 |
| 521f0aa9-0d5f-4a64-9aee-f722c3a53ed1 | nid00018 | ACTIVE | -          | Running     | management=10.142.0.118 |
| 5ef4e335-ed9d-4b60-9838-b2b7e2ecf5c4 | nid00019 | ACTIVE | -          | Running     | management=10.142.0.119 |
| 70b83657-065e-435d-adfd-8fd943ed6e47 | nid00020 | ACTIVE | -          | Running     | management=10.142.0.120 |
| efe39d28-768b-42f6-bcd6-6067c868da06 | nid00021 | ACTIVE | -          | Running     | management=10.142.0.121 |
| 04ebbfaf-1d35-4337-98ec-c34ee4439b98 | nid00022 | ACTIVE | -          | Running     | management=10.142.0.122 |
| 2cb72b54-c64d-42bc-a0bd-4c82d81bf31e | nid00023 | ERROR  | spawning   | NOSTATE     |                         |
| a107dffd-5eec-4a76-9593-9ccb8a50070b | nid00024 | ACTIVE | -          | Running     | management=10.142.0.124 |
| ac258d7d-d460-4307-af5b-86d243b61fac | nid00025 | ACTIVE | -          | Running     | management=10.142.0.125 |
| 37569489-6459-4688-9cbb-be8013415b48 | nid00026 | ACTIVE | -          | Running     | management=10.142.0.126 |
| c84a9ad4-dae2-4175-b235-4fff722d6ba3 | nid00027 | ACTIVE | -          | Running     | management=10.142.0.127 |
| caf492dd-0511-4922-8414-07f3875d43eb | nid00028 | ACTIVE | -          | Running     | management=10.142.0.128 |
| 3ed3d2dc-75cc-4b26-8d1b-6e3376aeb6b9 | nid00029 | ACTIVE | -          | Running     | management=10.142.0.129 |
| 7cc4df19-d710-4ea3-a2e9-aeab05a818eb | nid00030 | ACTIVE | -          | Running     | management=10.142.0.130 |
| 03edaf69-7c1c-413d-b517-c374e9e6dc0b | nid00031 | ACTIVE | -          | Running     | management=10.142.0.131 |
| 7bf333ee-8568-4547-9ab1-81f3922edaff | nid00032 | ACTIVE | -          | Running     | management=10.142.0.132 |
| c6db1a6e-bf1e-4898-8136-aeef02267912 | nid00033 | ACTIVE | -          | Running     | management=10.142.0.133 |
| 25952061-cd6c-4489-b3cd-607069b3e282 | nid00034 | ACTIVE | -          | Running     | management=10.142.0.134 |
| 994e1665-703e-478c-a274-9eb562603f89 | nid00035 | ACTIVE | -          | Running     | management=10.142.0.135 |
| 40b1ae06-dd48-4b5f-9337-a14757586663 | nid00036 | ACTIVE | -          | Running     | management=10.142.0.136 |
| 9f5e21ff-e635-4bc0-a5c5-c5c611577fc7 | nid00037 | ACTIVE | -          | Running     | management=10.142.0.137 |
| 4a36a9c3-46b9-4b7e-95e1-9efd283d8f2d | nid00038 | ACTIVE | -          | Running     | management=10.142.0.138 |
| a13d90dc-d5b1-467a-b01a-488d9d37ccff | nid00040 | ACTIVE | -          | Running     | management=10.142.0.140 |
| 0b70da40-6d10-4bfa-9ca1-aa5f9a581377 | nid00041 | ACTIVE | -          | Running     | management=10.142.0.141 |
| 67afc079-4444-4dbc-bf38-e7b7603c7b5c | nid00047 | ACTIVE | -          | Running     | management=10.142.0.147 |
+--------------------------------------+----------+--------+------------+-------------+------------------------
```

3.8 Overview of Urika-GX System Management UI

The Urika®-GX system management interface enables performing a number of monitoring and management tasks, including, but not limited to:

- Managing nodes/instances
- Viewing information about nodes/instances
- Changing user settings
- Changing passwords
- Monitor and manage services

The Urika-GX system management interface currently supports the role of an admin only. To log on to this interface, point a browser at the **Urika-GX Applications Interface** UI, which can be accessed at `http://`*`machine`* and then select the **Cray System Management** icon. Though this is the recommended way of access (because it displays the Urika-GX Applications Interface banner, containing links for additional resources), the **Cray System Management** UI can also be accessed at `https://`*`machine`*`-smw/dashboard`.

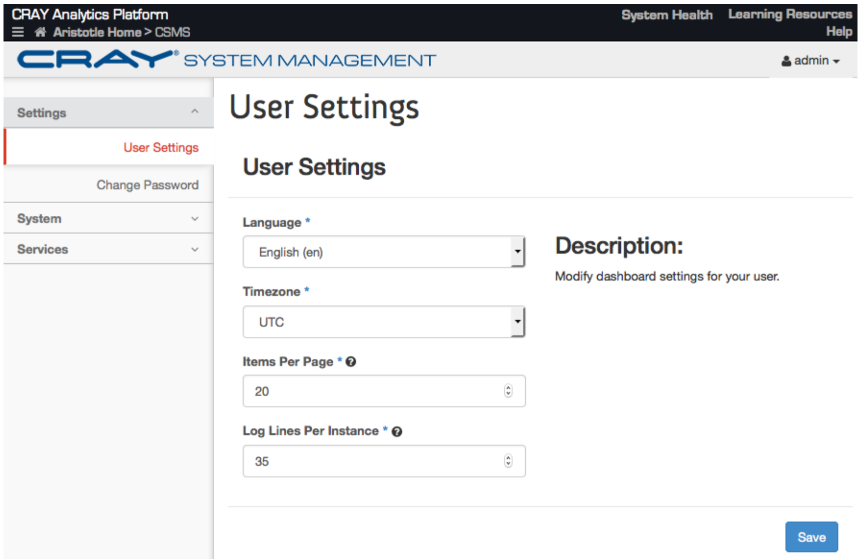
⚠ **CAUTION:** When accessing the **Cray System Management** UI for the first time, users should direct their browser at `https://machine-smw/dashboard` instead of accessing via the **Urika-GX Applications Interface** UI, otherwise the system will return an error because the CSMS SSL is configured with a self-signed certificate. In addition, when the user directs their browser at the **Cray System Management** UI for the first time, they will need to add an exception to the certificate/accept the browser exception in order to access the Cray System Management UI. This needs to be done only once. After adding an exception to the certificate, users can access **Cray System Management** UI from the **Urika-GX Applications Interface** UI also.

Accessing via the **Urika-GX Applications Interface** UI displays The default username for logging in is `admin` and the default password is `initial0`. After logging in, the **admin** menu located at the top right of the interface can be used to change passwords and UI settings.

The Urika-GX system management interface contains the following navigational links, which are located on the left side of the screen:

- **Settings** - The **Settings** tab enables managing users and credentials. This menu contains the following menu items:
  - **User Settings** - Enables users to change the management system UI settings/preferences, as shown in the following figure:

    Figure 4. Urika-GX System Management User Settings Interface

    User Settings

    User Settings

    Language *: English (en)

    Timezone *: UTC

    Items Per Page *: 20

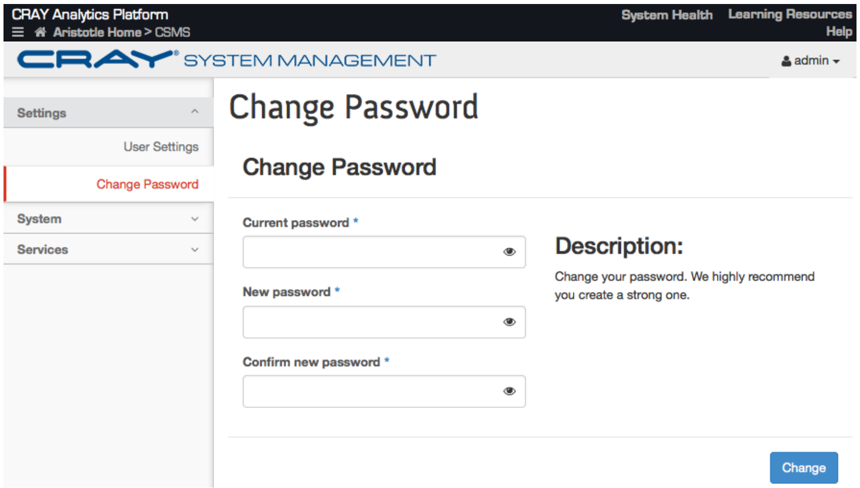
    Log Lines Per Instance *: 35

    Description:

    Modify dashboard settings for your user.

    Changing the number of items displayed per page and changing the language on the UI via the Language drop down is not supported.
  - **Change Password** - Enables users to change their password, as shown in the following figure:

Figure 5. Urika-GX System Management Change Password Interface



Description:

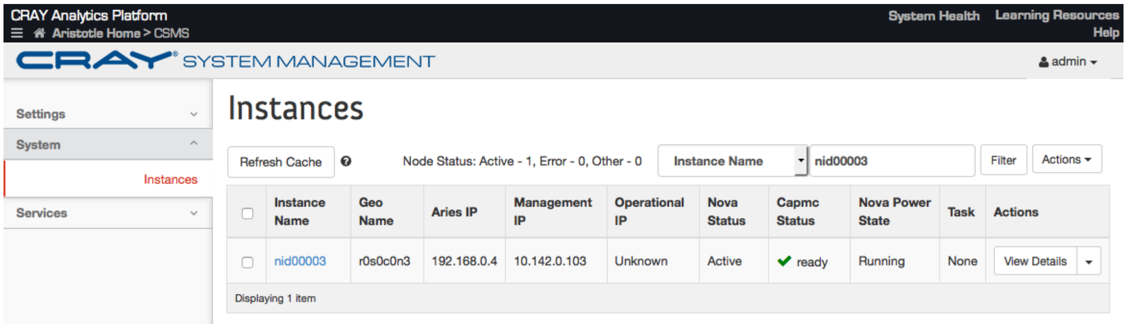
Change your password. We highly recommend you create a strong one.

- **System** - This is the landing page of the UI and contains **Instances** as a menu item.

  Selecting **System** > **Instances** presents the **Instances** interface.

  The **Instances** interface also displays a table containing information about the nodes/instances in the system, as shown in the following figure:

  Figure 6. Urika-GX System Management Instances Interface



Node Status: Active - 1, Error - 0, Other - 0

nid00003

☐	Instance Name	Geo Name	Aries IP	Management IP	Operational IP	Nova Status	Capmc Status	Nova Power State	Task	Actions
☐	nid00003	r0s0c0n3	192.168.0.4	10.142.0.103	Unknown	Active	✓ ready	Running	None	View Details

Displaying 1 item

  This table contains the following fields:

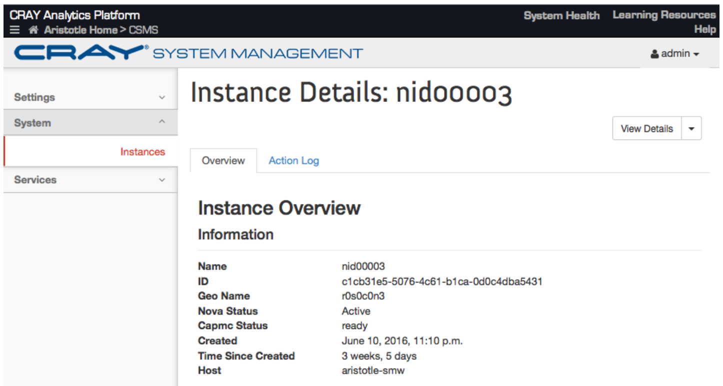
  - **Instance Name** - Displays the node/instance name in the format: `nid000N`, where *N* ranges from `[00-15]` for a rack containing one sub-rack, `[16-31]` for a rack containing 2 sub-racks, and `[32-47]` for a rack containing 3 sub-racks.
  - **Geo Name** - Refers to the physical component name of the node/instance.
  - **Aries IP** - Refers to the instance's IP address within the Aries High Speed Network (HSN), which provides high speed application and data network connectivity between nodes.
  - **Management IP** - Refers to the instance's IP address within the management network, which is used for system management.
  - **Operational IP** - Refers to the instance's IP address within the operational network, which is used for executing applications.
  - **Nova Status** - Displays the instance/node's status, as retrieved by the OpenStack Nova instance provisioning service.

- **Capmc Status** - Displays the instance/node's status, as retrieved by the Cray `capmc` monitoring utility. For more information, see the `capmc(1)` man page. Refer to the logs or contact the administrator if the power status is `unknown`, `on` or `off`.
- **Nova Power Status** - Displays the instance/node's power state, as retrieved by the OpenStack Nova instance provisioning service.
- **Task** - Displays the action currently being performed on the node. For example, if the **Reboot** button is selected, this column will display **Rebooting** until the node has booted.
- **Actions** - Displays the **View Details** drop down containing the following options:
  - **Soft Reboot Instance** - Gracefully shuts down the operating system and then restarts the instance.
  - **Hard Reboot Instance** - Abruptly removes power from the node and then reboots the instance.
  - **Shut Off Instance** - Shuts down the instance.
  - **Start Instances** - Starts the selected instance.

  If it is required to perform these actions on more than on node, select the nodes using the provided check boxes and use the **Actions** drop down located at the top right of the to select the appropriate action.

The values of the **Aries IP** and **Operational IP** fields are cached in the system. The **Refresh Cache** button can be used to refresh these values and display them on the UI. If the IP addresses of the Aries or Operations networks are manually changed, then an administrator would need to select the **Refresh Cache** button as doing so would update the **Instances** table. The cache may take a few seconds to refresh. Select an instance name from the **Instance Name** column or select the **View Details** button to display a UI containing tabs for displaying additional details about the instance and for viewing information about the list of actions performed on the instance.

Figure 7. Urika-GX System Management Instance Details Interface



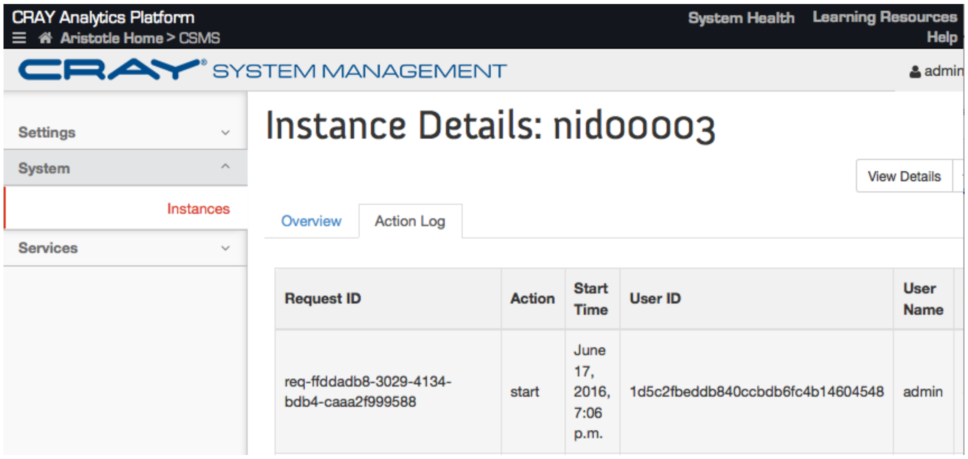
Instance Details: nid00003

Instance Overview

Information

Name	nid00003
ID	c1cb31e5-5076-4c61-b1ca-0d0c4dba5431
Geo Name	r0s0c0n3
Nova Status	Active
Capmc Status	ready
Created	June 10, 2016, 11:10 p.m.
Time Since Created	3 weeks, 5 days
Host	aristotle-smw

Figure 8. Urika-GX System Management Action Log Interface



Request ID	Action	Start Time	User ID	User Name
req-ffddadb8-3029-4134-bdb4-caaa2f999588	start	June 17, 2016, 7:06 p.m.	1d5c2fbeddb840ccbdb6fc4b14604548	admin

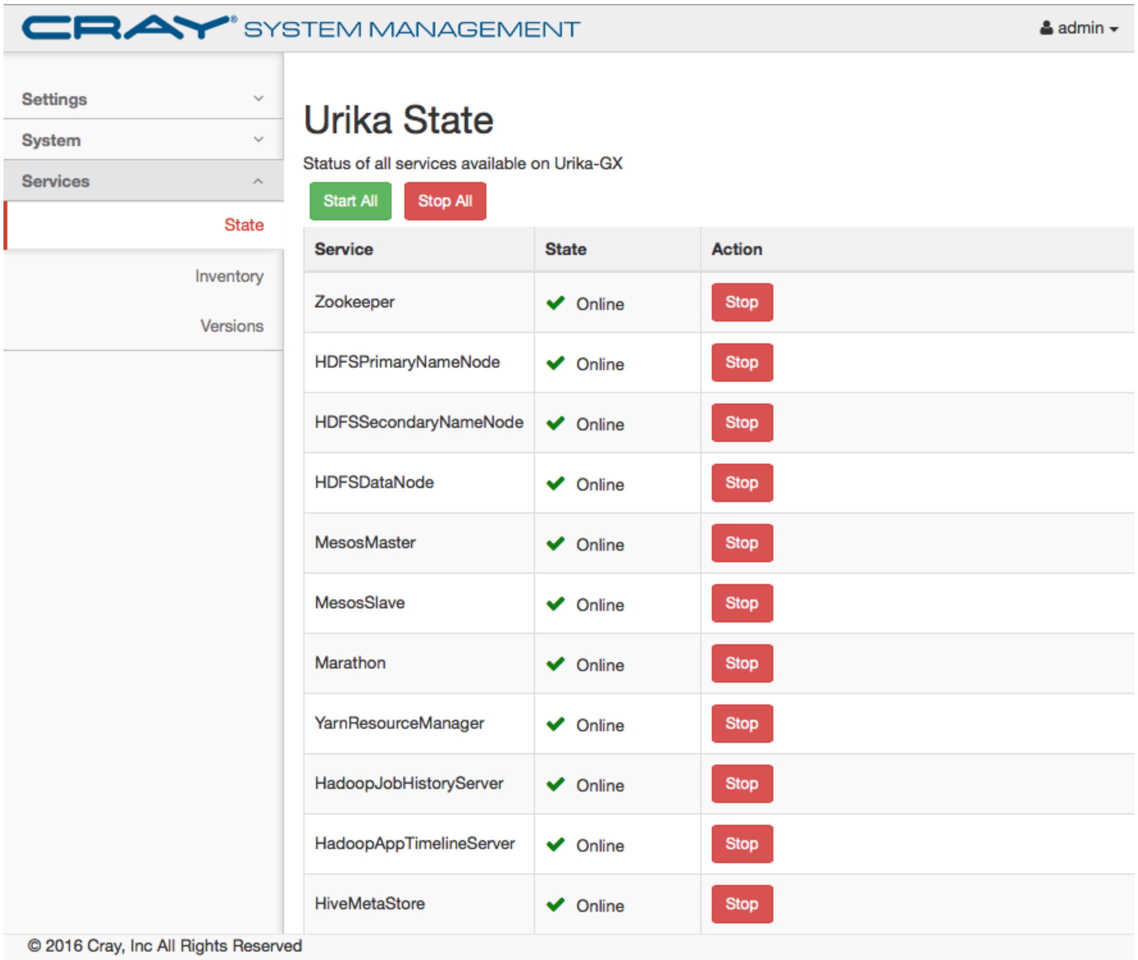
Click on a column heading to sort instances. Use the **Filter** field located at the top right of the **Instances** interface to filter instance as needed.

- **Services** - The **Services** menu enables managing Urika-GX services and contains the following sub-menu items:
  - **State** - Enables starting, stopping and monitoring the state of services. An `online` state indicates that the service is up and running, whereas an `offline` state indicates the service is down.

    ⚠ **CAUTION:** Before starting the Spark History server from the **Urika State** interface of the **Cray System Management** UI or via the `urika-start` command, it is required to start the following services in the order listed:

    1. HDFS NameNode
    2. HDFS DataNode

Figure 9. Urika-GX System Management Urika State Interface



Urika State

Status of all services available on Urika-GX

Service	State	Action
Zookeeper	✓ Online	Stop
HDFSPrimaryNameNode	✓ Online	Stop
HDFSSecondaryNameNode	✓ Online	Stop
HDFSDataNode	✓ Online	Stop
MesosMaster	✓ Online	Stop
MesosSlave	✓ Online	Stop
Marathon	✓ Online	Stop
YarnResourceManager	✓ Online	Stop
HadoopJobHistoryServer	✓ Online	Stop
HadoopAppTimelineServer	✓ Online	Stop
HiveMetaStore	✓ Online	Stop

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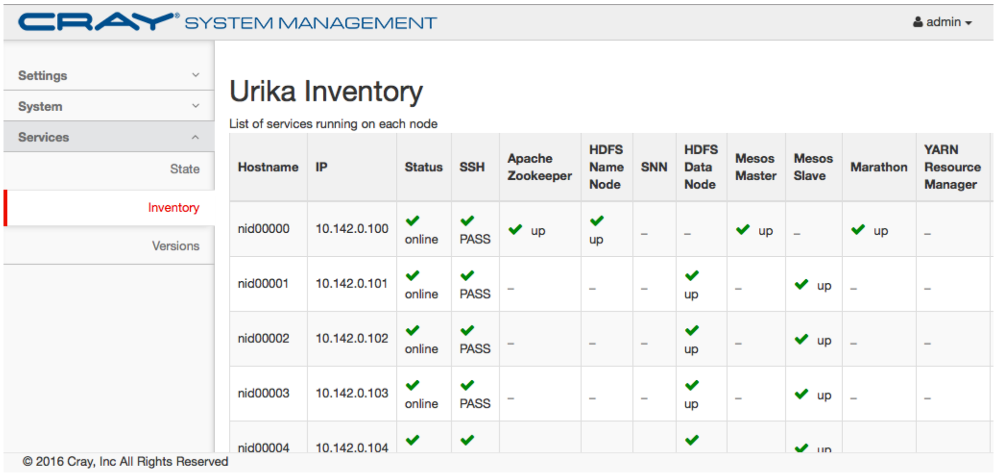
Hover over the service name to view a short description of the service. Refer to the `urika-state` man page for more information.

○ **Inventory -** Displays the list and status of services running on each node. Hover over the column heading to view a short description of the analytic service under consideration.

A green check mark in the services columns indicates that a service is installed on the node under consideration, whereas a red cross indicates that the service is down.

Figure 10. Urika-GX System Management Urika-Inventory Interface



Urika Inventory

List of services running on each node

Hostname	IP	Status	SSH	Apache Zookeeper	HDFS Name Node	SNN	HDFS Data Node	Mesos Master	Mesos Slave	Marathon	YARN Resource Manager
nid00000	10.142.0.100	✓ online	✓ PASS	✓ up	✓ up	–	–	✓ up	–	✓ up	–
nid00001	10.142.0.101	✓ online	✓ PASS	–	–	–	✓ up	–	✓ up	–	–
nid00002	10.142.0.102	✓ online	✓ PASS	–	–	–	✓ up	–	✓ up	–	–
nid00003	10.142.0.103	✓ online	✓ PASS	–	–	–	✓ up	–	✓ up	–	–
nid00004	10.142.0.104	✓	✓				✓		✓ up		

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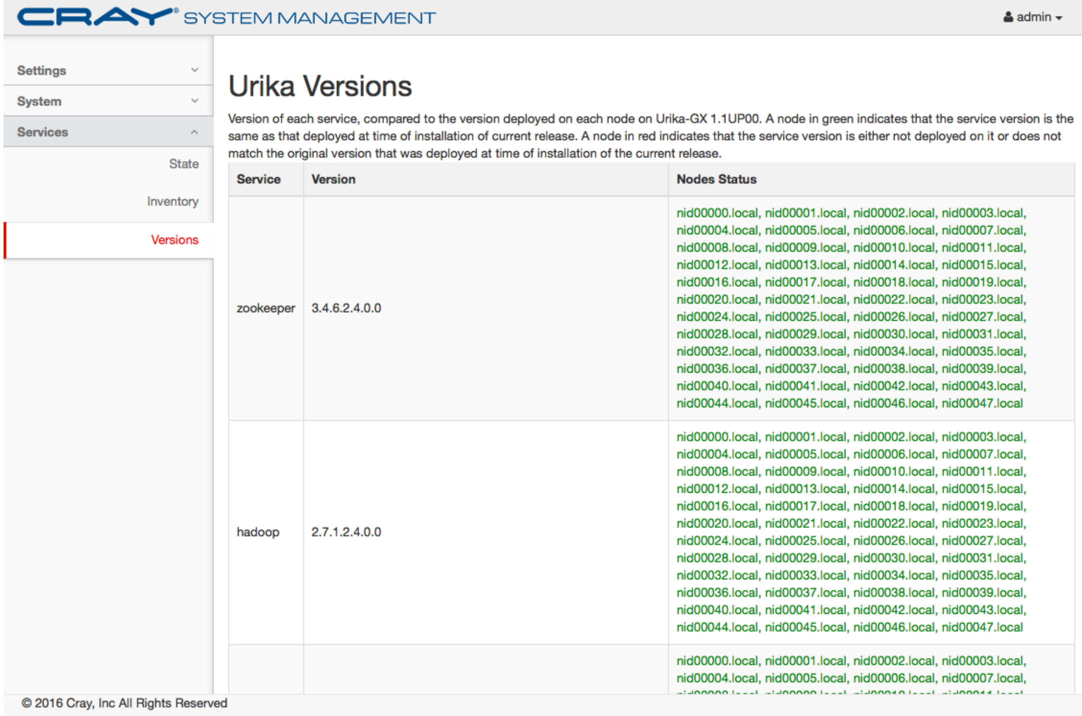
For more information, refer to the `urika-inventory` man page.

- **Versions** - Displays the version of components deployed on each node.

Figure 11. Urika-GX System Management Urika Revisions Interface



Urika Versions

Version of each service, compared to the version deployed on each node on Urika-GX 1.1UP00. A node in green indicates that the service version is the same as that deployed at time of installation of current release. A node in red indicates that the service version is either not deployed on it or does not match the original version that was deployed at time of installation of the current release.

Service	Version	Nodes Status
zookeeper	3.4.6.2.4.0.0	nid00000.local, nid00001.local, nid00002.local, nid00003.local, nid00004.local, nid00005.local, nid00006.local, nid00007.local, nid00008.local, nid00009.local, nid00010.local, nid00011.local, nid00012.local, nid00013.local, nid00014.local, nid00015.local, nid00016.local, nid00017.local, nid00018.local, nid00019.local, nid00020.local, nid00021.local, nid00022.local, nid00023.local, nid00024.local, nid00025.local, nid00026.local, nid00027.local, nid00028.local, nid00029.local, nid00030.local, nid00031.local, nid00032.local, nid00033.local, nid00034.local, nid00035.local, nid00036.local, nid00037.local, nid00038.local, nid00039.local, nid00040.local, nid00041.local, nid00042.local, nid00043.local, nid00044.local, nid00045.local, nid00046.local, nid00047.local
hadoop	2.7.1.2.4.0.0	nid00000.local, nid00001.local, nid00002.local, nid00003.local, nid00004.local, nid00005.local, nid00006.local, nid00007.local, nid00008.local, nid00009.local, nid00010.local, nid00011.local, nid00012.local, nid00013.local, nid00014.local, nid00015.local, nid00016.local, nid00017.local, nid00018.local, nid00019.local, nid00020.local, nid00021.local, nid00022.local, nid00023.local, nid00024.local, nid00025.local, nid00026.local, nid00027.local, nid00028.local, nid00029.local, nid00030.local, nid00031.local, nid00032.local, nid00033.local, nid00034.local, nid00035.local, nid00036.local, nid00037.local, nid00038.local, nid00039.local, nid00040.local, nid00041.local, nid00042.local, nid00043.local, nid00044.local, nid00045.local, nid00046.local, nid00047.local
		nid00000.local, nid00001.local, nid00002.local, nid00003.local, nid00004.local, nid00005.local, nid00006.local, nid00007.local,

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For more information, see the `urika-rev` man page.

3.9 Log on to the System Management UI

Prerequisites

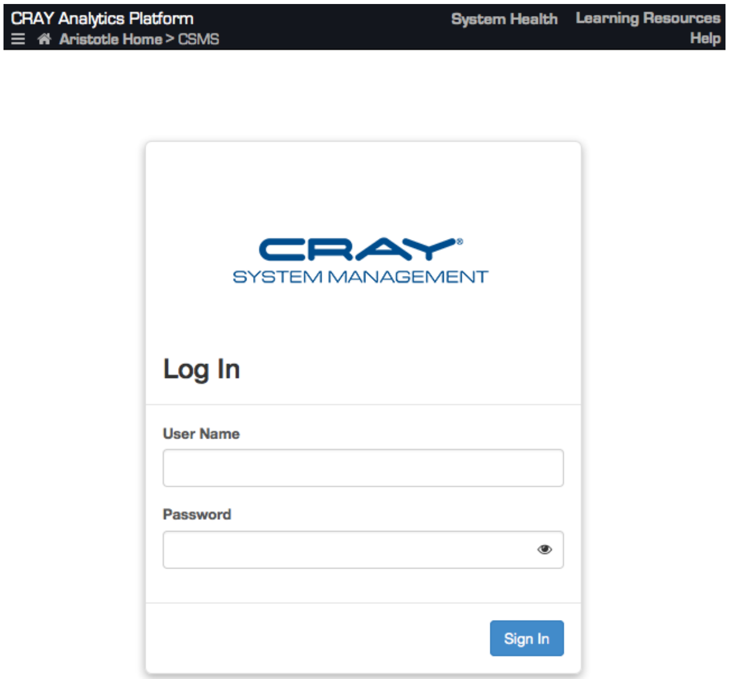
The management system UI is accessible and that the supported OpenStack services are running.

Procedure

1. Use a web browser to open the URL of the management system UI.

2. Enter the Cray default username (`admin`) and password (`initial0`) if logging on for the first time or if the default credentials have not been changed.

   Figure 12. Management System Log in Screen



3. Select the **Sign In** button.

3.10 Synchronize the System Management Workstation (SMW) to the Site NTP Server

Prerequisites

This procedure requires root privileges.

About this task

The components of the Cray system synchronize time with the System Management Workstation (SMW) through Network Time Protocol (NTP). By default, the NTP configuration of the SMW is configured to stand alone; however, the SMW can optionally be configured to synchronize with a site NTP server. Follow this procedure to configure the SMW to synchronize to a site NTP server.This procedure is for SMWs that run the CentOS 7.2 operating system, such as Urika-GX.

Procedure

1. Log on to the SMW as root.
2. Stop the NTP server by issuing the `systemctl stop ntpd` command.

   ```
   smw:~ # systemctl stop ntpd
   ```

3. Edit the `/etc/ntp.conf` file on the SMW to point to the new server.
4. Update the clocks

   ```
   smw:~ # ntpdate timeserver
   ```

5. Restart the NTP server by issuing the `systemctl start ntpd` command:

   ```
   smw:~ # systemctl start ntpd
   ```

   The SMW can continue to update the rest of the system by proxy. By default, the SMW qualifies as a stratum 3 (local) NTP server. For more information about NTP, refer to the Linux documentation.

6. Sync the hardware clock

   ```
   smw:~ # hwclock --systohc
   ```

7. Verify that the SMW has jitter from the NTP server

   ```
   smw:~ # ntpq -p
   ```

3.11 Synchronize Time of Day on System Nodes

Prerequisites

This procedure needs to be carried out as root.

About this task

Follow this procedure to configure Urika-GX compute nodes to synchronize to a site NTP server. This procedure is speicific to a 48 node system.

Procedure

1. Stop the NTP server by issuing the `systemctl stop ntpd` command.

   ```
   # pdsh -w nid000[00-47] " systemctl stop ntpd"
   ```

2. Edit the `/etc/ntp.conf` file on the SMW to point to the new server.

3. Update the clocks

   ```
   #  pdsh -w nid000[00-47] " ntpdate -s smw"
   ```

4. Sync the hardware clock

   ```
   # pdsh -w nid000[00-47] "hwclock --systohc "
   ```

5. Restart the NTP server by issuing the `systemctl start ntpd` command:

   ```
   # pdsh -w nid000[00-47] " systemctl start ntpd"
   ```

3.12 Power Up the Urika-GX System

Prerequisites

This procedure requires root access. The examples of this procedure assumes that the instructions are being carried out on a 3 sub-rack (48 node) system.

About this task

The instructions documented in the procedure can be used for powering up the Urika®-GX system. For detailed information, or for troubleshooting issues, please contact Cray Support.

Procedure

1. Physically power on the Power Distribution Units (PDUs).

2. Turn on the System Management Workstation (SMW).

   However, it is recommended to wait a few minutes to allow the RC to boot and to verify that the RC has been turned on. This can be achieved by executing the following command:

   ```
   root@smw:~ xtalive -l l1
   The expected response was received.
   ```

   The statement: "`The expected response was received`" indicates that the RC has been turned on.

3. Ensure that `alert` or `reserved` is not displayed in the `Flags` column of results when the following command is executed:

   ```
   root@smw:~ xtcli status -t l0 s0
   ```

if alert or reserved is displayed in the Flags column of results when the preceding command is executed, use the xtclear_alert or xtclear_reserve command to clear those statuses.

4. Power up the Aries Network Card Controllers (ANCCs) by executing the following command:

```
root@smw:~ xtcli power up s0
```

5. Verify that the dANCs are in the 'ready' state when the controller is responding to the xtalive command and is up and running. Also ensure that alert or reserved is not displayed in the Flags column of results when the following command is executed:

```
root@smw:~ xtcli status -t l0 s0
```

if alert or reserved is displayed in the Flags column of results when the preceding command is executed, use the xtclear_alert or xtclear_reserve command to clear those statuses.

6. Ensure that the ANCCs are powered on by executing the command:

```
root@smw:~ xtalive
All 6 expected responses were received.
```

The above response may vary, depending on the number of sub-racks in the system. The previous example displays a response the system would return if there are 3 sub-racks in the rack.

7. Become the crayadm user.

```
root@smw:~ su - crayadm
```

8. Initialize the High Speed Network (HSN) by executing the command:

```
crayadm@smw:~ xtbounce --linktune s0
```

This may step a few minutes to finish executing.

9. Exit to become the root user again.

```
crayadm@smw:~ exit
```

10. Use the HSS rtr command to request routing for the HSN

```
root@smw:~ rtr -R s0
```

11. Execute the following command to check for any alerts/issues.

```
root@smw:~ capmc node_status
```

12. Power on all the compute nodes of the system by executing the ux-nid-power-on script.

For more information, see the ux-nid-power-on man page.

```
root@smw:~ source /root/admin.openrc
root@smw:~ ux-nid-power-on all
```

Once all the node IDs have reported that they are up, wait for 5 or so minutes. The login nodes take longer than the rest of the nodes.

13. Verify that the compute nodes have been turned on.

    ```
    root@smw:~ xtcli status s0
    ```

    All the nodes should send a response. If a response is not received from all the nodes, do not proceed.

14. Execute the following command:

    ```
    root@smw:~ pall uptime |sort
    ```

    Once all the node IDs have reported that they are up, wait for 5 or so minutes. The login nodes take longer than the rest of the nodes.

15. Mount Lustre

    ```
    root@smw:~ pall mount /mnt/lustre
    ```

    Here pall is an alias for `pdsh -w` and should be configured in `.bash_profile`

16. Confirm that the required nodes have a mount point by executing the following command:

    ```
    root@smw:~ pall df -k |grep lustre |sort
    ```

17. Start up the analytic applications using the `urika-start` script.

    For more information, see the `urika-start` man page.

    ```
    root@smw:~ urika-start
    ```

    This starts up all the analytic applications installed on the system.

18. Pause for 5 minutes or so.

    It is important to allow Hadoop to perform the required set up before proceeding. Hadoop will initially be in safe mode when it starts.

19. Verify that the analytic services have started.

    ```
    root@smw:~ urika-inventory
    ```

20. Confirm services are up on all the expected nodes and that all processes are listed as online when the `urika-state` command is executed.

    ```
    root@smw:~ urika-state
    ```

21. Optional: Check the general health of the system.

    ```
    root@smw:~ urika-check-platform
    ```

3.13 Power Down the Urika-GX System

Prerequisites

Instructions in this procedure require root access. This procedure assumes that the instructions are being carried out on a 3 sub-rack system.

About this task

The instructions documented in the procedure should be following in the order listed to power off the Urika®-GX system. For detailed information, or for troubleshooting issues, please contact Cray Support. It is assumed that the instructions in procedure are being carried out on a 48 node system. Please use node IDs according to the actual system configuration.

Procedure

1. Log on to the System Management Workstation (SMW) as root
2. Power down the analytic applications using the `urika-stop` script.

   ```
   root@smw:~ urika-stop
   ```

   For more information, see the `urika-stop` man page.
3. Execute the `urika-state` command to ensure that analytic applications have shut down.

   The HA Proxy service may still be running.

   ```
   root@smw:~ urika-state
   ```

   For more information, see the `urika-state` man page.
4. Unmount all external Lustre mounts.

   This may not be required if `/mnt/lustre` or a Sonexion storage system are not used. For more information, contact support.

   ```
   root@smw:~ pall umount /mnt/lustre
   ```
5. Log on to a storage node (`nid00031` on a 3 sub-rack system) and switch to the `lustre-utils` directory.

   This step is only needed only if a Direct Attached Lustre (DAL) is used. Do not perform this step if using the Sonexion 900

   ```
   root@nid00031:~ cd /etc/opt/cray/lustre-utils
   ```
6. Stop Lustre if using a Direct Attached Lustre (DAL) storage system.

   Do not perform this step if using the Sonexion 900. For more information, refer to "*Sonexion 900 Power On-Off Procedures v 1.5*" available at *https://pubs.cray.com*.

   ```
   root@nid00031:~ ./lustre_control stop -a
   ```
7. Log on to the SMW and execute the `ux-nid-power-off` command to power off all the nodes.

```
root@smw:~ source /root/admin.openrc
root@smw:~ ux-nid-power-off all
```

For more information about the `ux-nid-power-off` command, see the `ux-nid-power-off` man page.

8. Log on to the SMW and execute the `capmc node_status` command.

It is important to wait until all the nodes are in the `off` state before proceeding. This process takes around 5-10 minutes. The `capmc` command should be executed on a different shell environment than that used to execute the `ux-nid-power-off` command. if a new shell is used for executing the `ux-nid-power-off` command, the `/root/admin.openrc` file would need to be sourced again, as shown in the previous step.

```
root@smw:~ capmc node_status
```

9. Ensure that `[noflags|]` is displayed in the `Flags` column of the results when the following commands are executed:

```
root@smw:~ xtcli status -t node s0
Network topology: class 0
Network type: Aries
           Nodeid: Service  Core Arch|  Comp state      [Flags]
--------------------------------------------------------------------------------
----
         r0s0c0n0:       -       ATHE|       ready      [noflags|]
         r0s0c0n1:       -       ATHE|       ready      [noflags|]
         r0s0c0n2:       -       ATHE|       ready      [noflags|]
         r0s0c0n3:       -       ATHE|       ready      [noflags|]
         r0s0c0n4:       -       ATHE|       ready      [noflags|]
         r0s0c0n5:       -       ATHE|       ready      [noflags|]
         r0s0c0n6:       -       ATHE|       ready      [noflags|]
         r0s0c0n7:       -       ATHE|       ready      [noflags|]
         r0s0c1n0:       -       ATHE|       ready      [noflags|]
         ...
```

10. Power down the dual Aries Network Cards (dANCs) by executing the following command:

```
root@smw:~ xtcli power down s0
```

11. Ensure that `[noflags|]` is displayed in the `Flags` column of the results when the following command is executed

```
root@smw:~ xtcli status -t node s0
Network topology: class 0
Network type: Aries
           Nodeid: Service  Core Arch|  Comp state      [Flags]
--------------------------------------------------------------------------------
----
         r0s0c0n0:       -       ATHE|       ready      [noflags|]
         r0s0c0n1:       -       ATHE|       ready      [noflags|]
         r0s0c0n2:       -       ATHE|       ready      [noflags|]
         r0s0c0n3:       -       ATHE|       ready      [noflags|]
         r0s0c0n4:       -       ATHE|       ready      [noflags|]
         r0s0c0n5:       -       ATHE|       ready      [noflags|]
         r0s0c0n6:       -       ATHE|       ready      [noflags|]
         r0s0c0n7:       -       ATHE|       ready      [noflags|]
         r0s0c1n0:       -       ATHE|       ready      [noflags|]
         ...
```

12. Turn off the SMW.

```
root@smw:~ shutdown -h
```

13. Ensure that Lustre is unmounted before shutting down breakers on rack, if Lustre is installed on the same rack.

14. Physically power down the rack by turning off the Power Distribution Units (PDUs).

3.14 Urika-GX CLI Commands for Managing Services

Urika-GX features a number of scripts for controlling and monitoring installed analytic applications. The commands need to be run as root from the System Management Workstation (SMW).

⚠ **CAUTION:** These scripts should only be executed by administrators.

`urika-start`

The `urika-start` command is used to start analytic services on the Urika-GX system. This command starts all the running services if used without any options. To start a specific service, use the `-s` or `--service` option to specify the name of that service.

⚠ **CAUTION:** The `urika-start` command should only be used to start pre-defined services. It should not be used to modify any existing services.

⚠ **CAUTION:** Before starting the Spark History server from the **Urika State** interface of the **Cray System Management** UI or via the `urika-start` command, it is required to start the following services in the order listed:

1. HDFS NameNode
2. HDFS DataNode

If this command is used without any options, it will start the YARN Node Manager service as well as the aforementioned services. It also calls the `urika-yam-flexup` script.

If run without any options, the `urika-start` command does not start the Spark Thrift Server. Use the -s option of this command to start the Spark Thrift Server.

For more information, see the `urika-start(8)` man page.

Start all running services

```
# urika-start
```

Start a single service (Hue in this example):

```
# urika-start --service hue
```

urika-stop

The urika-stop command is used to stop the analytic services running on the Urika-GX system. This command internally calls the urika-yam-flexdown-all script. To stop a specific service, use the -s or --service option to specify the name of that service. This command stops all the running services if used without any options. In addition, calling this command without and options will :

- flex down any YARN Node Managers flexed up through YAM
- stop all running mrun jobs
- stop the Spark Thrift Server service, if it is running.

⚠ **CAUTION:** The urika-stop command should only be used to stop pre-defined services. It should not be used to modify any existing services.

For more information, see the urika-stop(8) man page.

Stop all running services

```
# urika-stop
```

Stop a single service (HUE in this example):

```
# urika-stop --service hue
```

urika-inventory

The urika-inventory command displays the list of analytic services running on each node, as well as the IP address of each node. For more information, see the urika-inventory(8) man page.

Display the list of services running on each Urika-GX node:

```
# urika-inventory
```

urika-rev

The urika-rev command displays the version of deployed analytic components on Urika-GX nodes and checks if a different version of a software component is installed on individual nodes.

For more information, see the urika-rev(8) man page.

Display the version components deployed on Urika-GX:

```
# urika-rev
```

urika-state

The urika-state command displays the status of Urika-GX analytic services.

For more information, see the `urika-state(8)` man page.

Display status of services:

```
# urika-state
```

Sequence of Execution of Scripts

The urika-state command can be used to view the state services running on Urika-GX. Use this command to ensure that the following dependencies are met:

- Before executing the `start -s mesos_master` command, ensure that the ZooKeeper service is up and running.
- Before executing the `stop -s mesos_master` command, ensure that the Marathon and Mesos slave services have already been stopped
- Before executing the `start -s mesos_slave` command, ensure that the ZooKeeper and Mesos Master services are up and running.
- Before executing the `start -s marathon` command, ensure that the ZooKeeper and Mesos Master services are up and running.

In addition, it is recommended to stop the Mesos slave service before stopping Marathon via the `urika-stop -s marathon` command. The `urika-stop -s mesos_slave` command does not have any dependencies, though any running tasks would be lost. Therefore, it is recommended to ensure that all the existing jobs finish running before executing the `stop -s mesos_slave` command.

Additional Scripts (USE ONLY IF REQUESTED BY CRAY SUPPORT)

⚠ **CAUTION: The following scripts should ONLY be used by administrations and ONLY if requested by Cray Support for diagnostic/troubleshooting purposes:**

- `urika-datanode.service` - Service for HDFS Data Node, which stores and retrieves data on one node
- `urika-namednode_primary.service` - Service for HDFS Name Node, which keeps directory tree of all files in HDFS
- `urika-namednode_secondary.service` - Service for HDFS Secondary Name Node, which periodically stores metadata from NameNode
- `urika-zookeeper.service` - Service for Apache ZooKeeper, which is used to coordinate distributed applications
- `urika-oozie.service` - Service for Apache Oozie, which is a work-flow scheduler for Hadoop
- `urika-hive.service` - Service for Hive metastore, which stores the metadata for Hive tables and partitions
- `urika-hive2.service` - Service for HiveServer2 (HS2), which is a server interface that enables remote clients to execute queries against Hive `urika-webhcat.service` - Service for Hive WebHCat, which provides an API for Hive web interface.
- `urika-hue.service` - Service for Hadoop User Experience (HUE), which is a web interface that enables interacting with a Hadoop cluster and browsing HDFS

- `urika-yarn_rm.service` - Service for YARN Resource Manager, which is the main resource manager for MapReduce jobs
- `urika-hdp_app_timeline.service` - Service for Hadoop Application Timeline Server, which provides applications current and historic information
- `urika-hdp-history-server.service` - Service for Hadoop Job History Server, which manages historical information about YARN jobs
- `urika-spark_history_server.service` - Service for Spark History Server, which manages execution information for Spark jobs
- `urika-mesos-master.service` - Service for Mesos Master, which is the main Resource manager for Urika-GX
- `urika-mesos-slave.service` - Service for Mesos Slave Daemons, which provides resource information of the nodes to mesos master
- `urika-marathon.service` - Service for Marathon, which is a framework that runs on top of Mesos for container orchestration
- `collectl` - Service for Collectl , which gathers resource usage information from nodes
- `grafana-server` - Service for Grafana, which is a graphical interface that uses data in Influx DB
- `influxdb` - Service for Influx DB, which stores time series data collected by Collectl
- `urika-jupyter.service` - Service for JupyterHub , which is a multi-user HUB to manage notebooks

4 System Monitoring

4.1 System Monitoring Tools

Various tools are used to monitor individual components of Urika-GX.

- **System Management Workstation** - Monitored via the iDRAC.
- **Physical system resources** - Monitored via Grafana.
- **Physical system components** - Health of physical system components, such as PCIe Channels, Dual Aries Network Card (dANC) etc., is monitored via the Hardware Supervisory system (HSS).
    - **Sub-racks** - Sub-rack level attributes, such as power supply, amperage, fan status, and temperature info are monitored via the iSCB.

      ⚠ **CAUTION:** iSCB CLI commands other than the `status` command should NOT be executed on the Urika-GX system (unless advised by Cray Support) as they may interfere with OpenStack's performance. For more information, contact Cray support.
    - **Nodes/instances**- Monitored via:
        - The `capmc` command.
        - The system management UI.
        - The OpenStack Nova service.
- **OpenStack services** - Monitored via OpenStack CLI commands.

In addition to the aforementioned tools, Hadoop and Spark applications can be monitored using the Urika-GX performance analysis tools. For more information, see S-3015, "*Urika®-GX Analytic Applications Guide*".

4.2 Getting Started with Using Grafana

Grafana is a feature-rich metrics, dashboard, and graph editor. It provides information about utilization of system resources, such as CPU, memory, I/O, etc.

Major Grafana components and UI elements include:

- **Dashboard** - The **Dashboard** consolidates all the visualizations into a single interface. Urika-GX ships with pre-defined dashboards for resource utilization information. For information about these dashboards, see *Default Grafana Dashboards* on page 72.
- **Panels** - The **Panel** is the basic visualization building block of the GUI. Panels support a wide variety of formatting options and can be dragged, dropped, resized, and rearranged on the **Dashboard**.

- **Query Editor -** Each Panel provides a **Query Editor** for the data source, which is InfluxDB on the Urika-GX system. Information retrieved from the **Query Editor** is displayed on the **Panel**.
- **Data Source -** Grafana supports many different storage back-ends for retrieving time series data. Each **Data Source** has a specific **Query Editor** that is customized for the features and capabilities that the particular **Data Source** exposes. Urika-GX currently supports InfluxDB as its data source.
- **Organization -** Grafana supports multiple organizations in order to support a wide variety of deployment models. Each **Organization** can have one or more **Data Sources**. All Dashboards are owned by a particular Organization.
- **User -** A **User** is a named account in Grafana. A user can belong to one or more **Organizations**, and can be assigned different levels of privileges via roles.
- **Row -** A **Row** is a logical divider within a **Dashboard**, and is used to group **Panels** together.

Roles

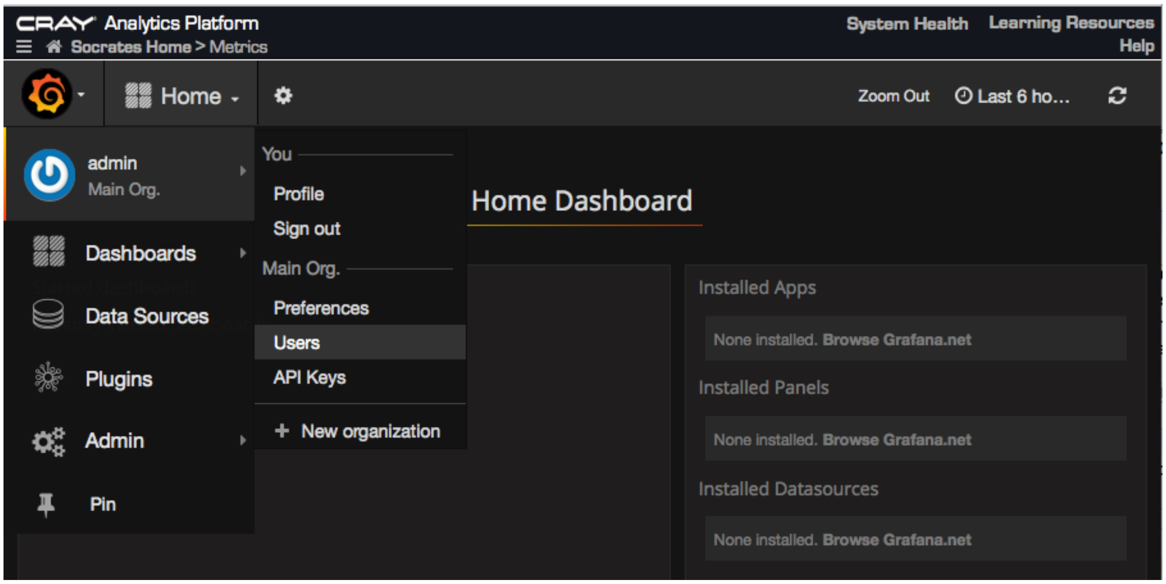
Users and **Organizations** can be assigned roles to specify permissions/privileges. These roles and their privileges are listed in the following table:

Table 11. Grafana Roles and Permissions

Role	Edit roles	View graphs	Edit/create copy of existing graphs	Add new graphs to existing dashboards	Create new/ import existing dashboards
Admin	Yes	Yes	Yes	Yes	Yes (These dashboards persist between sessions)
Viewer (default role)	No	Yes	No	No	No
Editor	No	Yes	Yes	Yes	Yes (These dashboards get deleted when the editor logs out)
Read only editor	No	Yes	Yes	Yes	No

Each role type can also export performance data via the dashboard. When a new user signs up for the first time, the default role assigned to the user is that of a Viewer. The admin can then change the new user's role if needed. All users have a default role of a **Viewer** when they first log on to Grafana. Administrators can change roles assigned to users as needed using the **Admin** menu.

Figure 13. Change User Roles Using the Admin Menu



Since the time displayed on the Grafana UI uses the browser's timezone and that displayed on the Spark History server's UI uses the Urika-GX system's timezone, the timezones displayed on the two UIs may not be the same.

By default, Grafana's refresh rate is turned off on the Urika-GX system. Sometimes the Hadoop and Spark Grafana dashboards take longer to load than expected. The usual cause of this issue is the time it takes InfluxDB to return all of the requested data. To reduce the time for the Hadoop and Spark dashboards to display data, refer to *Update the InfluxDB Data Retention Policy* on page 83. Reducing the amount of data retained makes Grafana dashboards dsiplay faster.

4.3 Default Grafana Dashboards

The default set of Grafana dashboards shipped with Urika-GX include:

- **Aggregate Compute Node Performance Statistics -** Displays graphs representing statistical data related to network, CPU, and I/O utilization for all Urika-GX nodes.

  This dashboard contains the following graphs:

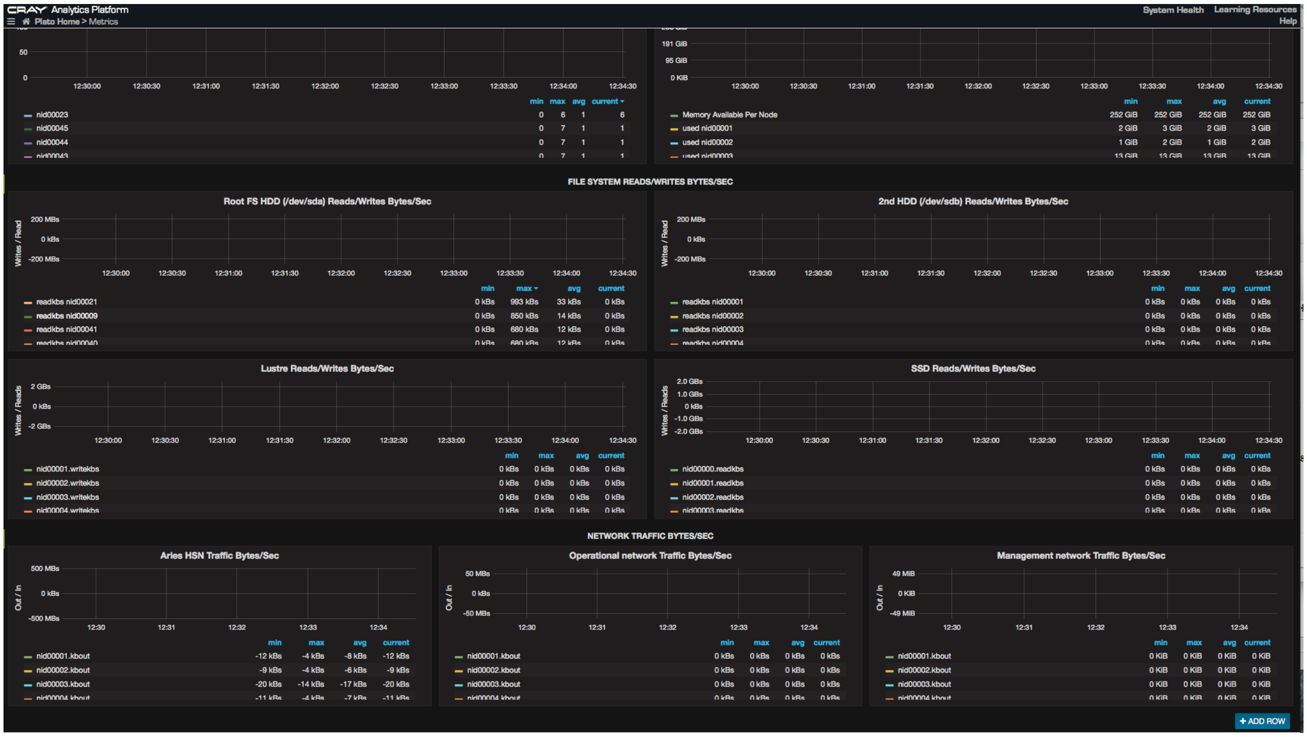
  - **CPU AND MEMORY**
    - **CPU utilization** - Displays the overall CPU utilization for all nodes.
    - **Memory utilization** - Displays the overall memory used by all nodes.
  - **FILE SYSTEM DATA RATES**
    - **SSD Reads/Writes Bytes/Second** - Displays SSD utilization for all nodes.
    - **Second Hard Drive (/dev/sdb) Reads/Writes Bytes/Sec -** Displays utilization of secondary hard disk space for all nodes.
    - **Root FS HDD (/dev/sda) Reads/Writes Bytes/Sec** - Displays utilization of root files system on the hard drive for all nodes.

- **Lustre Reads/Writes Bytes/Second** - Displays the aggregate Lustre I/O for all the nodes.

○ **NETWORK READS AND WRITES**

- **Aries HSN Bytes/Sec In/Out** - Displays the overall Aries network TCP traffic information for nodes. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
- **Operational network Bytes/sec In/Out** - Displays the overall operational network traffic information for all nodes.
- **Management network Bytes/sec In/Out** - Displays the overall management network traffic information for all nodes.

Figure 14. Aggregate Compute Node Performance Statistics



	min	max	avg	current
nid00023	0	6	1	6
nid00045	0	7	1	1
nid00044	0	7	1	1
nid00043	0	7	1	1

	min	max	avg	current
Memory Available Per Node	252 GiB	252 GiB	252 GiB	252 GiB
used nid00001	2 GiB	3 GiB	2 GiB	3 GiB
used nid00002	1 GiB	2 GiB	1 GiB	2 GiB
used nid00003	13 GiB	13 GiB	13 GiB	13 GiB

Root FS HDD (/dev/sda) Reads/Writes Bytes/Sec

	min	max	avg	current
readkbs nid00021	0 kBs	993 kBs	33 kBs	0 kBs
readkbs nid00009	0 kBs	850 kBs	14 kBs	0 kBs
readkbs nid00041	0 kBs	680 kBs	12 kBs	0 kBs
readkbs nid00040	0 kBs	680 kBs	12 kBs	0 kBs

2nd HDD (/dev/sdb) Reads/Writes Bytes/Sec

	min	max	avg	current
readkbs nid00001	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00002	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00003	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00004	0 kBs	0 kBs	0 kBs	0 kBs

Lustre Reads/Writes Bytes/Sec

	min	max	avg	current
nid00001.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00004.writekbs	0 kBs	0 kBs	0 kBs	0 kBs

SSD Reads/Writes Bytes/Sec

	min	max	avg	current
nid00000.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00001.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.readkbs	0 kBs	0 kBs	0 kBs	0 kBs

Aries HSN Traffic Bytes/Sec

	min	max	avg	current
nid00001.kbout	-12 kBs	-4 kBs	-8 kBs	-12 kBs
nid00002.kbout	-9 kBs	-4 kBs	-6 kBs	-9 kBs
nid00003.kbout	-20 kBs	-14 kBs	-17 kBs	-20 kBs
nid00004.kbout	-11 kBs	-4 kBs	-7 kBs	-11 kBs

Operational network Traffic Bytes/Sec

	min	max	avg	current
nid00001.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00004.kbout	0 kBs	0 kBs	0 kBs	0 kBs

Management network Traffic Bytes/Sec

	min	max	avg	current
nid00001.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00002.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00003.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00004.kbout	0 KiB	0 KiB	0 KiB	0 KiB

- **Basic Metrics** - Displays graphs representing statistical data related to network, CPU, and I/O utilization for the Urika-GX system, as a whole.

  TIP: It is recommended that administrators use the **Basic Metrics** dashboard before using other dashboards to retrieve a summary of the system's health.

  This dashboard contains the following graphs:

  ○ **CPU AND MEMORY**

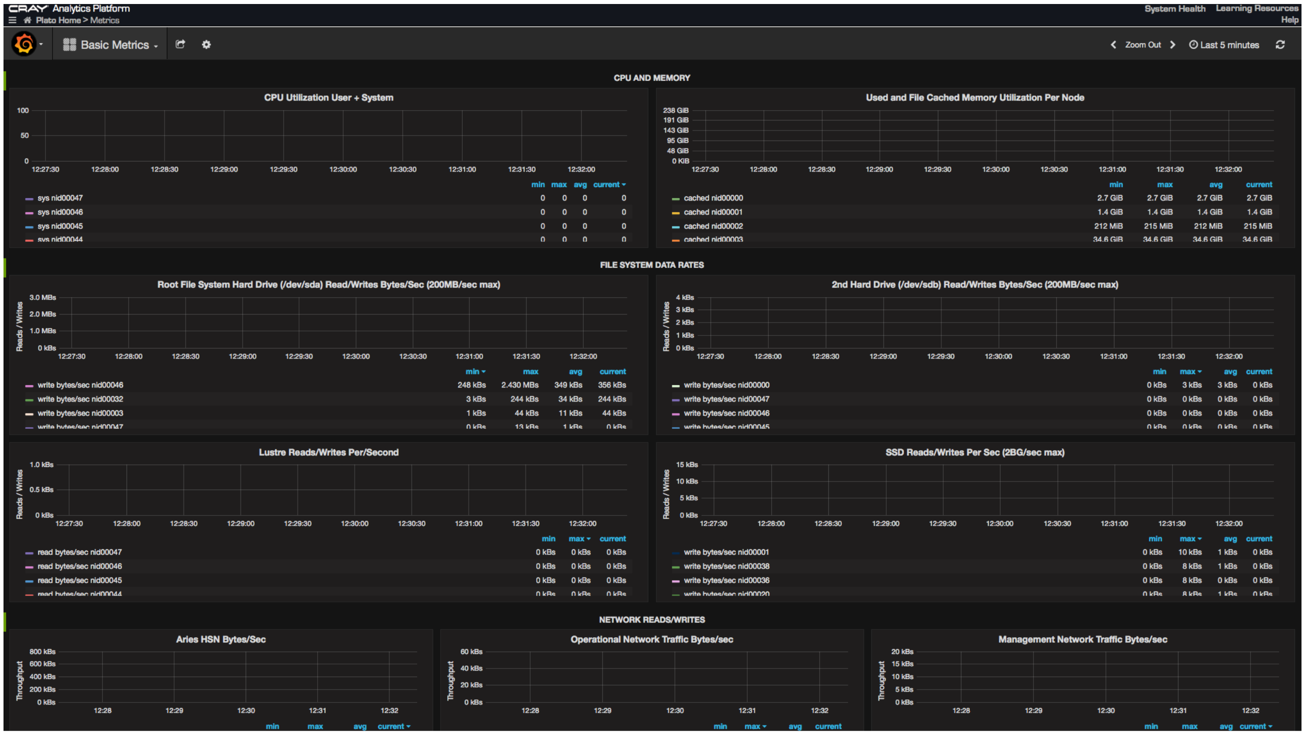
  - **Used and File Cached Memory** - Displays the used and file cached memory for each node.
  - **CPU Utilization User + System** - Displays the CPU utilization by the user and system for each node

  ○ **FILE SYSTEM DATA RATES**

  - **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec (200MB/sec max)** - Displays information about the usage of memory on the root file system for each node.

  - **2nd Hard Drive (/dev/sdb) Read/Writes** - Displays information about the usage of memory on the secondary hard drive of each node.
  - **Lustre Read/Writes Bytes/Second** - Displays the number of Lustre reads/writes for each node.
  - **SSD Read/Writes Bytes/Second** - Displays the number of reads/writes of the SSDs installed on the system.
- **NETWORK READS/WRITES**
  - **Aries HSN Bytes/Sec In/Out** - Displays the Aries network TCP traffic information for each node. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
  - **Operational network Bytes/sec In/Out** - Displays the overall operational network traffic information for each node.
  - **Management network Bytes/sec In/Out** - Displays the overall management network traffic information for each node.
- **FILE SYSTEM UTILIZATION**
  - **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec (200MB/sec max)** - Displays information about the usage of memory on the root file system for each node.
  - **2nd Hard Drive (/dev/sdb) Read/Writes** - Displays information about the usage of memory on the secondary hard drive of each node.
  - **Lustre Read/Writes Per/Second** - Displays the number of Lustre reads/writes for each node.
  - **SSD Read/Writes Per/Second** - Displays the number of reads/writes of each node's SSDs
- **NETWORK ERRORS AND DROPED PACKETS**
  - **Aries HSN Dropped Packets and Errors Per Sec** - Displays the number of dropped packets/errors per second for the Aries network TCP traffic information for each node. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
  - **Operational network Dropped Packets and Errors Per Sec** - Displays the number of dropped packets/errors per second for the operational network TCP traffic information for each node.
  - **Management network Dropped Packets and Errors Per Sec** - Displays the number of dropped packets/errors per second for the management network TCP traffic information for each node.

Figure 15. Basic Metrics Dashboard



	min	max	avg	current
sys nid00047	0	0	0	0
sys nid00046	0	0	0	0
sys nid00045	0	0	0	0
sys nid00044	0	0	0	0

	min	max	avg	current
cached nid00000	2.7 GiB	2.7 GiB	2.7 GiB	2.7 GiB
cached nid00001	1.4 GiB	1.4 GiB	1.4 GiB	1.4 GiB
cached nid00002	212 MiB	215 MiB	212 MiB	215 MiB
cached nid00003	34.6 GiB	34.6 GiB	34.6 GiB	34.6 GiB

	min	max	avg	current
write bytes/sec nid00046	248 kBs	2.430 MBs	349 kBs	356 kBs
write bytes/sec nid00032	3 kBs	244 kBs	34 kBs	244 kBs
write bytes/sec nid00003	1 kBs	44 kBs	11 kBs	44 kBs
write bytes/sec nid00047	0 kBs	13 kBs	1 kBs	0 kBs

	min	max	avg	current
write bytes/sec nid00000	0 kBs	3 kBs	3 kBs	0 kBs
write bytes/sec nid00047	0 kBs	0 kBs	0 kBs	0 kBs
write bytes/sec nid00046	0 kBs	0 kBs	0 kBs	0 kBs
write bytes/sec nid00045	0 kBs	0 kBs	0 kBs	0 kBs

	min	max	current
read bytes/sec nid00047	0 kBs	0 kBs	0 kBs
read bytes/sec nid00046	0 kBs	0 kBs	0 kBs
read bytes/sec nid00045	0 kBs	0 kBs	0 kBs
read bytes/sec nid00044	0 kBs	0 kBs	0 kBs

	min	max	avg	current
write bytes/sec nid00001	0 kBs	10 kBs	1 kBs	0 kBs
write bytes/sec nid00038	0 kBs	8 kBs	1 kBs	0 kBs
write bytes/sec nid00036	0 kBs	8 kBs	0 kBs	0 kBs
write bytes/sec nid00020	0 kBs	8 kBs	1 kBs	0 kBs

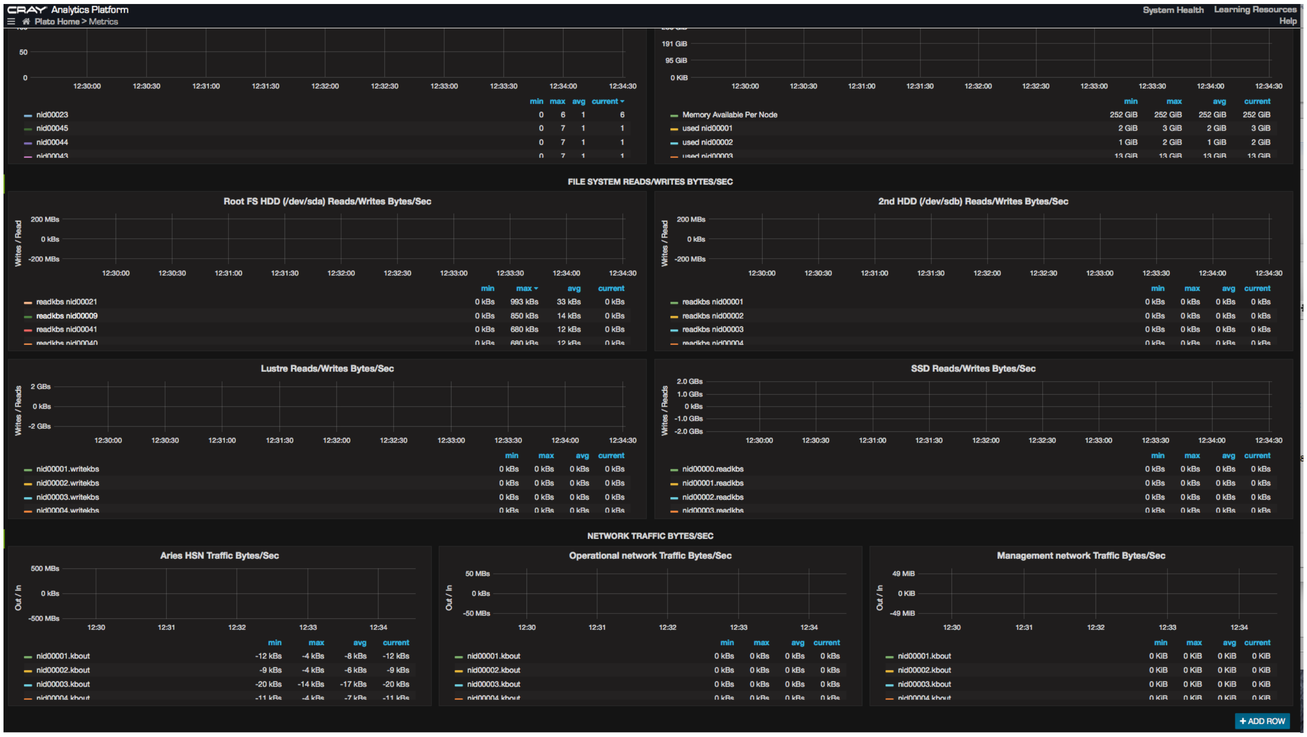
- **Compute Node Performance Statistics -** Displays graphs representing statistical data related to network, CPU, and I/O utilization for all Urika-GX compute nodes.

  This dashboard contains the following graphs:

  - **CPU MEMORY UTILIZATION**
    - **CPU utilization** - Displays the overall CPU utilization for all the compute nodes.
    - **Memory utilization** - Displays the overall memory (in KB or GB) used by all the compute nodes.
  - **FILE SYSTEM READS/WRITE BYTES/SEC**
    - **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec (200MB/sec max)** - Displays information about the usage of memory on the root file system by compute nodes.
    - **2nd Hard Drive (/dev/sdb) Read/Writes** - Displays information about the usage of memory by compute nodes on the secondary hard drive.
    - **Lustre Read/Writes Per/Second** - Displays the number of Lustre reads/writes by compute nodes.
    - **SSD Read/Writes Per/Second** - Displays the number of reads/writes of the compute node SSDs installed on the system.
  - **NETWORK READS/WRITES**
    - **Aries HSN Bytes/Sec In/Out** - Displays the Aries network TCP traffic information for compute nodes. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
    - **Operational network Bytes/sec In/Out -** Displays the overall operational network traffic information for compute nodes.

  - **Management network Bytes/sec In/Out** - Displays the overall management network traffic information for compute nodes.

Figure 16. Compute Node Performance Statistics



	min	max	avg	current
nid00023	0	6	1	6
nid00045	0	7	1	1
nid00044	0	7	1	1
nid00043	0	7	1	1

	min	max	avg	current
Memory Available Per Node	252 GiB	252 GiB	252 GiB	252 GiB
used nid00001	2 GiB	3 GiB	2 GiB	3 GiB
used nid00002	1 GiB	2 GiB	1 GiB	2 GiB
used nid00003	13 GiB	13 GiB	13 GiB	13 GiB

	min	max	avg	current
readkbs nid00021	0 kBs	993 kBs	33 kBs	0 kBs
readkbs nid00009	0 kBs	850 kBs	14 kBs	0 kBs
readkbs nid00041	0 kBs	680 kBs	12 kBs	0 kBs
readkbs nid00040	0 kBs	680 kBs	12 kBs	0 kBs

	min	max	avg	current
readkbs nid00001	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00002	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00003	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00004	0 kBs	0 kBs	0 kBs	0 kBs

	min	max	avg	current
nid00001.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00004.writekbs	0 kBs	0 kBs	0 kBs	0 kBs

	min	max	avg	current
nid00000.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00001.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.readkbs	0 kBs	0 kBs	0 kBs	0 kBs

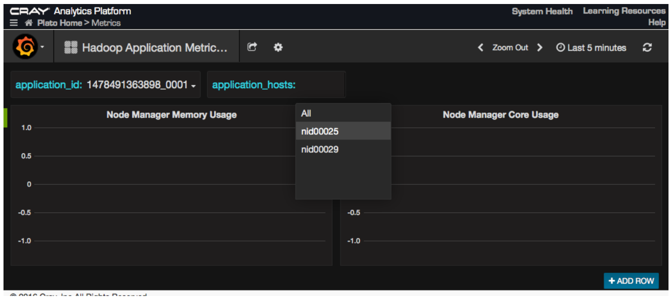
	min	max	avg	current
nid00001.kbout	-12 kBs	-4 kBs	-8 kBs	-12 kBs
nid00002.kbout	-9 kBs	-4 kBs	-6 kBs	-9 kBs
nid00003.kbout	-20 kBs	-14 kBs	-17 kBs	-20 kBs
nid00004.kbout	-11 kBs	-4 kBs	-7 kBs	-11 kBs

	min	max	avg	current
nid00001.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00002.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00003.kbout	0 kBs	0 kBs	0 kBs	0 kBs
nid00004.kbout	0 kBs	0 kBs	0 kBs	0 kBs

	min	max	avg	current
nid00001.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00002.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00003.kbout	0 KiB	0 KiB	0 KiB	0 KiB
nid00004.kbout	0 KiB	0 KiB	0 KiB	0 KiB

- **Hadoop Application Metrics** - This section contains the following graphs:
  - **Node Manager Memory Usage** - Displays the average memory usage per application in mega bytes per second (MBPS). The Y-axis is in MBPS.
  - **Node Manager Core Usage** - Displays the average CPU usage per application in MilliVcores . The Y-axis refers to MilliVcores.

Figure 17. Hadoop Applications Metrics Dashboard



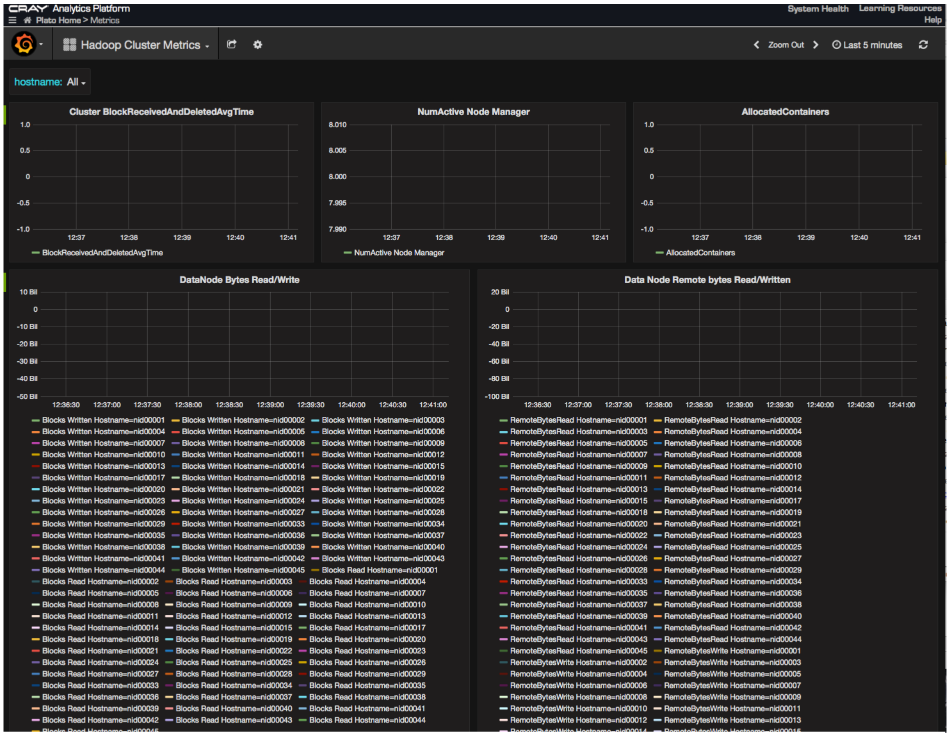
application_id: 1478491363898_0001
application_hosts:

- **Hadoop Cluster Metrics** - Displays graphs representing statistical data related to Hadoop components, such as HDFS Data Nodes and HDFS Name Nodes.

  This dashboard contains the following sections:

  - **Cluster BlockReceivedAndDeletedAvgTime** - Displays the average time in milliseconds for the hdfs cluster to send and receive blocks. The Y-axis represents time in milliseconds.

- ○ **NumActive Node Manager** - Displays the number of Node Managers up and running in the Hadoop cluster at a given time. The Y-axis represents a linear number.
- ○ **AllocatedContainers** - Displays the number of allocated YARN containers by all the jobs in the hadoop cluster. The Y-axis represents a linear number.
- ○ **DataNode Bytes Read/Write** - Displays the number of bytes read or write per node from local client in the hadoop cluster. The Y-axis refers to a linear number. Read is shown on the positive scale. Write is shown on the negative scale.
- ○ **Data Node Remote bytes Read/Written** - Displays the number of bytes read or written per node from remote clients in the Hadoop cluster. The Y-axis represents a linear number. The number of reads are shown on the positive scale. The number of writes are shown on the negative scale.
- ○ *Figure 18. Hadoop Cluster Metrics Dashboard*


CRAY Analytics Platform
Plato Home > Metrics
System Health
Learning Resources
Help
Hadoop Cluster Metrics
Zoom Out
Last 5 minutes
hostname: All
Cluster BlockReceivedAndDeletedAvgTime
1.0
0.5
0
-0.5
-1.0
12:37
12:38
12:39
12:40
12:41
BlockReceivedAndDeletedAvgTime
NumActive Node Manager
8.010
8.005
8.000
7.995
7.990
12:37
12:38
12:39
12:40
12:41
NumActive Node Manager
AllocatedContainers
1.0
0.5
0
-0.5
-1.0
12:37
12:38
12:39
12:40
12:41
AllocatedContainers
DataNode Bytes Read/Write
10 Bil
0
-10 Bil
-20 Bil
-30 Bil
-40 Bil
-50 Bil
12:36:30
12:37:00
12:37:30
12:38:00
12:38:30
12:39:00
12:39:30
12:40:00
12:40:30
12:41:00
Blocks Written Hostname=nid00001
Blocks Written Hostname=nid00002
Blocks Written Hostname=nid00003
Blocks Written Hostname=nid00004
Blocks Written Hostname=nid00005
Blocks Written Hostname=nid00006
Blocks Written Hostname=nid00007
Blocks Written Hostname=nid00008
Blocks Written Hostname=nid00009
Blocks Written Hostname=nid00010
Blocks Written Hostname=nid00011
Blocks Written Hostname=nid00012
Blocks Written Hostname=nid00013
Blocks Written Hostname=nid00014
Blocks Written Hostname=nid00015
Blocks Written Hostname=nid00017
Blocks Written Hostname=nid00018
Blocks Written Hostname=nid00019
Blocks Written Hostname=nid00020
Blocks Written Hostname=nid00021
Blocks Written Hostname=nid00022
Blocks Written Hostname=nid00023
Blocks Written Hostname=nid00024
Blocks Written Hostname=nid00025
Blocks Written Hostname=nid00026
Blocks Written Hostname=nid00027
Blocks Written Hostname=nid00028
Blocks Written Hostname=nid00029
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Blocks Written Hostname=nid00041
Blocks Written Hostname=nid00042
Blocks Written Hostname=nid00043
Blocks Written Hostname=nid00044
Blocks Written Hostname=nid00045
Blocks Read Hostname=nid00001
Blocks Read Hostname=nid00002
Blocks Read Hostname=nid00003
Blocks Read Hostname=nid00004
Blocks Read Hostname=nid00005
Blocks Read Hostname=nid00006
Blocks Read Hostname=nid00007
Blocks Read Hostname=nid00008
Blocks Read Hostname=nid00009
Blocks Read Hostname=nid00010
Blocks Read Hostname=nid00011
Blocks Read Hostname=nid00012
Blocks Read Hostname=nid00013
Blocks Read Hostname=nid00014
Blocks Read Hostname=nid00015
Blocks Read Hostname=nid00017
Blocks Read Hostname=nid00018
Blocks Read Hostname=nid00019
Blocks Read Hostname=nid00020
Blocks Read Hostname=nid00021
Blocks Read Hostname=nid00022
Blocks Read Hostname=nid00023
Blocks Read Hostname=nid00024
Blocks Read Hostname=nid00025
Blocks Read Hostname=nid00026
Blocks Read Hostname=nid00027
Blocks Read Hostname=nid00028
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Blocks Read Hostname=nid00033
Blocks Read Hostname=nid00034
Blocks Read Hostname=nid00035
Blocks Read Hostname=nid00036
Blocks Read Hostname=nid00037
Blocks Read Hostname=nid00038
Blocks Read Hostname=nid00039
Blocks Read Hostname=nid00040
Blocks Read Hostname=nid00041
Blocks Read Hostname=nid00042
Blocks Read Hostname=nid00043
Blocks Read Hostname=nid00044
Blocks Read Hostname=nid00045
Data Node Remote bytes Read/Written
20 Bil
0
-20 Bil
-40 Bil
-60 Bil
-80 Bil
-100 Bil
12:36:30
12:37:00
12:37:30
12:38:00
12:38:30
12:39:00
12:39:30
12:40:00
12:40:30
12:41:00
RemoteBytesRead Hostname=nid00001
RemoteBytesRead Hostname=nid00002
RemoteBytesRead Hostname=nid00003
RemoteBytesRead Hostname=nid00004
RemoteBytesRead Hostname=nid00005
RemoteBytesRead Hostname=nid00006
RemoteBytesRead Hostname=nid00007
RemoteBytesRead Hostname=nid00008
RemoteBytesRead Hostname=nid00009
RemoteBytesRead Hostname=nid00010
RemoteBytesRead Hostname=nid00011
RemoteBytesRead Hostname=nid00012
RemoteBytesRead Hostname=nid00013
RemoteBytesRead Hostname=nid00014
RemoteBytesRead Hostname=nid00015
RemoteBytesRead Hostname=nid00017
RemoteBytesRead Hostname=nid00018
RemoteBytesRead Hostname=nid00019
RemoteBytesRead Hostname=nid00020
RemoteBytesRead Hostname=nid00021
RemoteBytesRead Hostname=nid00022
RemoteBytesRead Hostname=nid00023
RemoteBytesRead Hostname=nid00024
RemoteBytesRead Hostname=nid00025
RemoteBytesRead Hostname=nid00026
RemoteBytesRead Hostname=nid00027
RemoteBytesRead Hostname=nid00028
RemoteBytesRead Hostname=nid00029
RemoteBytesRead Hostname=nid00033
RemoteBytesRead Hostname=nid00034
RemoteBytesRead Hostname=nid00035
RemoteBytesRead Hostname=nid00036
RemoteBytesRead Hostname=nid00037
RemoteBytesRead Hostname=nid00038
RemoteBytesRead Hostname=nid00039
RemoteBytesRead Hostname=nid00040
RemoteBytesRead Hostname=nid00041
RemoteBytesRead Hostname=nid00042
RemoteBytesRead Hostname=nid00043
RemoteBytesRead Hostname=nid00044
RemoteBytesRead Hostname=nid00045
RemoteBytesWrite Hostname=nid00001
RemoteBytesWrite Hostname=nid00002
RemoteBytesWrite Hostname=nid00003
RemoteBytesWrite Hostname=nid00004
RemoteBytesWrite Hostname=nid00005
RemoteBytesWrite Hostname=nid00006
RemoteBytesWrite Hostname=nid00007
RemoteBytesWrite Hostname=nid00008
RemoteBytesWrite Hostname=nid00009
RemoteBytesWrite Hostname=nid00010
RemoteBytesWrite Hostname=nid00011
RemoteBytesWrite Hostname=nid00012
RemoteBytesWrite Hostname=nid00013
RemoteBytesWrite Hostname=nid00014
RemoteBytesWrite Hostname=nid00015

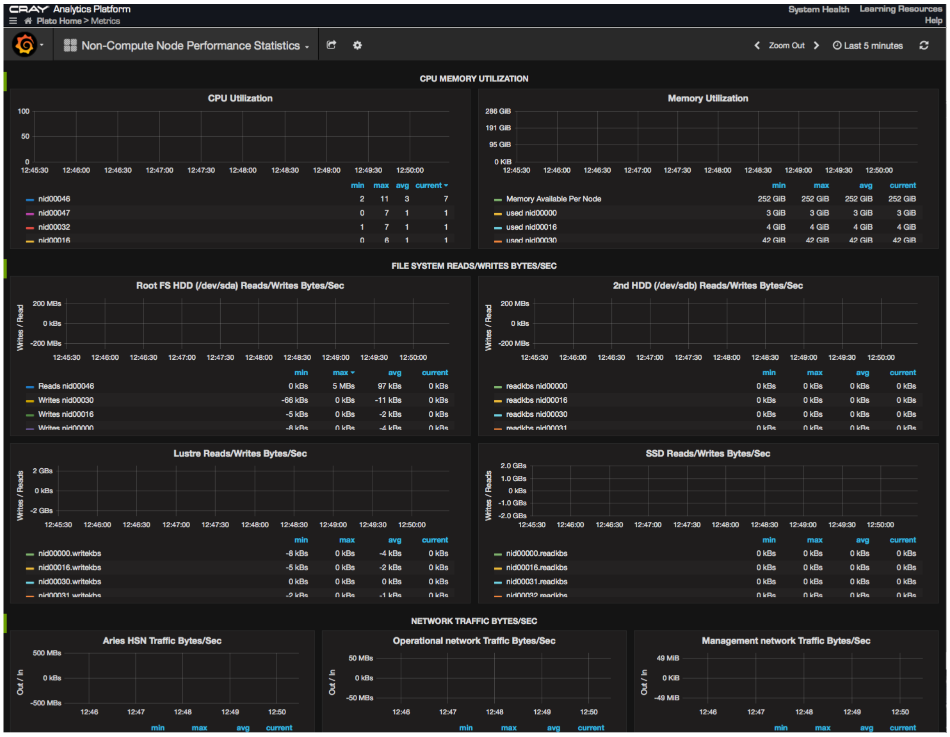
- **Non-compute Node Performance Statistics** - Displays graphs representing statistical data related to network, CPU, and I/O utilization for all the non-compute (I/O and login) nodes of Urika-GX.

  This dashboard contains the following graphs:

  - ○ **CPU MEMORY UTILIZATION**
    - ▪ **CPU utilization** - Displays the overall CPU utilization for I/O and login (non-compute) nodes.
    - ▪ **Memory utilization** - Displays the overall memory (in KB or GB) used by all the I/O and login nodes.
  - ○ **FILE SYSTEM READS/WRITE BYTES/SEC**
    - ▪ **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec (200MB/sec max)** - Displays information about the usage of memory on the root file system by I/O and login nodes.
    - ▪ **2nd Hard Drive (/dev/sdb) Read/Writes** - For I/O and login nodes, displays information about the usage of memory by compute nodes on the secondary hard drive.

        - **Lustre Read/Writes Bytes/Second** - Displays the number of Lustre reads/writes by I/O and login nodes.
        - **SSD Read/Writes Bytes/Second** - Displays the number of SSD reads/writes of the I/O and login nodes.
    - **NETWORK READS/WRITES**
        - **Aries HSN Bytes/Sec In/Out** - Displays the Aries network TCP traffic information for I/O and login nodes. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
        - **Operational network Bytes/sec In/Out** - Displays the overall operational network traffic information for I/O and login nodes.
        - **Management network Bytes/sec In/Out** - Displays the overall management network traffic information for I/O and login nodes.

Figure 19. Non-compute Node Performance Statistics



	min	max	avg	current
nid00046	2	11	3	7
nid00047	0	7	1	1
nid00032	1	7	1	1
nid00016	0	6	1	1

	min	max	avg	current
Memory Available Per Node	252 GiB	252 GiB	252 GiB	252 GiB
used nid00000	3 GiB	3 GiB	3 GiB	3 GiB
used nid00016	4 GiB	4 GiB	4 GiB	4 GiB
used nid00030	42 GiB	42 GiB	42 GiB	42 GiB

	min	max	avg	current
Reads nid00046	0 kBs	5 MBs	97 kBs	0 kBs
Writes nid00030	-66 kBs	0 kBs	-11 kBs	0 kBs
Writes nid00016	-5 kBs	0 kBs	-2 kBs	0 kBs
Writes nid00000	-8 kBs	0 kBs	-4 kBs	0 kBs

	min	max	avg	current
readkbs nid00000	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00016	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00030	0 kBs	0 kBs	0 kBs	0 kBs
readkbs nid00031	0 kBs	0 kBs	0 kBs	0 kBs

	min	max	avg	current
nid00000.writekbs	-8 kBs	0 kBs	-4 kBs	0 kBs
nid00016.writekbs	-5 kBs	0 kBs	-2 kBs	0 kBs
nid00030.writekbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00031.writekbs	-2 kBs	0 kBs	-1 kBs	0 kBs

	min	max	avg	current
nid00000.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00016.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00031.readkbs	0 kBs	0 kBs	0 kBs	0 kBs
nid00032.readkbs	0 kBs	0 kBs	0 kBs	0 kBs

min	max	avg	current

min	max	avg	current

min	max	avg	current

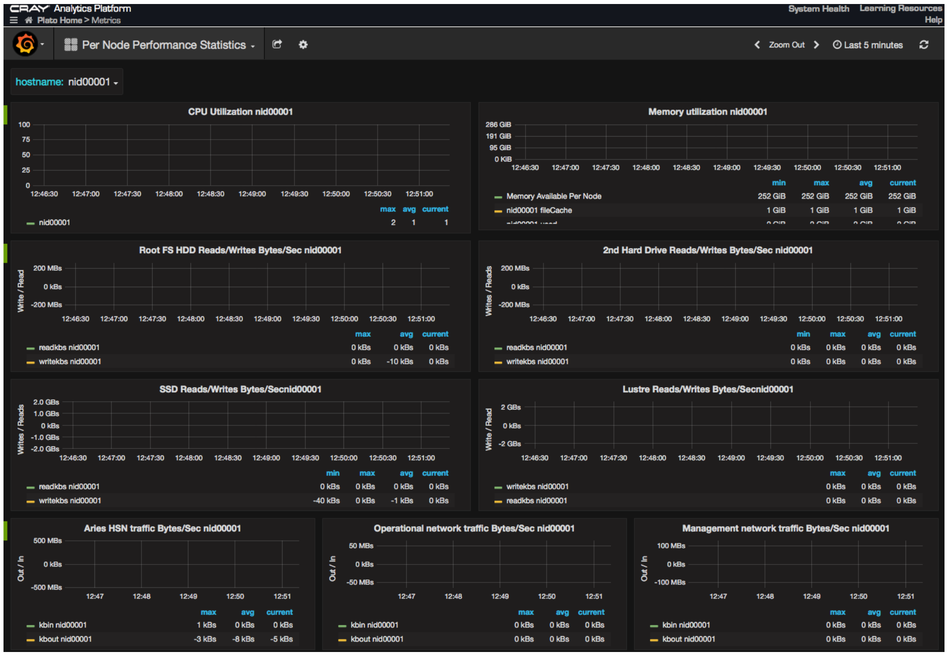
- **Per Node Performance Statistics** - Displays graphs representing statistical data related to network, CPU, and I/O utilization for individual Urika-GX nodes. The node's hostname can be selected using the **hostname** drop down provided on the UI.

  This dashboard contains the following graphs:

    - **CPU utilization** - Displays the CPU utilization for the selected node.
    - **Memory utilization** - Displays the memory (in KB or GB) used by the selected node.
    - **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec**- Displays the HDD SDA utilization for the selected node.
    - **2nd Hard Drive (/dev/sdb) Read/Writes** - Displays the HDD SDB utilization for the selected node.
    - **SSD Read/Writes Bytes/Second** - Displays the number of SSD reads/writes per second for each node.

- ○ **Lustre Read/Writes Bytes/Second -** Displays the number of Lustre reads/writes by the selected node.
- ○ **Aries HSN Bytes/Sec In/Out -** Displays the Aries network TCP traffic information for the selected node. Note that non-TCP Aries traffic, including most traffic generated by CGE, is not shown here.
- ○ **Operational network Bytes/sec In/Out -** Displays the overall operational network traffic information for the selected node.
- ○ **Management network Bytes/sec In/Out -** Displays the overall management network traffic information for the selected node.
- ○ **NFS HDFS Lustre Percentage Used -** Displays the percentage of NFS, HDFS and Lustre used by the selected node.
- ○ **File System Percent Used -** Displays the percentage of file system used by the selected node.

Figure 20. Per Node Performance Statistics



CPU Utilization nid00001

	max	avg	current
nid00001	2	1	1

Memory utilization nid00001

	min	max	avg	current
Memory Available Per Node	252 GiB	252 GiB	252 GiB	252 GiB
nid00001 fileCache	1 GiB	1 GiB	1 GiB	1 GiB

Root FS HDD Reads/Writes Bytes/Sec nid00001

	max	avg	current
readkbs nid00001	0 kBs	0 kBs	0 kBs
writekbs nid00001	0 kBs	-10 kBs	0 kBs

2nd Hard Drive Reads/Writes Bytes/Sec nid00001

	min	max	avg	current
readkbs nid00001	0 kBs	0 kBs	0 kBs	0 kBs
writekbs nid00001	0 kBs	0 kBs	0 kBs	0 kBs

SSD Reads/Writes Bytes/Secnid00001

	min	max	avg	current
readkbs nid00001	0 kBs	0 kBs	0 kBs	0 kBs
writekbs nid00001	-40 kBs	0 kBs	-1 kBs	0 kBs

Lustre Reads/Writes Bytes/Secnid00001

	max	avg	current
writekbs nid00001	0 kBs	0 kBs	0 kBs
readkbs nid00001	0 kBs	0 kBs	0 kBs

Aries HSN traffic Bytes/Sec nid00001

	max	avg	current
kbin nid00001	1 kBs	0 kBs	0 kBs
kbout nid00001	-3 kBs	-8 kBs	-5 kBs

Operational network traffic Bytes/Sec nid00001

	max	avg	current
kbin nid00001	0 kBs	0 kBs	0 kBs
kbout nid00001	0 kBs	0 kBs	0 kBs

Management network traffic Bytes/Sec nid00001

	max	avg	current
kbin nid00001	0 kBs	0 kBs	0 kBs
kbout nid00001	0 kBs	0 kBs	0 kBs

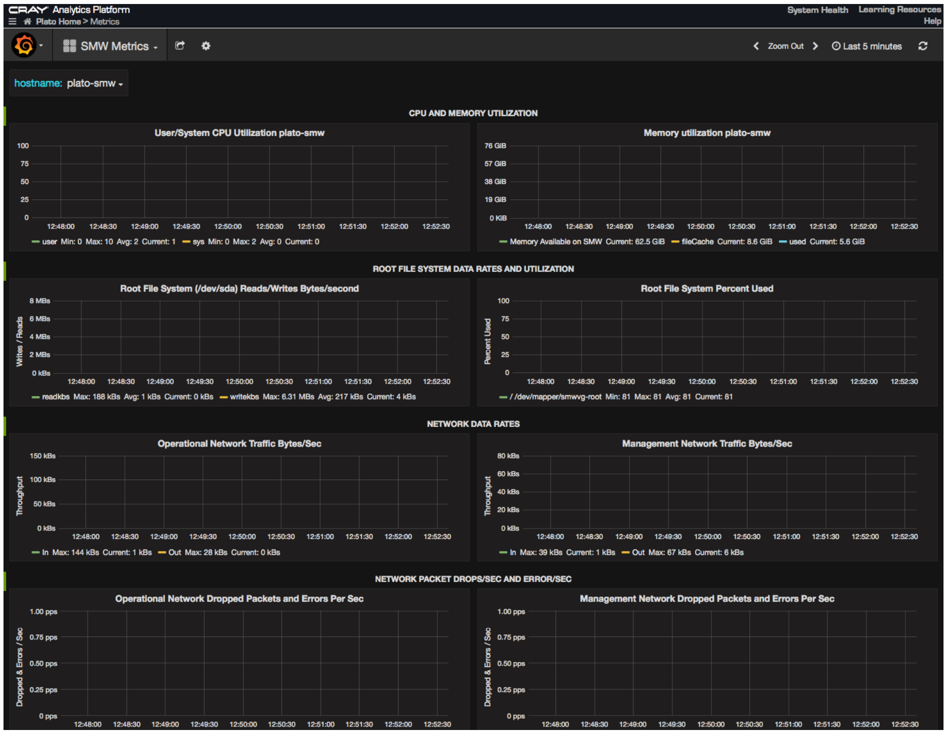
- **SMW Metrics/** - Displays graphs representing statistical data related to SMW's resources, such as the CPU's memory utilization, root file system, etc.

  This dashboard contains the following sections:

  - ○ **CPU and MEMORY UTILIZATION** - Displays the memory consumption by the SMW's CPU.
    - ▪ User/System CPU Utilization *`MACHINE_NAME`*
    - ▪ Memory utilization
  - ○ **Root File System Data Rates and Utilization** - Displays memory usage and data rate of the SMW's root file system.
    - ▪ **Root File System Hard Drive (/dev/sda) Reads/Writes Bytes/Sec** - Displays information about the usage of memory on the root file system of the SMW
    - ▪ **Root File System Percent Used** - Displays the percentage for used SMW root file system space.
  - ○ **NETWORK DATA RATES**

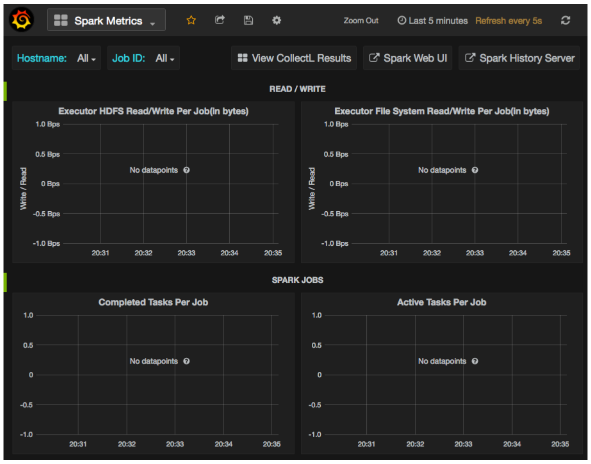
        - **Operational Network Traffic Bytes/sec** - Displays the operational network's data rate.
        - **Management Network Traffic Bytes/sec** - Displays the management network's data rate.
    - **NETWORK PACKET DROPS/SEC AND ERRORS/SEC**
        - **Operational Network Dropped and Errors Per Sec** - Displays the number of dropped packets and errors per second for the operational network.
        - **Management Network Dropped and Errors Per Sec** - Displays the number of dropped packets and errors per second for the operational network.

Figure 21. SMW Metrics Dashboard


CRAY Analytics Platform
Plato Home > Metrics
System Health
Learning Resources
Help
SMW Metrics
Zoom Out
Last 5 minutes
hostname: plato-smw
CPU AND MEMORY UTILIZATION
User/System CPU Utilization plato-smw
100
75
50
25
0
12:48:00
12:48:30
12:49:00
12:49:30
12:50:00
12:50:30
12:51:00
12:51:30
12:52:00
12:52:30
user Min: 0 Max: 10 Avg: 2 Current: 1
sys Min: 0 Max: 2 Avg: 0 Current: 0
Memory utilization plato-smw
76 GiB
57 GiB
38 GiB
19 GiB
0 KiB
Memory Available on SMW Current: 62.5 GiB
fileCache Current: 8.6 GiB
used Current: 5.6 GiB
ROOT FILE SYSTEM DATA RATES AND UTILIZATION
Root File System (/dev/sda) Reads/Writes Bytes/second
Writes / Reads
8 MBs
6 MBs
4 MBs
2 MBs
0 kBs
readkbs Max: 188 kBs Avg: 1 kBs Current: 0 kBs
writekbs Max: 6.31 MBs Avg: 217 kBs Current: 4 kBs
Root File System Percent Used
Percent Used
100
75
50
25
0
/ /dev/mapper/smwvg-root Min: 81 Max: 81 Avg: 81 Current: 81
NETWORK DATA RATES
Operational Network Traffic Bytes/Sec
Throughput
150 kBs
100 kBs
50 kBs
0 kBs
In Max: 144 kBs Current: 1 kBs
Out Max: 28 kBs Current: 0 kBs
Management Network Traffic Bytes/Sec
Throughput
80 kBs
60 kBs
40 kBs
20 kBs
0 kBs
In Max: 39 kBs Current: 1 kBs
Out Max: 67 kBs Current: 6 kBs
NETWORK PACKET DROPS/SEC AND ERROR/SEC
Operational Network Dropped Packets and Errors Per Sec
Dropped & Errors / Sec
1.00 pps
0.75 pps
0.50 pps
0.25 pps
0 pps
Management Network Dropped Packets and Errors Per Sec
Dropped & Errors / Sec
1.00 pps
0.75 pps
0.50 pps
0.25 pps
0 pps

- **Spark Metrics** - Displays graphs representing statistical data related to Spark jobs. This dashboard also contains links for viewing the **Spark Web UI** and **Spark History Server**.

Figure 22. Grafana Spark Metrics Dashboard



Graphs displayed on this dashboard are grouped into the following sections:

- **READ/WRITE**: Displays statistics related to the file system statistics of a Spark executor. Results in the graphs of this section are displayed per node for a particular Spark Job. The Y-axis displays the number in bytes, whereas the X-axis displays the start/stop time of the task for a particular Spark Job.

  This section contains the following graphs:

  - **Executor HDFS Read/Write Per Job (in bytes)**: Reading and writing from HDFS.
  - **Executor File System Read/Write Per Job (in bytes)**: Reading and writing from a File System.

- **SPARK JOBS**: Displays statistics related to the list of executors per node for a particular Spark Job. The Y-axis displays the number of tasks and X-axis displays the start/stop time of the task for a particular Spark Job.

  This section contains the following graphs:

  - **Completed Tasks Per Job**: The approximate total number of tasks that have completed execution.
  - **Active Tasks Per Job**: The approximate number of threads that are actively executing tasks.
  - **Current Pool Size Per Job**: The current number of threads in the pool.
  - **Max Pool Size Per Job**: The maximum allowed number of threads that have ever simultaneously been in the pool.

- **DAG Scheduler** - Displays statistics related to Spark's Directed Acyclic Graphs.

  This section contains the following graphs:

  - **DAG Schedule Stages** - This graph displays the following types of DAG stages:
    - Waiting Stages: Stages with parents to be computed.
    - Running Stages: Stages currently being run
    - Failed Stages: Stages that failed due to fetch failures (as reported by `CompletionEvents` for `FetchFailed` end reasons) and are going to be resubmitted.
  - **DAG Scheduler Jobs** - This graph displays the following types of DAG scheduler jobs:
    - All Jobs - The number of all jobs

        - Active Jobs - The number of active jobs
    - **DAG Scheduler Message Processing Time** - This graph displays the processing time of the DAG Scheduler.
- **JVM Memory Usage** - The memory usage dashboards represent a snapshot of used memory.
    - **JVM Memory Usage - init**: Represents the initial amount of memory (in bytes) that the Java virtual machine requests from the operating system for memory management during start up. The Java virtual machine may request additional memory from the operating system and may also release memory to the system over time. The value of `init` may be undefined.
    - **JVM Memory Usage - Used**: Represents the amount of memory currently used (in bytes).
    - **JVM Memory Usage - Committed**: Represents the amount of memory (in bytes) that is guaranteed to be available for use by the Java virtual machine. The amount of committed memory may change over time (increase or decrease). The Java virtual machine may release memory to the system and committed could be less than init. committed will always be greater than or equal to used.
    - **JVM Memory Usage - Max**: Represents the maximum amount of memory (in bytes) that can be used for memory management. Its value may be undefined. The maximum amount of memory may change over time if defined. The amount of used and committed memory will always be less than or equal to max if max is defined. A memory allocation may fail if it attempts to increase the used memory such that `used > committed` even if `used <= max` is still true, for example, when the system is low on virtual memory.
    - **JVM Heap Usage**: Represents the maximum amount of memory used by the JVM heap space
    - **JVM Non-Heap Usage**: Represents the maximum amount of memory used by the JVM non-heap space

4.4 Update InfluxDB Security Settings

Prerequisites

This procedure requires root privileges.

About this task

The default configuration for InfluxDB as shipped with Urika-GX is:

1. InfluxDB UI on socket `login2:8083` is disabled
2. No authorization is enabled.

This means that any user on login node 2 can call the `/bin/influx` command and modify databases. To restrict this to only a privileged user, the admin needs to create an authorized user and enable basic authentication for InfluxDB.

⚠ **CAUTION:** After creating the privilege user the Grafana data sources **must** to be updated to provide the name and password for Grafana queries to InfluxDB to succeed.

To enable add an authorized user and enable basic authentication:

Procedure

1. Log on to login2 (login node 2) and become root.

2. Connect to InfluxDB and add a user named `admin` user and set its password.

   ```
   # /bin/influx
   Visit https://enterprise.influxdata.com to register for updates, InfluxDB
   server management, and monitoring.
   Connected to http://localhost:8086 version 0.12.2
   InfluxDB shell 0.12.2
   > create user admin with password 'admin' with all privileges
   > show users
   user    admin
   admin    true
   ```

3. Edit the `/etc/influxdb/influxdb.conf` file as root.

   ```
   # vi /etc/influxdb/influxdb.conf
   < change auth to be true, save file, exit >
   # systemctl restart influxdb
   ```

   At this point Grafana dashboards will still work because Grafana is shipped with credentials for InfluxDB to be user `admin` with `admin` as the password. If the privileged user differs from these defaults Grafana queries will fail and graphs in dashboards will not work. To resolve this issue, log on to Grafana as the admin user and open each data source, edit the InfluxDB details, updating the user and password to match that of the privileged InfluxDB user.

   For more information, visit *https://docs.influxdata.com/*.

4.5 Update the InfluxDB Data Retention Policy

Prerequisites

Ensure that the InfluxDB service is running using the `urika-state` command. For more information, see the `urika-state` man page.

About this task

The data retention policy for InfluxDB defaults to infinite, i.e. data is never deleted. As a result, Spark and Hadoop Grafana dashboards may take longer to load and InfluxDB may take up more space than necessary. To reduce the amount of space being used by InfluxDB, the data retention policy for each database needs to be reduced, as described in this procedure. Reducing the data retention policy for Spark and Hadoop databases can reduce the load time of the Spark and Hadoop Grafana dashboards.

Procedure

1. Log on to login2 and become root.

2. Switch to the `/var/lib/influxdb/data` directory.

```
# cd /var/lib/influxdb/data
```

3. Use the `du` command to show how much space being used.

   The sizes below are shown as examples. Actual sizes on the system may vary.

```
$ du -sh *
14G    Cray Urika GX
1.5G      CrayUrikaGXHadoop
906M      CrayUrikaGXSpark
21M    _internal
#
```

4. Connect to InfluxDB to view the current data retention policy.

```
# /bin/influx
Visit https://enterprise.influxdata.com to register for updates, InfluxDB
server management, and monitoring.
Connected to http://localhost:8086 version 0.12.2
InfluxDB shell 0.12.2
> show retention policies on "Cray Urika GX"
name    duration    shardGroupDuration    replicaN    default
default    0               168h0m0s        1        true
```

5. Update the data retention policy according to requirements.

   In this example the data retention duration is changed from 0 (forever) to 2 weeks (504 hours).

```
> alter retention policy default on "Cray Urika GX" Duration 2w
> show retention policies on "Cray Urika GX"
name    duration    shardGroupDuration    replicaN    default
default    504h0m0s    24h0m0s            1        true
> exit
```

   The change will take a while to be applied. The default is 30 minutes.

6. Verify that the data retention change has taken effect

```
# du -sh *
3G    Cray Urika GX
1.5G    CrayUrikaGXHadoop
906M    CrayUrikaGXSpark
21M    _internal
```

4.6 Grafana's Configuration Settings

Grafana's configuration options can be specified using environment variables or the `grafana.ini` configuration file, which is located at `/etc/grafana/`. This file contains default settings that Urika-GX ships with, and can be modified as needed. Options in this configuration file can be overridden using environment variables.

Grafana needs to be restarted for the changes in the `grafana.ini` file to take effect. To do so, log onto login2 (login node 2), become root or use `sudo`, and then execute the following command:

```
# systemctl restart grafana-server
```

In addition, the metrics that Grafana displays on the UI are retrieved from the `collectl.conf` file, which specifies the list of metrics that need to be collected from each node and stored in InfluxDB. By default, a subset of the list of collected metrics is displayed on the Grafana dashboard. Users with admin or editor privileges can create/modify dashboards to update the default list of displayed metrics if needed. The `collectl.conf` configuration file contains instructions for making such updates.

4.7 Change the Default Timezone Displayed on Grafana

Prerequisites

This procedure requires administrative privileges.

About this task

Urika-GX ships with UTC as the default timezone displayed on the Grafana UI. This procedure can be used to change the timezone for newly created dashboards or copies of the predefined dashboards shipped with the system.

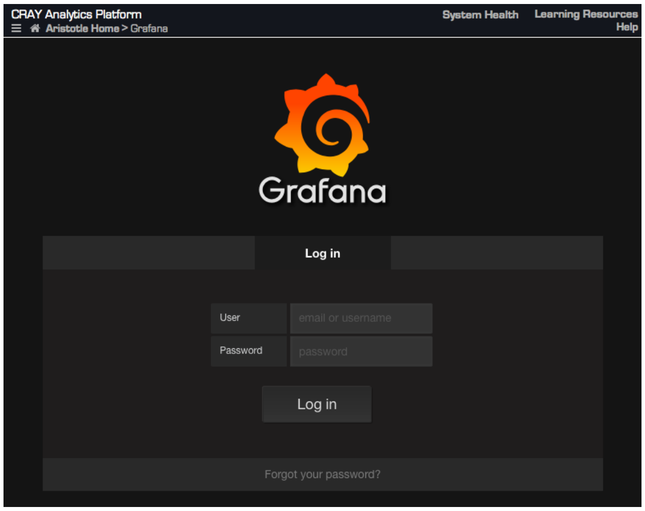
> **NOTE:** The timezone for the default set of Dashboards shipped with the system cannot be changed. Since the time displayed on the Grafana UI uses the browser's timezone and that displayed on the Spark History server's UI uses the Urika-GX system's timezone, the timezones displayed on the two UIs may not be the same.

Procedure

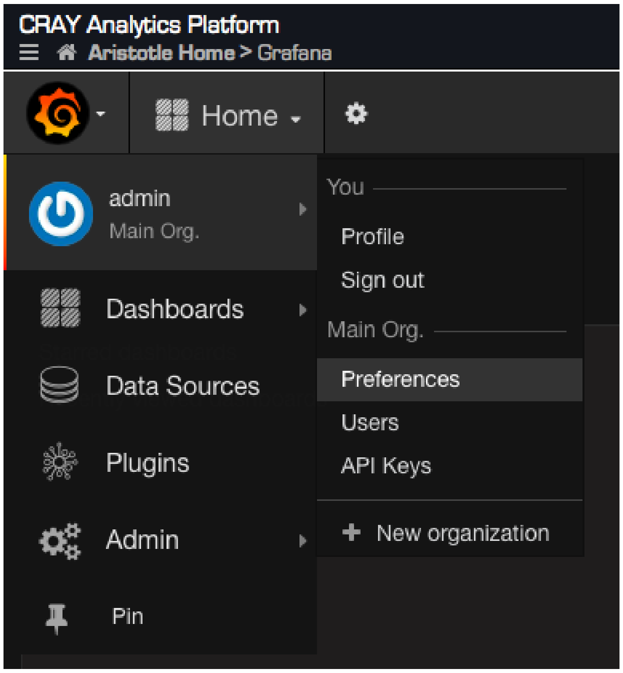
1. Access the Grafana UI using the **Urika-GX Applications Interface** by pointing a browser at `http://` *`hostname`*`-login1` (which is the recommended way of access) or at http://*`hostname`*-login2`:3000`.

2. Log on to Grafana as an admin.

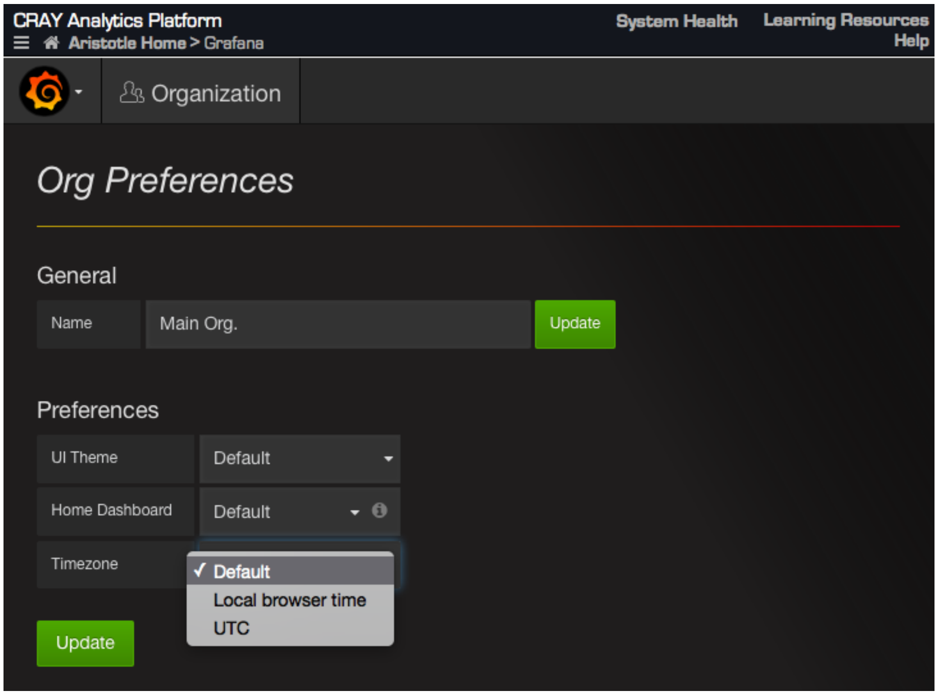
   Figure 23. Grafana Login Screen



3. Select Home **>admin > Preferences**



4. Use the **Timezone** drop down on the **Org Preferences** page to select the timezone of choice.



Org Preferences

General

Name: Main Org.

Update

Preferences

UI Theme: Default

Home Dashboard: Default

Timezone: ✓ Default | Local browser time | UTC

Update

4.8 Create a New Grafana Dashboard

Prerequisites

This procedure requires administrative privileges.

About this task

In addition to the default set of dashboards, administrators can add additional dashboards to the Grafana UI, as described in the following instructions.

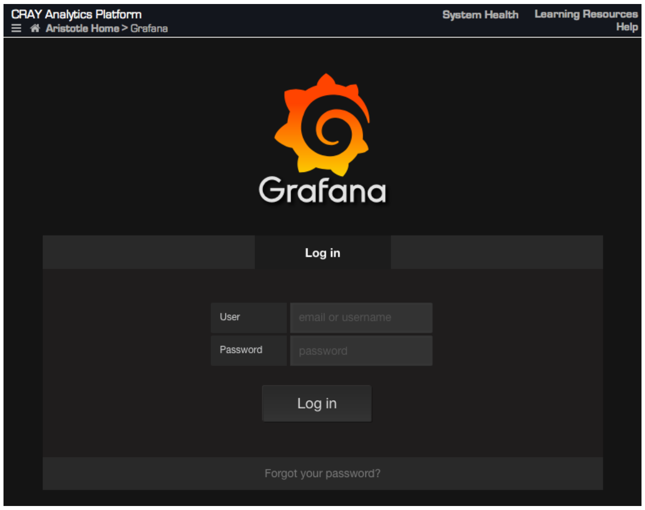
> **IMPORTANT:** New graphs can be created/added by user of any role type. However, those added by a user with the role of a 'Viewer' persist only for the current session and will be deleted once the user logs out.

Procedure

1. Access the Grafana UI using the **Urika-GX Applications Interface** by pointing a browser at `http://`*`hostname`*`-login1` (which is the recommended way of access) or at http://*`hostname`*-login2`:3000`.

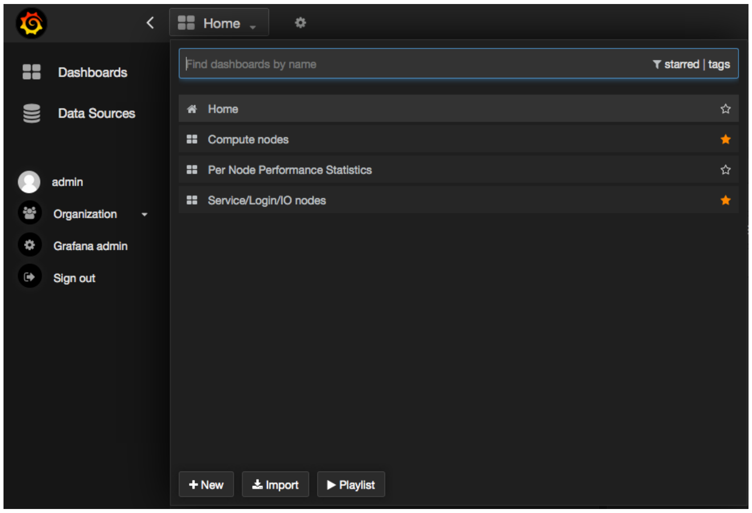
2. Log on to Grafana by entering LDAP credentials, or credentials of the default Grafana account (username: `admin`, password: `admin`) to log on to Grafana.

   Figure 24. Grafana Login Screen

3. Select **Home** from the top of the interface and then select the **New** button from the displayed pop-up.

Figure 25. New Dashboard Pop-up

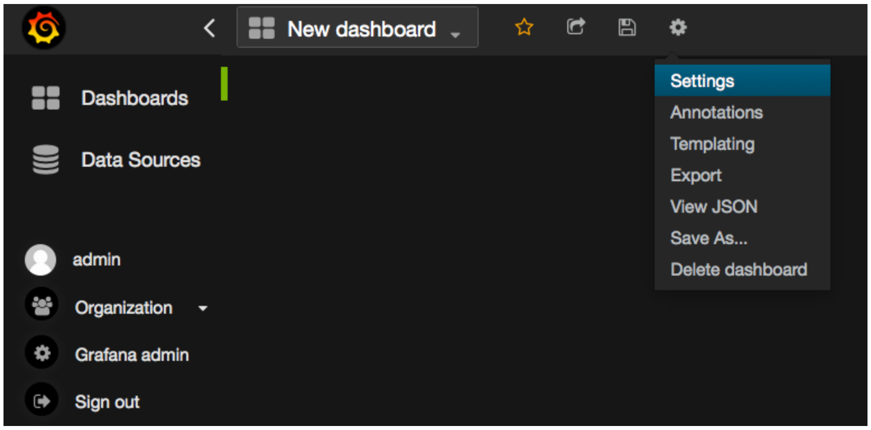


4. Select **Dashboard** from the left navigation menu

5. Add panels/graphs/rows to the new dashboard and customize as needed.

6. Optional: Update the dashboard's default settings using **Settings** from the configuration gear at the top of the interface.

   Figure 26. Select Grafana Settings



4.9 Add a New Graph to the Grafana Dashboard

Prerequisites

This procedure requires administrative privileges.

About this task

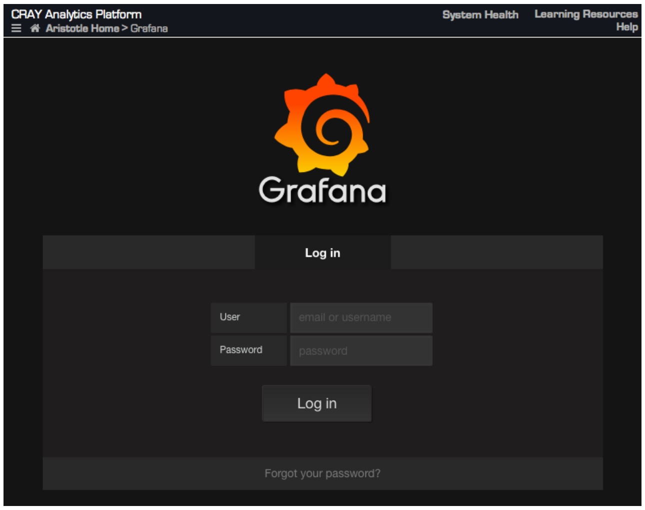
In addition to the default set of panels, administrators can add additional panels to the **Dashboard** of the Grafana UI, as described in the following instructions.

Procedure

1. Access the Grafana UI using the **Urika-GX Applications Interface** by pointing a browser at `http://`*`hostname`*(which is the recommended method) or at http://*`hostname`*`:3000`.

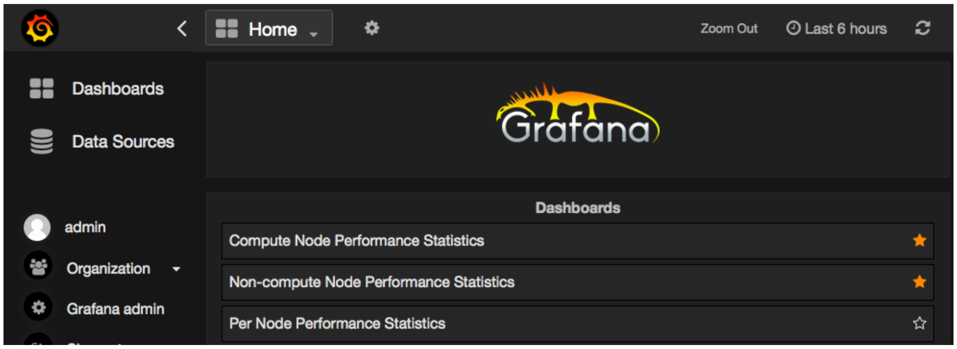
2. Log on to Grafana by entering LDAP credentials, or credentials of the default Grafana account (username: `admin`, password: `admin`) to log on to Grafana.

   Figure 27. Grafana Login Screen



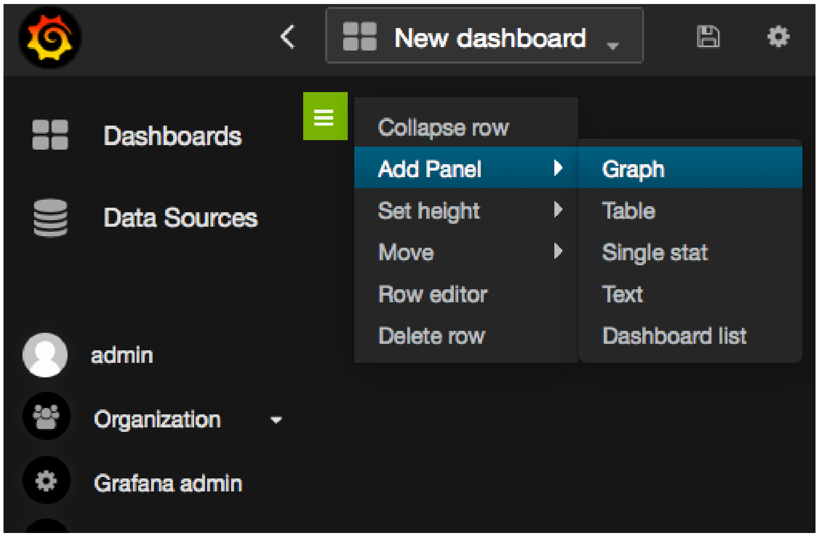
3. Select the dashboard that the new graph needs to be added to.

   Figure 28. Default Grafana UI on Urika-GX


Home
Zoom Out
Last 6 hours
Dashboards
Data Sources
admin
Organization
Grafana admin
Grafana
Dashboards
Compute Node Performance Statistics
Non-compute Node Performance Statistics
Per Node Performance Statistics

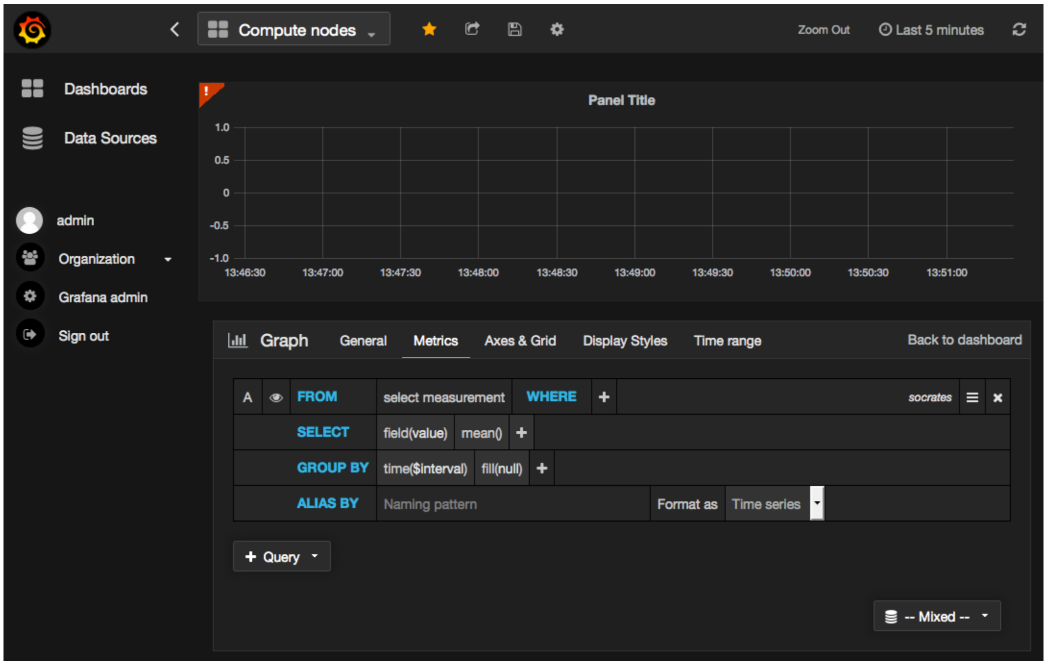
4. Select **Add Panel** > **graph** from the green menu on the left side of the Dashboard.

Figure 29. Add a New Graph to Grafana Dashboard



5. Click on the title of the new panel and select **edit** as shown in the following figure:

Figure 30. Edit a Grafana Panel



FROM select measurement WHERE +

SELECT field(value) mean() +

GROUP BY time($interval) fill(null) +

ALIAS BY Naming pattern Format as Time series

6. Enter a title for the graph in the **Title** field of the **General** tab and optionally specify a span and/or height for the graph.

7. Specify/select metrics using UI elements.

8. Optional: Click on the **Axes & Grid** and/or **Display Styles** tabs for specifying formatting options for the graph.

4.10 Start InfluxDB Before Hadoop Services

Prerequisites

This procedure requires root privileges.

About this task

If the **Hadoop Cluster Metrics** Grafana dashboard takes too long to populate, it may because the InfluxDB service was started after Hadoop services. Follow the instructions documented in this procedure to troubleshoot this issue.

Procedure

1. Log on to the SMW as root.
2. Stop YARN.

   ```
   # urika-stop --service yarn
   ```

3. Stop the HDFS services.

   ```
   # urika-stop --service hdfs
   ```

4. Verify that the InfluxDB service is running or start it if it is not already started.

   ```
   # urika-start --service influxdb
   ```

5. Start the HDFS services.

   ```
   # urika-start --service hdfs
   ```

6. Start YARN.

   ```
   # urika-start --service yarn
   ```

7. Refresh the browser to load the Hadoop Clusters Grafana dashboard again.

4.11 Monitor Subrack Attributes

Prerequisites

This procedure requires root access.

About this task

Access to the iSCB module is made through an SSH password-less login. Once logged on, the iSCB `status` command can be used to monitor the physical attributes of the sub-rack, such as the power supply, amperage, fan status, and temperature.

Procedure

1. Log on to the System Management Workstation (SMW) as root.
2. SSH to the iSCB associated with the sub-rack under consideration.

   In the following, the iSCB associated with sub-rack `0`, having a component ID of `r0s0i0` is used as an example.

   ```
   # ssh r0s0i0
   ```

3. Execute the iSCB status command to retrieve the physical attributes of the sub-rack.

   ```
   # iscb status
   iSCB Status
      Node:  00  01  02  03  04  05  06  07  08  09  10  11  12  13  14  15 Total
     Power:   *   *   *   *   *   *   *   *   *   *   *   *   *           *
    ID-LED:   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
   Console:
       BMC:   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
   Temp 'C: -65 -65 -64 -61 -63 -64 -61 -62 -63 -64 -65 -62 -64         -63
   Watt  W:  94  86 102  98  78  83  97  87  96 107  92  86 107          87  1300

       PSU:        00        01        02        03        04        05     Total
     Power:        on        on        on        on        on        on
    Status:        ok        ok        ok        ok        ok        ok
      Temp:      22'C      24'C      23'C      23'C      23'C      23'C
       Fan: 6208,5280 6208,5280 6144,5280 6176,5248 6144,5248 6176,5312
       12V:       22A       21A       21A       21A       21A       21A      127A
     AC In:      211V      210V      210V      208V      207V      207V
      Watt:      300W      314W      308W      310W      310W      312W     1854W

       CFU:        00        01        02        03        04        05
    Status:        ok        ok        ok        ok        ok        ok
      Fan1:   3522rpm   3513rpm   3529rpm   3472rpm   3506rpm   3483rpm
      Fan2:   3540rpm   3513rpm   3538rpm   3486rpm   3529rpm   3492rpm
      Duty:       60%       60%       60%       60%       60%       60%
   ok
   ```

4.12 Analyze Node Memory Dump Using the `kdump` and `crash` Utilities on a Node

The `kdump` and `crash` utilities may be used to analyze the memory on any Urika®-GX compute node. The `kdump` command is used to dump node memory to a file. `kdump` is the Linux kernel's built-in crash dump mechanism. In the event of a kernel crash, `kdump` creates a memory image (also known as `vmcore`) that can be analyzed for the purposes of debugging and determining the cause of a crash. Dumped image of the main memory, exported as an Executable and Linkable Format (ELF) object, can be accessed either directly during the handling of a kernel crash (through /proc/vmcore), or it can be automatically saved to a locally accessible file system, to a raw device, or to a remote system accessible over the network. kdump is configured to automatically generate vmcore crash dumps on node crashes. These dumps can be found on the node in the crash partition, mounted to nid000*XX*:/mnt/crash/var/crash/*datestamp*/*, where *XX* ranges from 00-15 for a rack containing a single sub-rack, 00-31 for a rack containing 2 sub-racks, and 00-47 for a rack containing 3 sub-racks. After kdump completes, the crash utility can be used on the dump file generated by kdump. The xtdumpsys SMW utility can be used to extract vmcores from the cluster and store them on the SMW for crash analysis as well.

> **NOTE:** Cray recommends executing the kdump utility only if a node has panicked or is hung, or if a dump is requested by Cray.
>
> On the Urika-GX compute nodes, kdump's system facing configuration files are set to have a kdump file stored on a local hard drive partition that is mounted as /mnt/crash so the kernel crash dumps are store in /mnt/crash/var/crash. Urika-GX has two local HDDs. kdump stores the vmcore collections on one of these drives. It is advised not to modify the /etc/kdump.conf or /etc/sysconfig/kdump configuration files.

Using kdump

- Starting kdump - Log on to the desired node and use the following command to start the kdump utility:

  ```
  $ service kdump start
  ```

- Stopping kdump - Log on to the desired node and use the following command to stop the kdump utility:

  ```
  $ service kdump stop
  ```

- Checking the status of kdump - Log on to the desired node and use the following command to check the status of the kdump utility:

  ```
  $ service kdump status
  ```

For more information, see the kdump(8) and crash(8) man pages.

4.13 Use the urika-check-platform Command

Prerequisites

This procedure requires root access to the System Management Workstation (SMW).

About this task

The urika-check-platform command can be used to retrieve various pieces of information.

Procedure

1. Log on to the SMW as root.

2. Execute the urika-check-platform command, as shown in the following examples.

   - Various HSS checks, Rack controller, dANCs, xtcli status, and xtcablecheck using the --hss option:

```
# urika-check-platform --hss
```

- Get revision info of Rack Controller, iSCBs, dANCs, and Compute Nodes using the `--rev` option:

  ```
  # urika-check-platform --rev
  ```

  If nodes are not listed then revision information is unavailable. Make sure `/global/cray/mfg/self_update_fw/intel_fw_chk.sh` is installed properly on each node.
- Check if Aries is routed:

  ```
  # urika-check-platform --aries
  ```
- Get OpenStack data about each individual node using the `--open-stack` option:

  ```
  # urika-check-platform --open-stack
  ```
- Test node connectivity using the `--testnodes` option. First perform the ping test. If the nodes can be pinged, then ssh is attempted. If ssh succeeds then the Aries IP is resolved and displayed next to the hostname with the subnet mask:

  ```
  # urika-check-platform --testnodes
  ```
- Display all of the aforementioned sections together by executing the command without any options:

  ```
  # urika-check-platform
  ```

For more information, see the `urika-check-platform` man page.

5 Logging

5.1 Urika-GX System Management Log File Locations

Table 12. System Log File Locations

Application/ Service	Associated Component	Log File Location	Additional Notes
Logs of the dual Aries Network Card (dANC) `syslog` and Hardware Supervisory System (HSS) daemons	dANC	Located on the System Management Workstation (SMW) at location: `/var/opt/cray/log/controller/`*`dancname`*	`syslogs`, forwarded by LLM
Logs of the Rack Controller (RC) `syslog` and HSS	RC	Located on the SMW at: `/var/opt/cray/log/controller/`*`rackname`*	`syslogs`, forwarded by LLM
Logs of SMW HSS monitor daemons	SMW	Located at `var/opt/cray/log/p0-default` on the SMW. The following log files are stored in this directory: ● `console-`*`date`* - Contains node console logs ● `consumer-`*`date`* - Contains ERD event collector (`xtconsumer`) logs ● `netwatch-`*`date`* - Contains logs generated by the `xtnetwatch` command ● `nlrd-`*`date`* - Contains logs generated by the `xtnlrd` command ● `pcimon-`*`date`* - Contains PCIe monitor logs ● hwerrlogd-*`date`* -Contains logs generated by the `hwerrlogd` command In the above list, *`date`* is the date stamp with a format of *`yyyymmdd`*.	All HSS daemons and processes log here, except `xtremoted` and `erd`. Logs within this directory are rotated daily.
SMW `syslogs` logs	SMW	Located on the SMW at: `/var/opt/cray/log/`*`smwmessages-datestamp`*	SMW `syslogs`, rotated daily

Application/ Service	**Associated Component**	**Log File Location**	**Additional Notes**
Logs generated erd/erdh event logs	SMW	Located on the System Management Workstation (SMW) at: `/var/opt/cray/log/events-`*`datestamp`*	`capmc` remote agent. Logs a level up from HSS daemons. These logs are rotated daily.
Logs generated by the State Manager, ERD, ERFS, NID mgr, `xtremoted` stdout/stderr	SMW	Located on the SMW at: `/var/opt/cray/log/`*`daemon`*`-`*`datestamp`*	State Manager, ERD, ERFS, NID mgr,`xtremoted` stdout/ stderr. Rotated daily.
HSS command logs	SMW	Located on the SMW at: `/var/opt/cray/log/commands`	Log of all HSS commands executed, with time stamps, exit status, etc. Rotated daily.
`rsyslog` logs	SMW	Located on the SMW at: `/var/opt/cray/log/logsystem-`*`datestamp`*	Log of `rsyslog` actions. Rotated daily.
`xtdiscover` logs	SMW	Located on the SMW at: `/var/opt/cray/log/xtdiscover/log.`*`datestamp`*	`xtdiscover` log files. Rotated daily, or when `xtdiscover` is run, whichever is less often.
Heat	OpenStack	Primary logs located on the SMW at: `/var/log/heat/heat-engine.log`, whereas additional logs are located on the SMW at:`/var/log/heat/heat-api.log`	Heat Orchestration Template processing logs. Most useful for initial diagnosis of the reason that a node deployment

Application/ Service	Associated Component	Log File Location	Additional Notes
			failed (as reported by the `heat stack-list` command.
Ironic	OpenStack	Primary logs located on the SMW at: `/var/log/ironic/ironic-conductor.log`, whereas additional log files are located on the SMW at: `/var/log/ironic/ironic-api.log`	OpenStack Ironic deployment log. Most useful for reviewing the power management and deployment operations for a specific node by UUID, as identified in the `iroinc node-list` report
Nova	OpenStack	Primary logs located on the SMW at: `/var/log/ironic/nova-conductor.log`. Additional logs located under the same directory include: ● `nova-consoleauth.log` ● `nova-manage.log` ● `nova-scheduler.log` ● `nova-compute.log` ● `nova-cert.log`	NA
RabbitMQ	OpenStack RabbitMQ server	Located on the SMW at: `/var/log/rabbitmq`	NA
OpenVSwitch	OpenStack OpenVSwitch server	Located on the SMW at: `/var/log/openvswitch`	NA
Neutron	OpenStack	Located on the SMW at: `/var/log/neutron`. Some helpful logs include: ● `neutron-server.log` ● `neutron-l3-agent.log` ● `neutron-openvswitch-agent.log`	NA

Application/ Service	Associated Component	Log File Location	Additional Notes
		- `neutron-metadata-agent.log` - `neutron-dhcp-agent.log` - `neutron-ns-metadata-proxy-*.log`	
Grafana	Grafana	`/var/log/grafana/grafana.log` on login node 2	This is a user visible UI.

5.2 Analytic Applications Log File Locations

Log files for a given service are located on the node(s) the respective service is running on, which can be identified using the `urika-inventory` command. For more information, see the `urika-inventory` man page.

Table 13. Analytics Applications Log File Locations

Application/Script	Log File Location
Mesos	`/var/log/mesos`
Marathon	`/var/log/messages`
HA Proxy	`/var/log/haproxy.log`
Mesos frameworks: - Marathon - Spark	*/var/log/mesos/agent/slaves/*. Within this directory, a framework's output is placed in files called `stdout` and `stderr`, in a directory of the form `slave-`*X*`/fw-`*Y*`/`*Z*, where *X* is the slave ID, *Y* is the framework ID, and multiple subdirectories *Z* are created for each attempt to run an executor for the framework. These files can also be accessed via the web UI of the slave daemon. The location of the Spark logs is determined by the cluster resource manager that it runs under, which is Mesos on Urika-GX.
Grafana	`/var/log/grafana/grafana.log`
InfluxDB	`/var/log/influxdb/influxd.log`
collectl	collectl does not produce any logging information. It uses logging as a mechanism for storing metrics. These metrics are exported to InfluxDB. If collectl fails at service start time, the cause can be identified by executing the `collectl` command on the command line and observing what gets printed. It will not complain if the InfluxDB socket is not available.
Hadoop	The following daemon logs appear on the node they are running on: - `/var/log/hadoop/hdfs/hadoop-hdfs-namenode-`*nid*`.log` - `/var/log/hadoop/hdfs/hadoop-hdfs-datanode-`*nid*`.log` - `/var/log/hadoop/yarn/yarn-yarn-nodemanager-`*nid*`.log` - `/var/log/hadoop/yarn/yarn-yarn-resourcemanager-`*nid*`.log` In the above locations, *nid* is used as an example for the node name.

Application/Script	Log File Location
	Application specific logs reside in HDFS at `/app-logs`
Spark	● Spark event logs (used by the Spark History server) reside at: `hdfs://user/spark/applicationHistory` ● Spark executor logs (useful to debug Spark applications) reside with the other Mesos framework logs on the individual compute nodes (see above) at: `/var/log/mesos/agent/slaves/`
Jupyter Notebook	`/var/log/jupyterhub.log`
Flex scripts: ● `urika-yam-status` ● `urika-yam-flexdown` ● `urika-yam-flexdown-all` ● `urika-yam-flexup`	`/var/log/urika-yam.log`
ZooKeeper	`/var/log/zookeeper`
Hive Metastore	`/var/log/hive`
HiveServer2	`/var/log/hive`
HUE	`/var/log/hue`
Spark Thrift Server	`/var/log/spark`

5.3 OpenStack Log File Locations

OpenStack log files for services managed by `systemd` are located under `/var/log/`*`service`* directory on the management server/controller.

Table 14. OpenStack Services Log File Locations

OpenStack Service	Log File Location
Cinder	`/var/log/cinder`
Glance	`/var/log/glance`
Heat	`/var/log/heat`
Ironic	`/var/log/ironic`
Keystone	`/var/log/keystone`
Neutron	`/var/log/neutron`
Nova	`/var/log/nova`

OpenStack Service	Log File Location
Swift	`/var/log/swift`

Log files of OpenStack services running under Docker are stored in the `kolla_logs` Docker volume on the management server/controller. These files may be accessed via `/var/lib/docker/volumes/kolla_logs/_data/`*`service`*. For example, Keystone log files are located under `/var/lib/docker/volumes/kolla_logs/_data/keystone`.

More detailed information about logging and monitoring in OpenStack is available at: *http://www.openstack.org*. Specific information about logs of each service can also be found in the documentation of the service under consideration.

5.4 Default Log Settings

The following table lists the default log levels of various Urika-GX analytic components. If a restart of the service is needed, please first stop services using the `urika-stop` command, change the log level, and then restart services using the `urika-start` command.

Table 15. Default Log Levels

Component	Default Log Level	Restarting service required after changing log level?
Spark	Default log levels are controlled by the `/opt/cray/spark/default/conf/log4j.properties` file. Default Spark settings are used when the system is installed, but can be customized by creating a new `log4j.properties` file. A template for this can be found in the `log4j.properties.template` file.	No
Hadoop	Default log levels are controlled by the `log4j.properties` file. Default Hadoop settings are used when the system is installed, but can be customized by editing the `log4j.properties` file.	Yes
Mesos	Default log level is `INFO`	Yes
Marathon	Default log level is `INFO`. Log levels can be modified by editing the `log4j.properties` file.	Yes
Grafana	Default log level is `INFO`. Log properties can be modified by editing the `/etc/grafana/grafana.ini` file.	Yes
Jupyter Notebook	Log levels are controlled by the `Application.log_level` configuration parameter in `/etc/jupyterhub/jupyterhub_config.py`. It is set to 30 by default.	Yes

Component	Default Log Level	Restarting service required after changing log level?
Cray Graph Engine (CGE)	Default log level of CGE CLI is set to 8 (`INFO`). The `log-reconfigure —log-level` *`number`* command can be used to modify the log level. Use the drop down on the CGE UI to set the log level for the specific action being performed, i.e. `query`, `update` or `checkpoint`. Use the drop down on the **Edit Server Configuration** page to set the log level. Changing the log level in this manner persists until CGE is shut down.	No. Restarting CGE reverts the log level to 8 (`INFO`)
Flex scripts: ● `urika-yam-status` ● `urika-yam-flexup` ● `urika-yam-flexdown` ● `urika-yam-flexdown-all`	Default log level is `INFO`. Changing the log level for these scripts is not supported.	NA
Spark Thrift server	Default log level is `INFO`.	Yes
HiverServer2	Default log level is `INFO`.	Yes

6 Resource Management

6.1 Manage Resources on Urika-GX

The resource management model of Mesos is different from traditional HPC schedulers. With traditional HPC schedulers, jobs request resources and the scheduler decides when to schedule and execute the job. Mesos on the other hand offers resources to frameworks that are registered with it. It is up to the framework scheduler to decide whether to accept or reject its resources. If framework rejects the offer, Mesos will continue to make new offers based on resource availability. Framework refers to implementation of different computing paradigms such as Spark, Hadoop, CGE etc.

For example, a user submits a spark job that requests 1000 cores to run. Spark registers as a framework with Mesos. Mesos offers its available resources to Spark. If Mesos offers 800 cores, Spark will either choose to accept the resources or reject it. If Spark accepts the resource offer, the job will be scheduled on the cluster. If it rejects the offer, Mesos will continue to make new offers.

Mesos Frameworks on Urika-GX

When users submit jobs to a Mesos cluster, frameworks register with Mesos. Mesos offers resources to registered frameworks. Frameworks can either choose to accept or reject the resource offer from Mesos. If the resource offer satisfies the resource requirements for a job, they accept the resources and schedule the jobs on the slaves. If the resource offer does not satisfy the resource requirements, frameworks can reject them. Frameworks will still be registered with Mesos. Mesos will update the resources it has at regular intervals (when an existing framework finishes running its job and releases the resources or when some other frameworks reject the resources) and continues to offer the resources to registered frameworks.

Each spark job is registered as a separate framework with Mesos. For each spark job that has been submitted, Mesos makes separate resource offers.

Marathon is registered as a single framework with Mesos. Marathon provides a mechanism to launch non-framework applications to run under Mesos. Marathon enables long-running services under Mesos such as databases, streaming engines etc. Cray has developed:

- the `mrun` command, which sets up resources for CGE
- scripts for setting up resources for YARN

These are submitted as applications to Marathon. Marathon negotiates for resources from Mesos and they get resources from Marathon.

Mesos tracks the frameworks that have registered with it. If jobs are submitted and there are no resources available, frameworks will not be dropped. Instead, frameworks will remain registered (unless manually killed by the user) and will continue to receive updated resource offers from Mesos at regular intervals. As an example, consider a scenario where there are four Spark jobs running and using all of the resources on the cluster. A user attempts to submit a job with framework `Y` and framework `Y` is waiting for resources. As each Spark job completes its execution, it releases the resources and Mesos updates its resource availability. Mesos will continue to give resource offers to the framework `Y`. `Y` can chose either to accept or reject resources. If `Y` decides to accept the resources, it will schedule its tasks. If `Y` rejects the resources, it will remain registered with Mesos and will continue to receive resource offers from Mesos.

Allocation of resources to Spark by Mesos

Let us say that the `spark-submit` command is executed with parameters `--total-executor-cores 100 --executor-memory 80G`. Each node has 32 cores. Mesos tries to use as few nodes as possible for the 100 cores you requested. So in this case it will start Spark executors on 4 nodes (roundup(100 / 32)). You have asked each executor to have 80G of memory. Default value for `spark.mesos.executor.memoryOverhead` is 10% so it allocates 88G to each executor. So in Mesos you will see that `88 * 4 = 352 GB` allocated to the 4 Spark executors. For more information, see the latest Spark documentation at *http://spark.apache.org/docs*

Additional points to note:

- On Urika-GX, the Mesos cluster runs in High Availability mode, with 3 Mesos Masters and Marathon instances configured with Zookeeper.
- Unlike Marathon, Mesos does not offer any queue. Urika-GX scripts for flexing clusters and the `mrun` command do not submit their jobs unless they know the resource requirement is satisfied. Once the flex up request is successful, YARN uses its own queue for all the Hadoop workloads.
- Spark accepts resource offers with fewer resources than what it requested. For example, if a Spark job wants 1000 cores but only 800 cores are available, Mesos will offer those 800 to the Spark job. Spark will then choose to accept or reject the offer. If Spark accepts the offer, the job will be executed on the cluster. By default, Spark will accept any resource offer even if the number of resources in the offer is much less than the number of nodes the job requested. However, Spark users can control this behavior by specifying a minimum acceptable resource ratio; for example, they could require that Spark only accept offers of at least 90% of the requested cores. The configuration parameter that sets the ratio is `spark.scheduler.minRegisteredResourcesRatio`. It can be set on the command line with `--conf spark.scheduler.minRegisteredResourcesRatio=N` where `N` is between 0.0 and 1.0.
- `mrun` and flex scripts do not behave the way Spark behaves (as described in the previous bullet). `mrun` accepts two command-line options:
  - `--immediate=XXX` (default 30 seconds)
  - `--wait` (default `False`)

  When a user submits an `mrun` job, if more resources are needed than Mesos currently has available, the command will return immediately, showing system usage and how many nodes are available vs how many nodes are needed. If the user supplies the `--wait` option, this tells mrun to not return, but instead continue to poll Mesos until enough nodes are available. `mrun` will continue to poll Mesos for up to `--immediate` seconds before timing out. Finally, once Mesos informs `mrun` there are enough resources available; mrun will post the job to Marathon.

  When the requested resources are not available, flex scripts will display the current resources availability and exit.
- With `mrun`, the exact need must be met. If the user asks for 8 nodes, all CPU and memory on 8 nodes must be free for Marathon to accept the offer on behalf of `mrun`.

- The Marathon API does not offer a way to ask if the needs of a job can be fully satisfied before a request can be submitted. Therefore, Mesos is queried for its resource availability.
- Users request for resources from Mesos to give to YARN via Cray developed scripts for starting NodeManagers. The request is submitted to Marathon. This is called flex up. Once users get the requested resources, they can run their Hadoop jobs/ Hive queries / Oozie work-flows. Once they complete this, they release the resources back to Mesos via the Cray flex scripts. Flex scripts require the exact number of nodes to address requests and cannot run with fewer resources. When the number of resources requested in the flex up request does not match the current number of resources that are available with Mesos, an error message is displayed indicating that the number of resources available is less than the number of requested resources and that the user can submit a new flex up request.
- If the system is loaded and other frameworks (e.g. Spark) keep submitting smaller jobs, flex scripts may keep exiting if they do not receive the required number of nodes. This could lead to starvation of Hadoop jobs.

6.2 Use Apache Mesos on Urika-GX

Apache™ Mesos™ is a cluster manager that provides efficient resource isolation and sharing across distributed applications and/or frameworks. It lies between the application layer and the operating system and simplifies the process of deploying and managing applications in large-scale cluster environments, while optimizing resource utilization. It can execute multiple applications on a dynamically shared pool of nodes. Mesos introduces a distributed two-level scheduling mechanism called resource offers. Mesos decides how many resources to offer each framework. Frameworks then decide which resources to accept and which computations to run on them.

Mesos acts as the primary resource manager on the Urika-GX platform.

Architecture

Major components of a Mesos cluster include:

- **Mesos agents/slaves** - Agents/slaves are the worker instances of Mesos that denote resources of the cluster.
- **Mesos masters** - The master manages agent/slave daemons running on each cluster node and implements fine-grained sharing across frameworks using resource offers. Each resource offer is a list of free resources on multiple agents/slaves. The master decides how many resources to offer to each framework according to an organizational policy, such as fair sharing or priority.

  By default, Urika-GX ships with three Mesos masters with a quorum size of two. At least two Mesos masters must be running at any given time to ensure that the Mesos cluster is functioning properly. Administrators can use the `urika-state` and `urika-inventory` commands to check the status of Mesos masters and slaves. Administrators can also check the status of Mesos by pointing their browser at http:*hostname*-login1:5050 and ensuring that it is up. In addition, executing the `ps -ef | grep mesos` command on the login nodes displays the running Mesos processes.

Components that Interact with Mesos

- **Frameworks** - Frameworks run tasks on agents/slaves. The Mesos Master offers resources to frameworks that are registered with it. Frameworks decide either to accept or reject the offer. If a framework accepts the offer, Mesos offers the resources and the framework scheduler then schedules the respective tasks on resources. Each framework running on Mesos consists of two components:

  - A scheduler that is responsible for scheduling the tasks of a framework's job, within the accepted resources.
  - An executor process that is launched on agent/slave nodes to run the framework's tasks.
- In addition to the aforementioned components, Urika-GX also supports Marathon and `mrun` (the Cray-developed application launcher) as ecosystem components of Mesos. `mrun` is built upon Marathon commands for ease of use and running data secure distributed applications.

Role of HA Proxy

HAProxy is free, open source software offering proxying solution for TCP and HTTP based applications that spreads requests across multiple servers through gateway node.

On Urika-GX system, requests received on the login nodes for the following services are proxied using HAProxy to the compute nodes where the services run:

- YARN Resource Manager
- HDFS NameNode
- Secondary HDFS NameNode
- Hadoop Application Timeline Server
- Hadoop Job History Server
- Spark History Server, and Oozie

For services like Mesos Masters and Marathon, while there are 3 instances running, one of them is the active leader. Requests received by the login node are proxied to the currently active leader. If a leader runs into issues, one of the backup leaders take over and the requests are proxied to the current leader.

HA Proxy can be configured to provide SSL. Some possible solutions are documented in the security section of "*Urika®-GX System Administration Guide*".

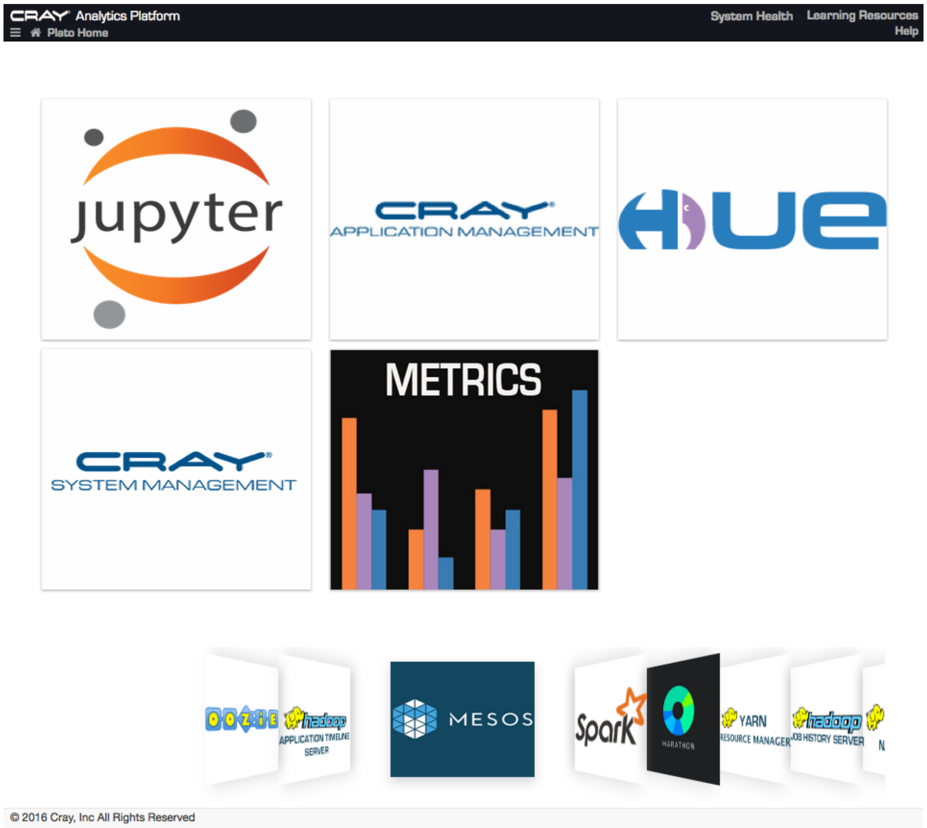
On Urika-GX, the Mesos master runs on port `5050`. To view the Mesos UI, point a browser at **Urika-GX Applications Interface** UI and then double click on the **Mesos** icon at the bottom of the screen. Though this is the recommened method of accessing Mesos, it can also be accessed at the port it runs on, i.e. at: `http://`*`hostname`*`-login1:5050` or `http://`*`hostname`*`-login2:5050`

> **NOTE:** Do not launch applications through Mesos directly because all the frameworks are pre-configured on Urika-GX. Only a few frameworks (Spark and Marathon) are pre-configured to authenticate with Mesos.

On Urika-GX, all tasks launched directly from Marathon need to be run as user '`marathon`', and cannot be run as any other user ID. If a user tries to launch applications/tasks as non-Marathon user, the application will fail with error “`Not authorized to launch as `*`userID`*”. This behavior has no impact on Hadoop, Spark, `mrun` and/or CGE jobs.

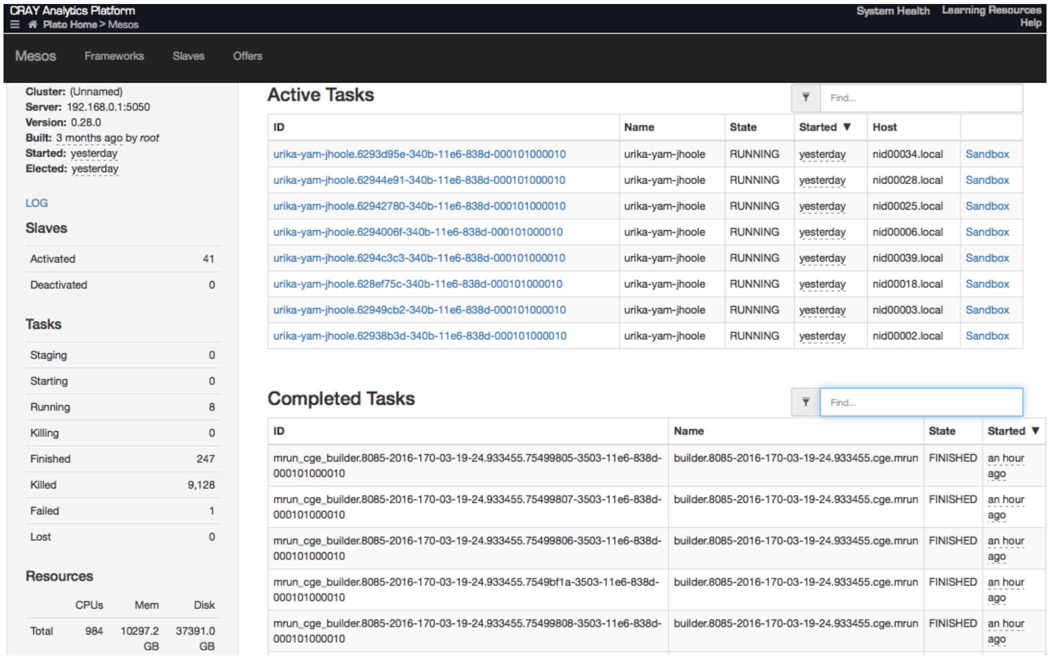
Authentication is turned on for Mesos. This means that if a new framework (other than Spark and Marathon) needs to be registered with Mesos, it will need to use Mesos authentication. An administrator will need to add credentials (a principal and a secret) for the new framework to the file `/etc/marathon-auth/credentials`. This file will need to be propagated to all nodes and the Mesos will need to be restarted. The new framework will then need to supply the newly-added principal and secret to Mesos when it registers a job. This requires root privileges. For more information, administrators should refer to the procedure titled '*Modify the Secret of a Mesos Framework*' in the *Urika-GX System Administration Guide*.

Figure 31. Select Hadoop Resource Manager from the Urika-GX Applications Interface UI



The Mesos UI is displayed in the following figure:

Figure 32. Apache Mesos UI



Cluster: (Unnamed)
Server: 192.168.0.1:5050
Version: 0.28.0
Built: 3 months ago by *root*
Started: yesterday
Elected: yesterday

Slaves

Activated	41
Deactivated	0

Tasks

Staging	0
Starting	0
Running	8
Killing	0
Finished	247
Killed	9,128
Failed	1
Lost	0

Resources

	CPUs	Mem	Disk
Total	984	10297.2 GB	37391.0 GB

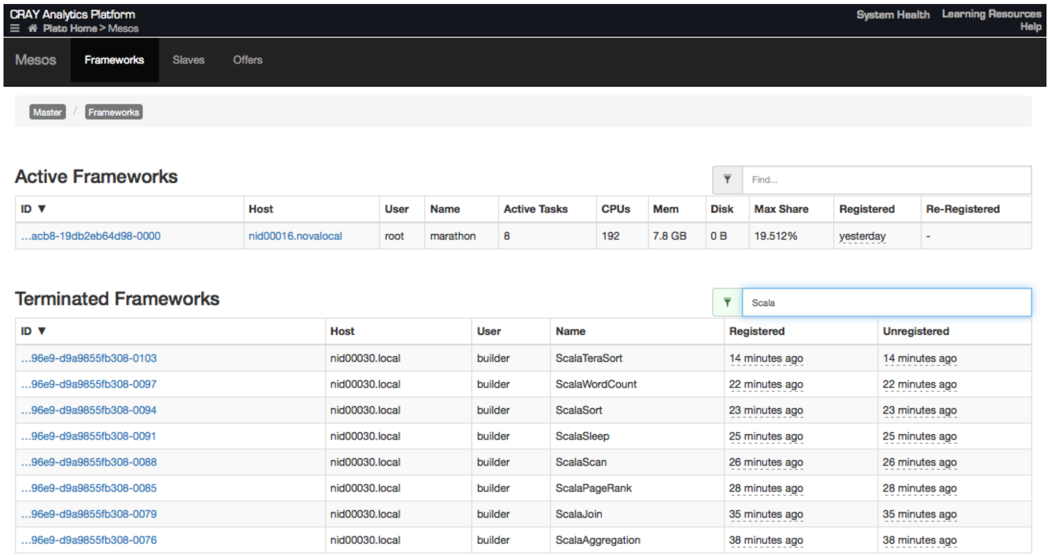
Active Tasks

ID	Name	State	Started ▼	Host	
urika-yam-jhoole.6293d95e-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00034.local	Sandbox
urika-yam-jhoole.62944e91-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00028.local	Sandbox
urika-yam-jhoole.62942780-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00025.local	Sandbox
urika-yam-jhoole.6294006f-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00006.local	Sandbox
urika-yam-jhoole.6294c3c3-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00039.local	Sandbox
urika-yam-jhoole.628ef75c-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00018.local	Sandbox
urika-yam-jhoole.62949cb2-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00003.local	Sandbox
urika-yam-jhoole.62938b3d-340b-11e6-838d-000101000010	urika-yam-jhoole	RUNNING	yesterday	nid00002.local	Sandbox

Completed Tasks

ID	Name	State	Started ▼
mrun_cge_builder.8085-2016-170-03-19-24.933455.75499805-3503-11e6-838d-000101000010	builder.8085-2016-170-03-19-24.933455.cge.mrun	FINISHED	an hour ago
mrun_cge_builder.8085-2016-170-03-19-24.933455.75499807-3503-11e6-838d-000101000010	builder.8085-2016-170-03-19-24.933455.cge.mrun	FINISHED	an hour ago
mrun_cge_builder.8085-2016-170-03-19-24.933455.75499806-3503-11e6-838d-000101000010	builder.8085-2016-170-03-19-24.933455.cge.mrun	FINISHED	an hour ago
mrun_cge_builder.8085-2016-170-03-19-24.933455.7549bf1a-3503-11e6-838d-000101000010	builder.8085-2016-170-03-19-24.933455.cge.mrun	FINISHED	an hour ago
mrun_cge_builder.8085-2016-170-03-19-24.933455.75499808-3503-11e6-838d-000101000010	builder.8085-2016-170-03-19-24.933455.cge.mrun	FINISHED	an hour ago

Figure 33. Mesos Frameworks



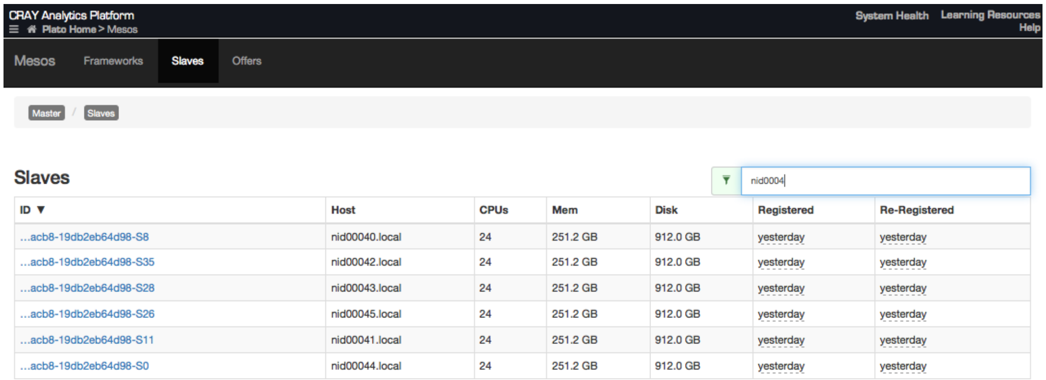
Active Frameworks

ID ▼	Host	User	Name	Active Tasks	CPUs	Mem	Disk	Max Share	Registered	Re-Registered
...acb8-19db2eb64d98-0000	nid00016.novalocal	root	marathon	8	192	7.8 GB	0 B	19.512%	yesterday	-

Terminated Frameworks

ID ▼	Host	User	Name	Registered	Unregistered
...96e9-d9a9855fb308-0103	nid00030.local	builder	ScalaTeraSort	14 minutes ago	14 minutes ago
...96e9-d9a9855fb308-0097	nid00030.local	builder	ScalaWordCount	22 minutes ago	22 minutes ago
...96e9-d9a9855fb308-0094	nid00030.local	builder	ScalaSort	23 minutes ago	23 minutes ago
...96e9-d9a9855fb308-0091	nid00030.local	builder	ScalaSleep	25 minutes ago	25 minutes ago
...96e9-d9a9855fb308-0088	nid00030.local	builder	ScalaScan	26 minutes ago	26 minutes ago
...96e9-d9a9855fb308-0085	nid00030.local	builder	ScalaPageRank	28 minutes ago	28 minutes ago
...96e9-d9a9855fb308-0079	nid00030.local	builder	ScalaJoin	35 minutes ago	35 minutes ago
...96e9-d9a9855fb308-0076	nid00030.local	builder	ScalaAggregation	38 minutes ago	38 minutes ago

Figure 34. Mesos Slaves



Slaves

ID ▼	Host	CPUs	Mem	Disk	Registered	Re-Registered
...acb8-19db2eb64d98-S8	nid00040.local	24	251.2 GB	912.0 GB	yesterday	yesterday
...acb8-19db2eb64d98-S35	nid00042.local	24	251.2 GB	912.0 GB	yesterday	yesterday
...acb8-19db2eb64d98-S28	nid00043.local	24	251.2 GB	912.0 GB	yesterday	yesterday
...acb8-19db2eb64d98-S26	nid00045.local	24	251.2 GB	912.0 GB	yesterday	yesterday
...acb8-19db2eb64d98-S11	nid00041.local	24	251.2 GB	912.0 GB	yesterday	yesterday
...acb8-19db2eb64d98-S0	nid00044.local	24	251.2 GB	912.0 GB	yesterday	yesterday

Use the Cray-developed `urika-mesos_metrics` script, which can be used to view Mesos related details. This script is located in the `/root/urika-tools/urika-cli` directory on the SMW and needs to be run as root.

Following is a sample output of the `urika-mesos_metrics` script:

```
# urika-mesos_metrics
 HTTP/1.1 200 OK
 Proceeding further...
******* MESOS CLUSTER METRICS **********
 Total cpus :  984
 Used cpus :  0
 Master elected :  1
******* MESOS FRAMEWORK METRICS **********
 Frameworks active :  1
 Frameworks connected :  1
 Frameworks disconnected:  0
 Frameworks inactive:  0
******* MESOS SLAVE METRICS **********
 Slaves active :  41
 Slaves connected :  41
 Slaves disconnected:  0
 Slaves inactive:  0
```

Troubleshooting information

- Mesos logs are located at `/var/log/mesos`, whereas log files of Mesos framework are located under `/var/log/mesos/agent/slaves/` on the node(s) the service runs on.
- If the system indicates that the `mesos-slave` process is running, but it is not possible to schedule jobs, it is recommended to execute the following commands as root on each of the agent/slave node:

  ```
  # systemctl stop urika-mesos-slave
  # rm -vf /var/log/mesos/agent/meta/slaves/latest
  # systemctl start urika-mesos-slave
  ```
- For additional troubleshooting help, refer to Mesos log files, which are located at `/var/log/mesos`. Log files are located on the node(s) a given service runs on.
- If the Mesos UI displays orphaned Mesos tasks, refer to *Diagnose and Troubleshoot Orphaned Mesos Tasks* on page 167 to debug the issue.

For more information about Mesos, visit *http://mesos.apache.org*.

6.3 Use mrun to Retrieve Information About Marathon and Mesos Frameworks

Cray has developed the `mrun` command for launching applications. `mrun` enables running parallel jobs on Urika-GX using resources managed by Mesos/Marathon. In addition, this command enables viewing the currently active Mesos Frameworks and Marathon applications. It provides extensive details on running Marathon applications and also enables cancelling/stopping currently active Marathon applications.

The Cray Graph Engine (CGE) uses `mrun` to launch jobs under the Marathon framework on the Urika®-GX system.

⚠ **CAUTION:** Both the `munge` and `ncmd` system services must be running for `mrun`/CGE to work. If either service is stopped or disabled, `mrun` will no longer be able to function

Using mrun

The `mrun` command needs to be executed from a login node. Some examples of using `mrun` are listed below:

- **Launch a job with `mrun`** - Use the `mrun` command to launch a job, as shown in the following example:

  ```
  $ mrun /bin/date
  Wed Aug 10 13:31:51 CDT 2016
  ```
- **Display information about frameworks, applications and resources** - Use the `--info` option of the `mrun` command to retrieve a quick snapshot view of Mesos Frameworks, Marathon applications, and available compute resources.

  ```
  $ mrun --info
  Active Frameworks:
       IBM Spark Shell : Nodes[10] CPUs[ 240] : User[builder]
      Jupyter Notebook : Nodes[ 0] CPUs[   0] : User[urika-user]
  ```

```
            marathon : Nodes[20] CPUs[ 480] : User[root]
Active Marathon Jobs:
  /mrun/cge/user.dbport-2016-133-03-50-28.235572
                     : Nodes[20] CPUs[320/480] : user:user cmd:cge-server
Available Resources:
                     : Nodes[14] CPUs[336] idle nid000[00-13]
                     : Nodes[30] CPUs[480] busy nid000[14-29,32-45]
                     : Nodes[ 2] CPUs[???] down nid000[30-31]
```

In the example output above, notice the `CPUs[320/480]` indicates that while the user only specified `mrun --ntasks-per-node=16 -N 20` (meaning the application is running on 320 CPUs), `mrun` intends **ALL** applications to have exclusive access to each node it is running on, and thus will ask Mesos for **ALL** the CPUs on the node, not just the number of CPUs per node the user requested to run on.

- **Retrieve a summary of running Marathon applications** - Use the `--brief` option of the `mrun` command to obtain a more concise report on just the running Marathon applications and node availability.

```
$ mrun --brief
N:20 CPU:320/480  <user>  /mrun/cge/user.dbport-2016-133-03-50-28.235572 cge-
server -d /mn...
Status: Idle:14  Busy:30  Unavail:2
```

- **Retrieve information on a specific Marathon application** - Use the `--detail` option of the `mrun` command to obtain additional information on a specific Marathon application. The application ID needs to be specified with this option.

```
$ mrun --detail /mrun/cge/user.dbport-2016-133-03-50-28.235572
Active Frameworks:
     IBM Spark Shell : Nodes[10] CPUs[ 240] : User[builder]
    Jupyter Notebook : Nodes[ 0] CPUs[   0] : User[urika-user]
            marathon : Nodes[20] CPUs[ 480] : User[root]
Active Marathon Jobs:
  /mrun/cge/user.dbport-2016-133-03-50-28.235572
                     : Nodes[20] CPUs[320/480] : user:<user> cmd:cge-server
                     : [nid00032.urika.com]: startedAt:2016-05-12T17:05:53.573Z
                     : [nid00028.urika.com]: startedAt:2016-05-12T17:05:53.360Z
                     : [nid00010.urika.com]: startedAt:2016-05-12T17:05:53.359Z
                     : [nid00007.urika.com]: startedAt:2016-05-12T17:05:53.397Z
                     : [nid00001.urika.com]: startedAt:2016-05-12T17:05:53.384Z
                     : [nid00019.urika.com]: startedAt:2016-05-12T17:05:53.383Z
...
...
```

The additional information provided by the `--detail` option includes a list of all the node names the application is running on, and at what time the application was launched on those nodes.

- **Stop, cancel or abort a running Marathon application** - Use the `--cancel` option of the `mrun` command to stop, cancel or abort a running Marathon application. The application ID needs to be specified with this option.

```
$ mrun --cancel /mrun/cge/user.3750-2016-133-20-01-07.394582
Thu May 12 2016 15:01:21.284876 CDT[][mrun]:INFO:App /mrun/cge/user.
3750-2016-133-20-01-07.394582 has been cancelled
```

If the application has already been cancelled, or completes, or does not exist, the following message is displayed:

```
$ mrun --cancel /mrun/cge/user.3750-2016-133-20-01-07.394582
App '/mrun/cge/user.3750-2016-133-20-01-07.394582' does not exist
```

- **Retrieve a list of nodes, CPU counts and available memory** - Use the `--resources` option of the `mrun` command to obtain a complete list of nodes, CPU counts, and available memory.

```
$ mrun --resources
 NID  HEX   NODENAME CPUs    MEM STAT
   0 0x00   nid00000   32 515758 idle
   1 0x01   nid00001   32 515758 busy
   2 0x02   nid00002   32 515758 idle
   3 0x03   nid00003   32 515758 busy
   4 0x04   nid00004   32 515758 busy
   5 0x05   nid00005   32 515758 idle
   6 0x06   nid00006   32 515758 idle
   7 0x07   nid00007   32 515758 busy
   8 0x08   nid00008   32 515758 busy
   9 0x09   nid00009   32 515758 busy
  10 0x0a   nid00010   32 515758 busy
  11 0x0b   nid00011   32 515758 busy
  12 0x0c   nid00012   32 515758 idle
  13 0x0d   nid00013   32 515758 idle
  14 0x0e   nid00014   32 515758 busy
  15 0x0f   nid00015   32 515758 busy
  16 0x10   nid00016   36 515756 idle
  17 0x11   nid00017   36 515756 idle
  18 0x12   nid00018   36 515756 busy
  19 0x13   nid00019   36 515756 busy
  20 0x14   nid00020   36 515756 idle
  21 0x15   nid00021   36 515756 idle
  22 0x16   nid00022   36 515756 busy
  23 0x17   nid00023   36 515756 idle
  24 0x18   nid00024   36 515756 idle
  25 0x19   nid00025   36 515756 busy
  26 0x1a   nid00026   36 515756 idle
  27 0x1b   nid00027   36 515756 busy
  28 0x1c   nid00028   36 515756 busy
  29 0x1d   nid00029   36 515756 idle
  30 0x1e   nid00030    0      0 unavail
  31 0x1f   nid00031    0      0 unavail
  32 0x20   nid00032   24 515758 busy
  33 0x21   nid00033   24 515758 idle
  34 0x22   nid00034   24 515758 idle
  35 0x23   nid00035   24 515758 idle
  36 0x24   nid00036   24 515758 idle
  37 0x25   nid00037   24 515758 idle
  38 0x26   nid00038   24 515758 busy
  39 0x27   nid00039   24 515758 idle
  40 0x28   nid00040   24 515758 idle
  41 0x29   nid00041   24 515758 idle
  42 0x2a   nid00042   24 515758 busy
  43 0x2b   nid00043   24 515758 busy
  44 0x2c   nid00044   24 515758 idle
  45 0x2d   nid00045   24 515758 idle
```

Node names that are marked as `unavail` are hidden from Mesos as available compute resources, such as the login node (`nid00030`). In the example above, some nodes have 24 CPUs/node, some have 32 CPUs/node and some have 36 CPUs/node. While not a typical situation, `mrun` does support this configuration, and a command such as `cge-launch -I36 -N 4 d....` would in fact be allowed to proceed, and would be limited to 4 instances on `nid000[16-29]`.

Configuration Files

When `mrun` is invoked, it sets up some internal default values for required settings. `mrun` will then check if any system defaults have been configured in the `/etc/mrun/mrun.conf` file. An example `mrun.conf` file is shown below:

```
#
# (c) Copyright 2016 Cray Inc.  All Rights Reserved.
#
# Anything after an initial hashtag '#' is ignored
# Blank lines are ignored.
#
#NCMDServer=nid00000
#MesosServer=localhost      # same as --host
#MesosPort=5050
#MarathonServer=localhost
#MarathonPort=8080
#DebugFLAG=False            # same as --debug
#VerboseFLAG=False          # same as --verbose
#JobTimeout=0-0:10:0        # ten minutes, same as --time
#StartupTimeout=30          # 30 seconds,  same as --immediate
#HealthCheckEnabled=True    # Run with Marathon Health Checks enabled
#HCGracePeriodSeconds=5     # Seconds at startup to delay Health Checks
#HCIntervalSeconds=10       # Seconds between Health Check pings
#HCTimeoutSeconds=10        # Seconds to answer Health Check successfully
#HCMaxConsecutiveFailures=3 # How many missed health checks before app killed
```

If any of the lines above are not commented out, those values will become the new defaults for every `mrun` invocation.

Additionally, after the system `/etc/mrun/mrun.conf` file is loaded (if it exists), the user's private `$HOME/.mrun.conf` file will be loaded (if it exists). The following items should be noted:

- Any settings in the user's `$HOME/.mrun.conf` file will take precedence over any conflicting settings in the system `/etc/mrun/mrun.conf` file.
- Any command-line arguments that conflict with any pre-loaded configuration file settings will take precedence for the current invocation of `mrun`.

⚠ **CAUTION:** Since Marathon does not require authentication, the `mrun --cancel` command does not prevent users from killing other users' applications, as they can easily do this from the Marathon UI instead.

For more information, see the `mrun(1)` man page.

6.4 Manage Long Running Services Using Marathon

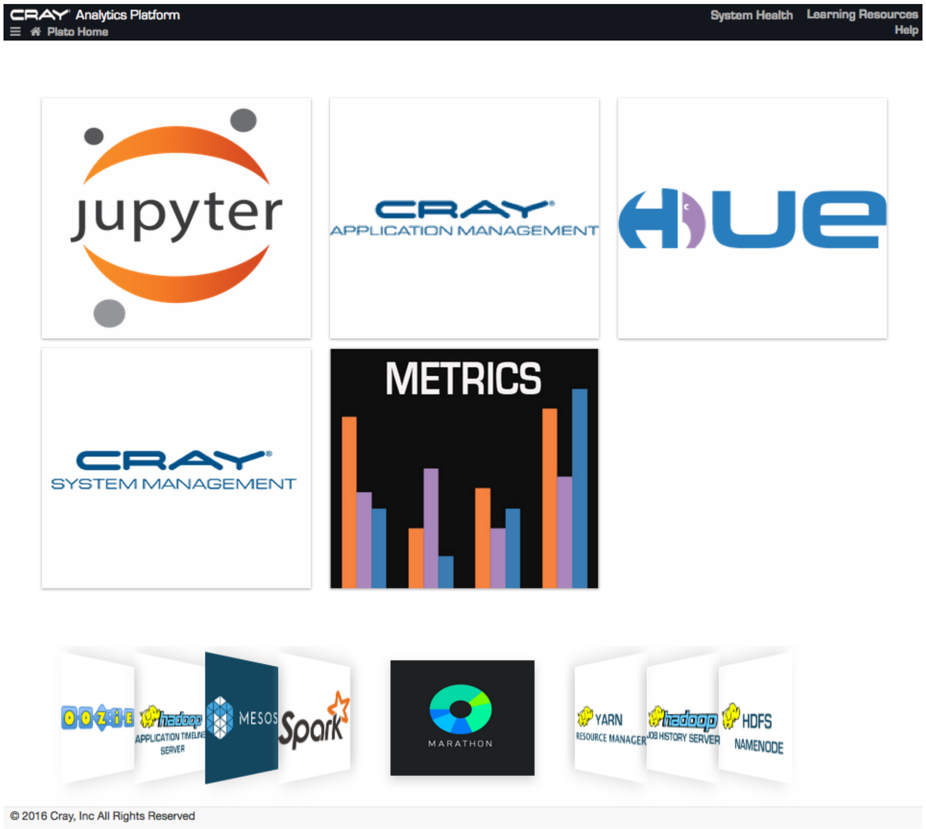
Marathon is a Platform as a Service (PaaS) service system that scales to thousands of physical servers. It runs as a framework on Mesos. Marathon is fully REST based and allows canary style deployment topologies.

Marathon provides an API for starting, stopping, and scaling long running services. It is highly available, elastic, and distributed.

On the Urika-GX system, there are always three Mesos Masters and three Marathon instances running, while one of them is the active leader. Requests received by the login node are proxied to the currently active leader. If a leader runs into issues, one of the backup leaders take over and the requests are proxied to the current leader.

The Marathon web UI can be accessed using the **Urika-GX Applications Interface** UI, which can be accessed at: `http://hostname-login1` and then selecting **Marathon** from the list of icons located at the bottom of the UI. Though this is the recommended method of accessing Marathon, it can also be accessed at the port it runs on, i.e. at `http://hostname-login1:8080` or `http://hostname-login2:8080`

Figure 35. Urika-GX Applications Interface



On Urika-GX, the Marathon service presents both a web UI and a REST API on port 8080. From most nodes, the REST API can be reached via http://hostname-login1:8080.

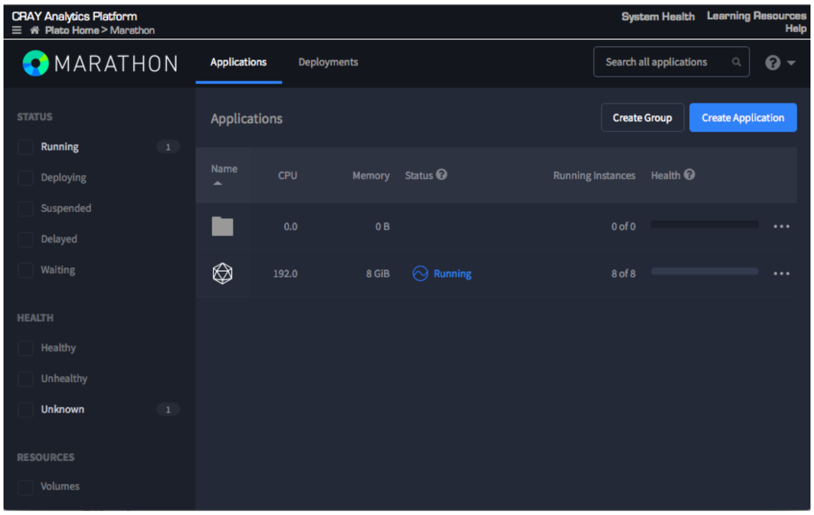
On Urika-GX, Marathon is used by the Cray-developed command named `mrun` to allocate node resources from Mesos and launch application instances as needed. To learn more about `mrun`, see the `mrun` man page.

> **TIP:** If Marathon does not start after a system crash, because the queue has reached full capacity, use `urika-stop` and then `urika-start` to start Marathon again.

In addition, Cray-developed scripts for starting a cluster of YARN Node Managers are also launched through Marathon.

> ⚠ **CAUTION:** Unless it is required to shut down YARN nodes, analytic applications that use the Cray-developed scripts for flexing a cluster should not be deleted through the Marathon UI, as doing will lead to loss of YARN nodes.

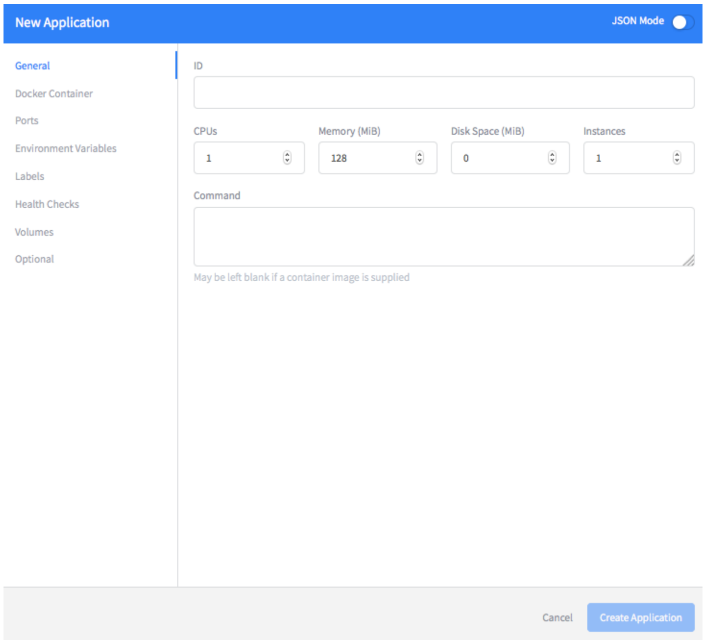
Figure 36. Marathon UI



Name	CPU	Memory	Status	Running Instances	Health
	0.0	0 B		0 of 0	
	192.0	8 GiB	Running	8 of 8	

Marathon also enables creating applications from the UI via the **Create Application** button, which displays the **New Application** pop up:

Figure 37. Create an Application Using the Marathon UI



ID:

CPUs: 1

Memory (MiB): 128

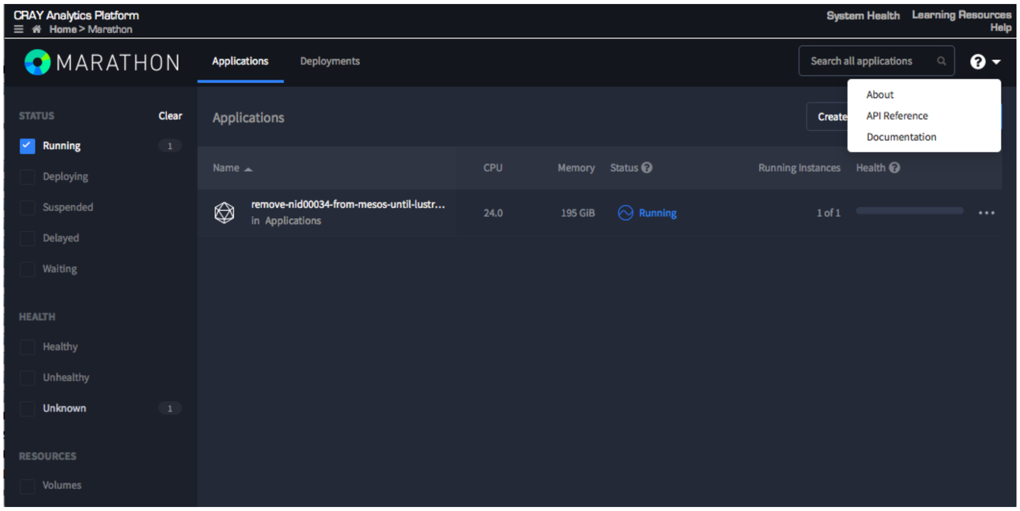
Disk Space (MiB): 0

Instances: 1

Command:

May be left blank if a container image is supplied

The **Docker Container** menu item on the left side of the **New Application** pop up is currently not supported and should not be used. For additional information about using Marathon, select the help icon **(?)** and then select **Documentation**.



6.5 Manage the Spark Thrift Server as a Non-Admin User

Prerequisites

- This procedure requires the following software to be installed on the client machine:
  - Tableau Desktop (version 10.0.1.0)
  - Simba Spark ODBC driver.
- If using a MAC, the following procedure requires version 10.10 of the operating system.

About this task

Cray recommends to have the Spark Thrift to be started up by administrators, however, users can use the following instructions if they need to start up their own Spark Thrift server.

⚠ **CAUTION:** It is recommended for multiple users (admin and non-admin) to use the same Spark Thrift server (that has been started by an administrator) instead of spinning up their own individual servers, as doing so could result in resource lockdown. In addition, though it is possible for multiple users to connect to each other's Spark Thrift server, doing so can result in loss of connectivity if the server is brought down by the user who brings it up. If a user who starts up the Spark Thrift server brings it down, other users may experience loss of connection issues.

Procedure

1. Copy the `spark-env.sh`, `spark-defaults.conf` and `hive-site.xml` files to the local `$Home` directory.

```
$ cp /opt/cray/spark2/default/conf/spark-env.sh $HOME
$ cp /opt/cray/spark2/default/conf/spark-defaults.conf $HOME
$ cp /opt/cray/spark2/default/conf/hive-site.xml $HOME
```

2. Modify the `hive-site.xml` configuration file to set `hive.server2.thrift.port` to a non-conflicting port.

3. Increase the number of compute nodes if needed by editing the `spark-defaults.conf` configuration file and changing the default value of `spark.cores.max` from 128 to the desired value.

4. Execute the `start-thriftserver.sh` script.

   ```
   $ /opt/cray/spark2/default/sbin/start-thriftserver.sh
   ```

5. Stop the Spark Thrift server when finished using it.

   ```
   $ /opt/cray/spark2/default/sbin/stop-thriftserver.sh
   ```

7 Control the Spark Thrift Server

The Spark Thrift server is one of the analytic components of the Urika-GX software stack. The `urika-start` and `urika-stop` commands can be used to control this service.

Start the Spark Thrift Server

To start the Spark Thrift Server, execute the `urika-start` command as root from the SMW, specifying `spark_thrift` as the name of the service to start:

```
# urika-start -s spark_thrift
```

For more information, see the `urika-start` man page.

Stop the Spark Thrift Server

To stop the Spark Thrift Server, execute the `urika-stop` command as root from the SMW, specifying `spark_thrift` as the name of the service to stop:

```
# urika-stop -s spark_thrift
```

Calling the `urika-stop` command without any options also stops the Spark Thrift Server. For more information, see the `urika-stop` man page.

Check the Status of the Spark Thrift Server

To check the status of the Spark Thrift Server, execute the `urika-state` command as root from the SMW:

```
# urika-state
```

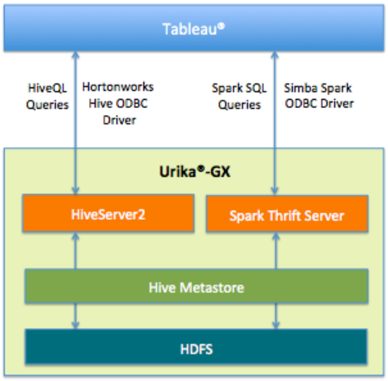
For more information, see the `urika-state` man page.

8 Use Tableau® with Urika-GX

Tableau is a desktop application running on either Windows or Mac. Urika-GX features connectivity to Tableau® for data visualization. Tableau connects easily to Urika-GX, as well as to other data sources. It enables viewing data as visually appealing visualizations called dashboards, quickly and easily.

The following figure depicts how Tableau connects to Urika-GX via the Hive and SparkSQL Thrift servers:

Figure 38. Urika-GX connectivity to Tableau



8.1 Connect Tableau to HiveServer2

Prerequisites

- Ensure that LDAP authentication for Tableau to HiveServer2 is enabled. For more information, refer to section 'Enable LDAP for Connecting Tableau to HiverServer2 of the '*Urika®-GX System Administration Guide*'.
- This procedure requires the following software to be installed on the client machine (which is an external machine connected to Urika-GX):
  - Tableau Desktop (version 10.0.1.0)
  - Hortonworks Hive ODBC driver.
- If using a Mac, the following procedure requires version 10.10 of the OS X operating system.
- Request an administrator to ensure that the Hive service is up and running.

About this task

⚠ **CAUTION:** It is recommended for multiple users to use the same Hive server (that has been started by an administrator) instead of spinning up their own individual servers, as doing so could result in resource lockdown.

Procedure

1. Log on to a Urika-GX system's login node.

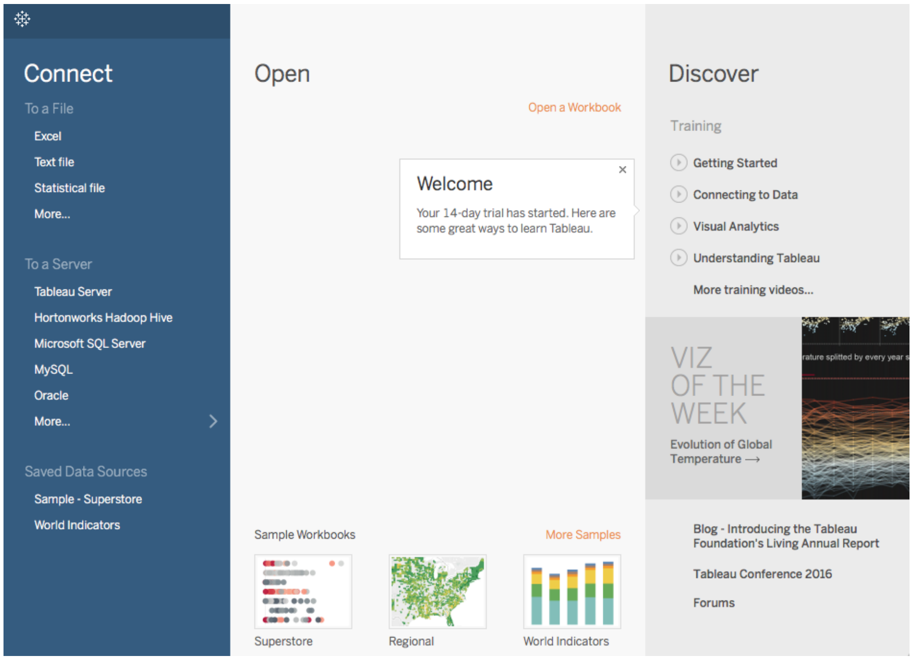
2. Request an administrator to flex up the YARN cluster.

   > **NOTE:** Cray recommends that YARN clusters for Tableau connectivity be flexed up only by administrators on Urika-GX. Administrators should use the `urika-yam-flexup` command and specify a timeout value of 0 when using this procedure. For more information, administrators should see the `urika-yam-flexup` man page or refer to the section titled '*Flex up a YARN sub-cluster on Urika-GX*' of the '*Urika®-GX Analytic Applications Guide*'.

3. Launch the Tableau application on a client machine.

   This will start the Tableau application and bring up the Tableau UI on the user's desktop.

   Figure 39. Tableau UI



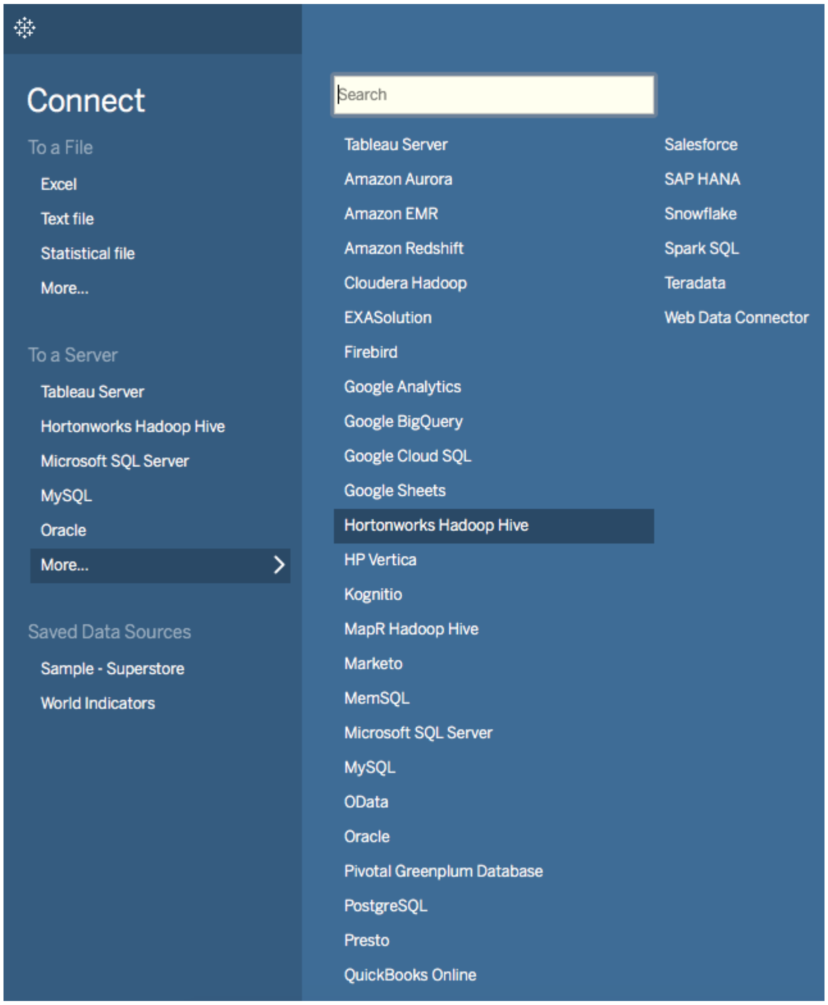
Welcome

Your 14-day trial has started. Here are some great ways to learn Tableau.

4. Navigate to **Connect > To a Server > More**

5. Select **Hortonworks Hadoop Hive** from the list of servers.

Figure 40. Selecting Hortonworks Hadoop Hive Server



6. Populate the server connection pop up.

a. Enter *`hostname`*`-login1` in the **Server** field, where *`hostname`* is used as an example for the name of the machine and should be replaced with the actual machine name when following this step.

b. Enter `10000` in the **Port** field.

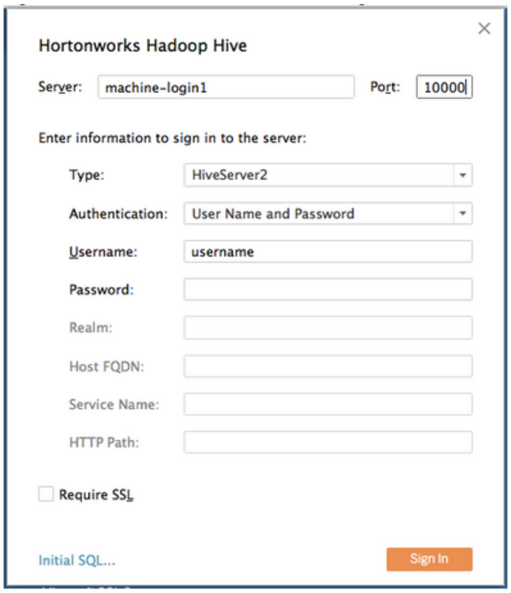
c. Select **HiveServer2** from the **Type** drop down.

d. Select **User Name and Password** from the **Authentication** drop down.

e. Enter values in the **Username** and **Password** fields.

f. Select the **Sign In** button.

Figure 41. Connect HiveServer2 to Tableau



Hortonworks Hadoop Hive

Server: machine-login1 Port: 10000

Enter information to sign in to the server:

Type: HiveServer2

Authentication: User Name and Password

Username: username

Password:

Realm:

Host FQDN:

Service Name:

HTTP Path:

□ Require SSL

7. Perform data visualization/exploration tasks as needed using Tableau.

8. Request an administrator to flex down the YARN cluster.

   NOTE: Cray recommends that YARN clusters for Tableau connectivity be flexed down only by administrators on Urika-GX. For more information, administrators should see the `urika-yam-flexdown` man page or refer to the section titled '*Flex up a YARN sub-cluster on Urika-GX*' of the '*Urika®-GX Analytic Applications Guide*'.

8.2 Connect Tableau to HiveServer2 Securely

Prerequisites

- This procedure requires the following software to be installed on the client machine:
  - Tableau Desktop (version 10.0.1.0)
  - Hortonworks Hive ODBC driver.
- If using a Mac, the following procedure requires version 10.10 of the OS X operating system.
- Request and administrator to ensure that the Hive service is up and running.

About this task

⚠ **CAUTION:** It is recommended for multiple users to use the same Hive server (that has been started by an administrator) instead of spinning up their own individual servers, as doing so could result in resource lockdown.

Procedure

1. Request an administrator to enable SSL.

   Administrators should follow instructions listed in section '*Enable SSL on Urika-GX*' of the '*Urika-GX System Administration Guide*' to enable SSL. To connect to the HiveServer2 from Tableau, the `ServerCertificate.crt` SSL certificate must be present on the machine running Tableau and needs to be added to Tableau.

2. Log on to a Urika-GX system's login node.

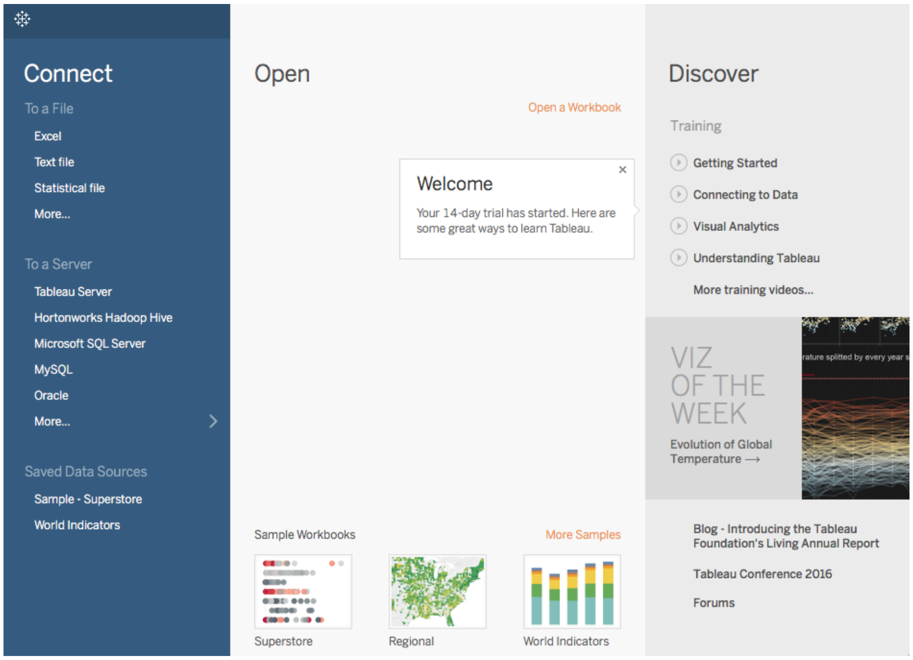
3. Request an administrator to flex up the YARN cluster.

   > **NOTE:** Cray recommends that YARN clusters for Tableau connectivity be flexed up only by administrators on Urika-GX. Administrators should use the `urika-yam-flexup` command and specify a timeout value of 0 when using this procedure. For more information, administrators should see the `urika-yam-flexup` man page or refer to the section titled '*Flex up a YARN sub-cluster on Urika-GX*' of the '*Urika®-GX Analytic Applications Guide*'.

4. Launch the Tableau application on a client machine.

   This will present the Tableau UI.

   Figure 42. Tableau UI

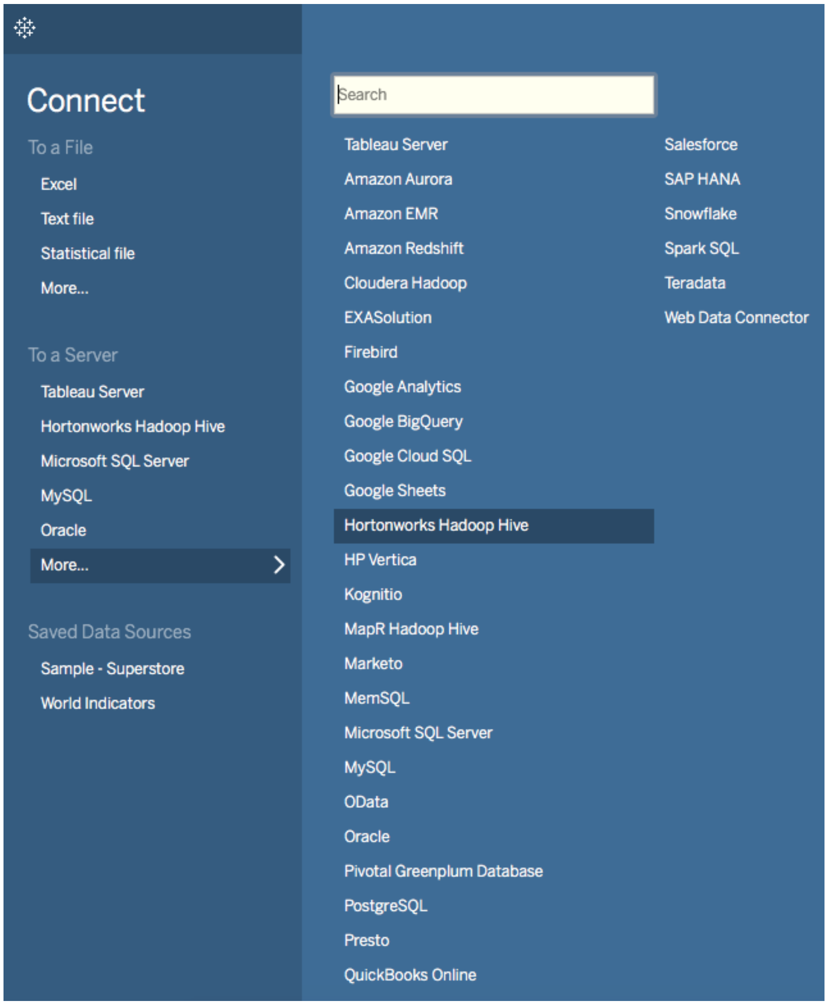


Your 14-day trial has started. Here are some great ways to learn Tableau.

5. Navigate to **Connect > To a Server > More**

6. Select **Hortonworks Hadoop Hive** from the list of servers.

Figure 43. Selecting Hortonworks Hadoop Hive Server



7. Populate the server connection pop up.

a. Enter `machine-login1` in the **Server** field, using the FQDN to ensure that it matches the domain name for the SSL certificate. `machineName` is used as an example for the name of the machine and should be replaced with the actual machine name when following this step.

b. Enter `29207` (which is the port number configured in HA Proxy) in the **Port** field.

c. Select **HiveServer2** from the **Type** drop down.

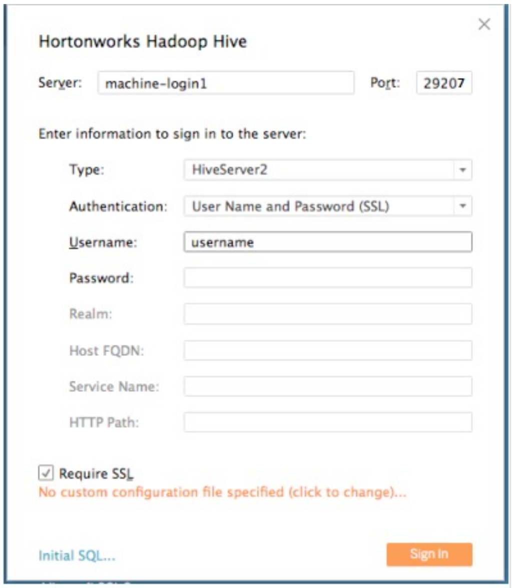
d. Select **User Name and Password (SSL)** from the **Authentication** drop down.

e. Enter values in the **Username** and **Password** fields.

f. Select the **Require SSL** check-box.

g. Click on the **No custom configuration file specified (click to change)...** link.

Figure 44. Connect HiveServer2 to Tableau Securely



Hortonworks Hadoop Hive

Server: machine-login1 Port: 29207

Enter information to sign in to the server:

Type: HiveServer2

Authentication: User Name and Password (SSL)

Username: username

Password:

Realm:

Host FQDN:

Service Name:

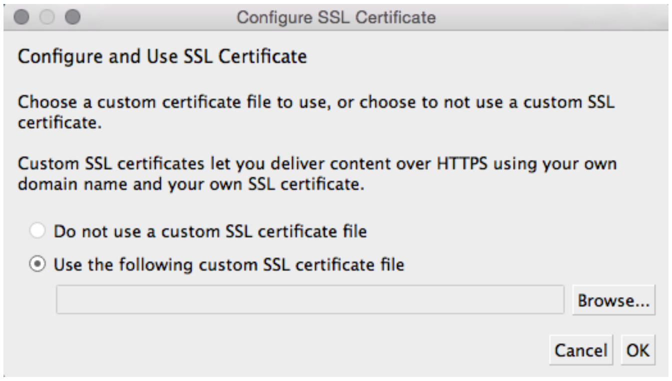
HTTP Path:

☑ Require SSL

No custom configuration file specified (click to change)...

h. Select **Use the following custom SSL certificate** option on the **Configure SSL certificate** pop up.

Figure 45. Tableau Configure SSL Pop up



Configure SSL Certificate

Configure and Use SSL Certificate

Choose a custom certificate file to use, or choose to not use a custom SSL certificate.

Custom SSL certificates let you deliver content over HTTPS using your own domain name and your own SSL certificate.

○ Do not use a custom SSL certificate file

● Use the following custom SSL certificate file

i. Select the **Browse** button to select the SSL certificate file.

j. Select the **OK** button.

k. Select the **Sign In** button.

8. Perform data visualization/exploration tasks as needed using Tableau.

9. Request an administrator to flex down the YARN cluster.

> **NOTE:** Cray recommends that YARN clusters for Tableau connectivity be flexed down only by administrators on Urika-GX. For more information, administrators should see the `urika-yam-flexdown` man page or refer to the section titled '*Flex up a YARN sub-cluster on Urika-GX*' of the '*Urika®-GX Analytic Applications Guide*'.

8.3 Connect Tableau to the Spark Thrift Server

Prerequisites

- This procedure requires the following software to be installed on the client machine, which is an external machine connected to Urika-GX:
  - Tableau Desktop (version 10.0.1.0)
  - Simba Spark ODBC driver.
- If using a Mac, the following procedure requires version 10.10 of the OS X operating system.

About this task

The Spark Thrift server ships pre-configured with LDAP authentication.

⚠ **CAUTION:** The recommended approach for using Tableau with the Spark Thrift server on Urika-GX is to have multiple users (admin and non-admin) to use the same Spark Thrift server (that has been started by an administrator) instead of spinning up their own individual servers, as doing so could result in resource lockdown. In addition, though it is possible for multiple users to connect to each other's Spark Thrift server, doing so can result in loss of connectivity if the server is brought down by the user who brings it up.

Procedure

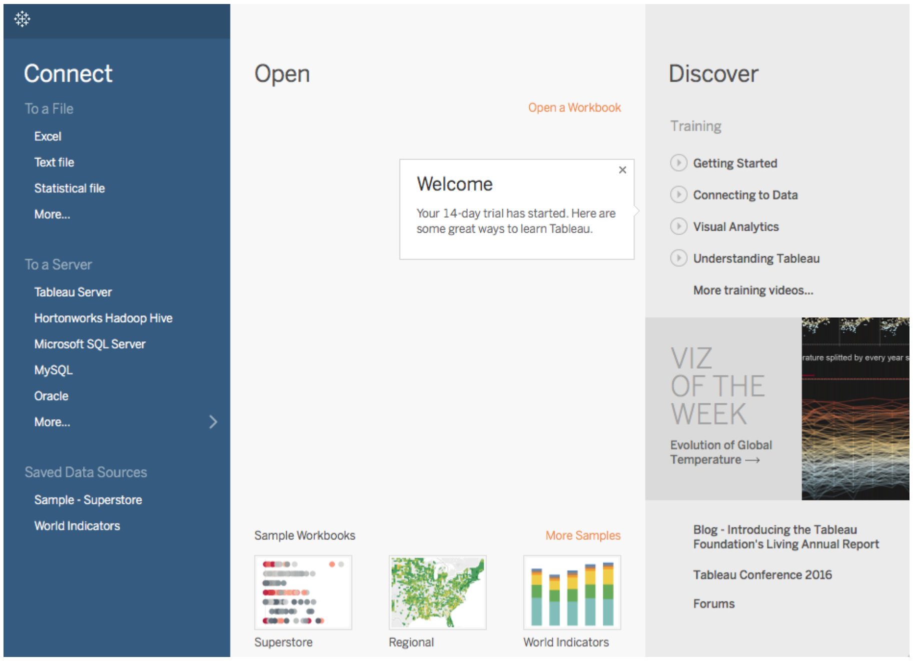
1. Request the administrator to verify that the Spark Thrift server is running and to start it if it is not already up.

   Administrators should refer to the section titled, '*Control the Spark Thrift Server*' in the '*Urika®-GX System Administration Guide*' to start the Spark Thrift server. Cray recommends to have the Spark Thrift server stopped by administrators. In order to start the Spark Thrift server non-admins have started without administrative privileges, non-admins should refer to *Manage the Spark Thrift Server as a Non-Admin User* on page 114.

2. Launch the Tableau application on a client machine.

   This will present the Tableau UI.

Figure 46. Tableau UI

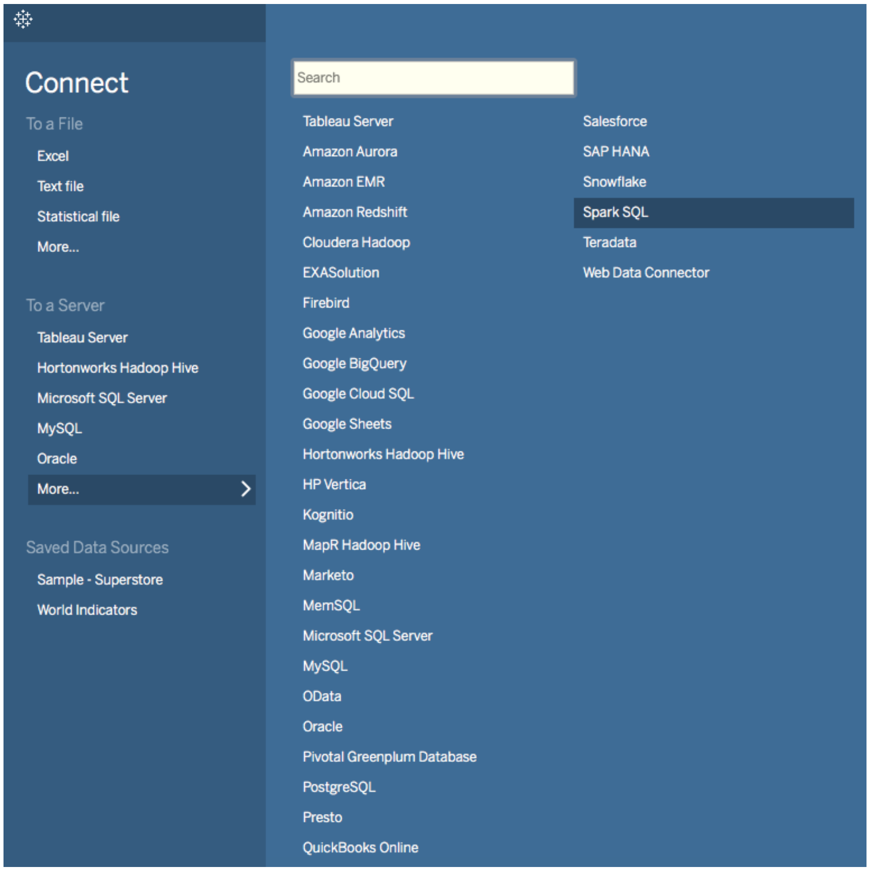


Your 14-day trial has started. Here are some great ways to learn Tableau.

3. Navigate to **Connect > To a Server > More**

4. Select **Spark SQL** server from the list of servers.

Figure 47. Selecting Spark SQL Server



5. Populate the server connection pop up.

a. Enter `hostname-login1` in the **Server** field, where `hostname` is used as an example for the name of the machine and should be replaced with the actual machine name when following this step.

b. Enter `10015` in the **Port** field.

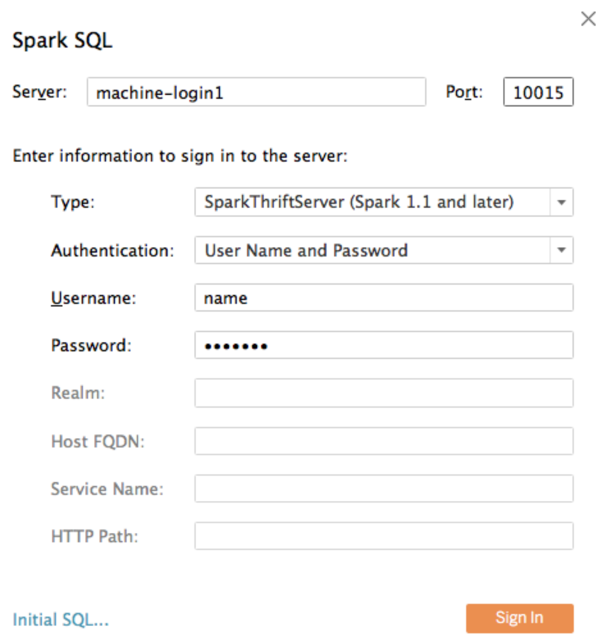
c. Select **SparkThriftServer (Spark 1.1 and later)** from the **Type** drop down.

d. Select **User Name and Password** from the **Authentication** drop down.

e. Enter values in the **Username** and **Password** fields.

f. Select the **Sign In** button.

Figure 48. Tableau's Spark Connection Pop up



Spark SQL

Server: machine-login1

Port: 10015

Enter information to sign in to the server:

Type: SparkThriftServer (Spark 1.1 and later)

Authentication: User Name and Password

Username: name

Password: •••••••

Realm:

Host FQDN:

Service Name:

HTTP Path:

6. Perform data visualization/exploration tasks as needed.

7. Request an administrator to stop the Spark Thrift server service.

   Administrators should refer to the section titled, '*Control the Spark Thrift Server*' in the '*Urika®-GX System Administration Guide*' to stop the Spark Thrift server. Cray recommends to have the Spark Thrift server stopped by administrators. In order to stop the Spark Thrift server non-admins have started without administrative privileges, non-admins should refer to '*Manage the Spark Thrift Server as a Non-Admin User*' of the '*Urika-GX Analytic Applications Guide*'.

8.4 Connect Tableau to the Spark Thrift Server Securely

Prerequisites

- This procedure requires the following software to be installed on the client machine:
  - Tableau Desktop (version 10.0.1.0)
  - Simba Spark ODBC driver.
- If using a Mac, the following procedure requires version 10.10 of the OS X operating system.

About this task

⚠ **CAUTION:** The recommended approach for using Tableau with the Spark Thrift server on Urika-GX is to have multiple users (admin and non-admin) to use the same Spark Thrift server (that has been started by an administrator) instead of spinning up their own individual servers, as doing so could result in resource lockdown. In addition, though it is possible for multiple users to connect to each other's Spark Thrift server, doing so can result in loss of connectivity if the server is brought down by the user who brings it up.

Procedure

1. Request an administrator to verify that SSL is enabled.

   Administrators should follow instructions listed in section '*Enable SSL on Urika-GX*' of the '*Urika-GX System Administration Guide*' to enable SSL.

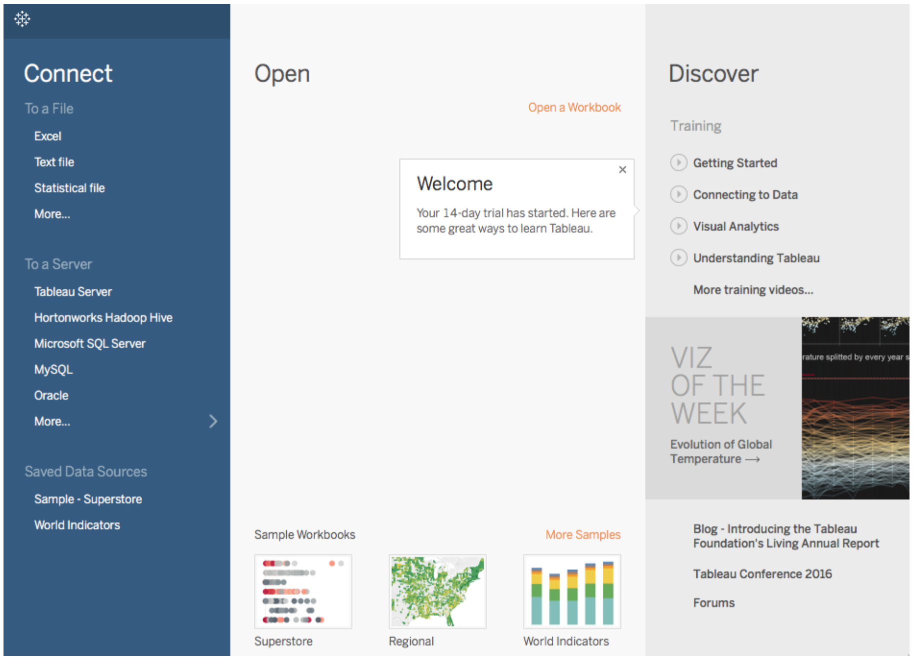
2. Request the administrator to verify that the Spark Thrift server is running and to start it if it is not already up.

   Administrators should refer to the section titled, '*Control the Spark Thrift Server*' in the '*Urika-GX System Administration Guide*' to start the Spark Thrift server. Cray recommends to have the Spark Thrift server stopped by administrators. In order to start the Spark Thrift server non-admins have started without administrative privileges, non-admins should refer to '*Manage the Spark Thrift Server as a Non-Admin User*' of the '*Urika-GX Analytic Applications Guide*'.

3. Launch the Tableau application.

   This will present the Tableau UI.

   Figure 49. Tableau UI

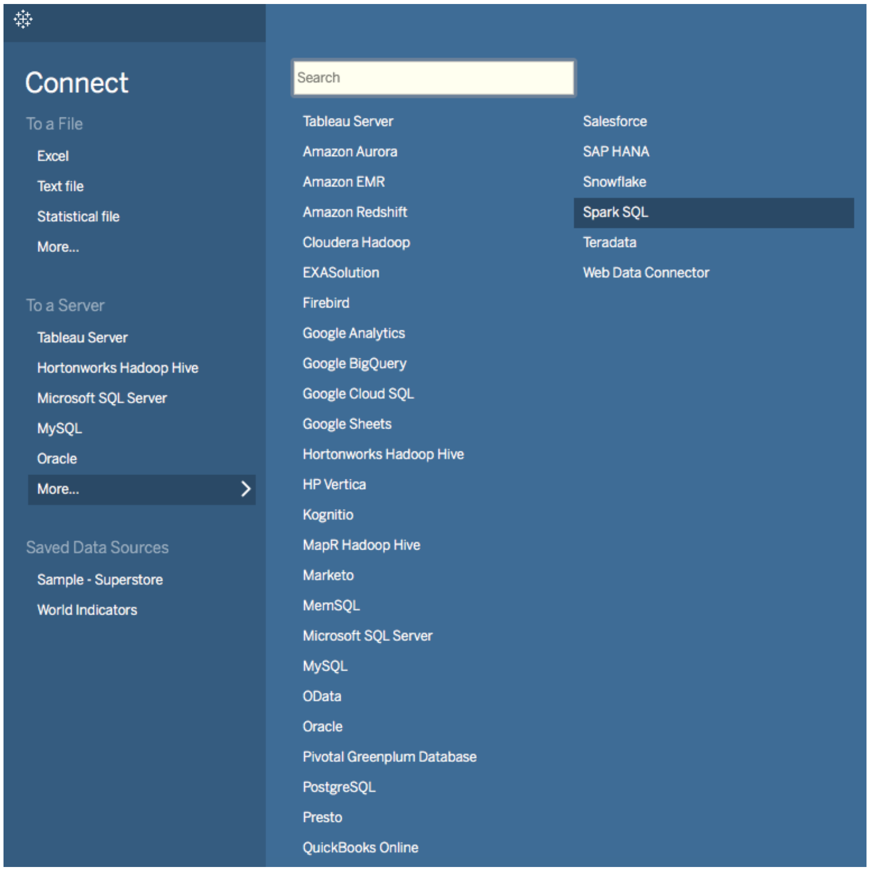


Your 14-day trial has started. Here are some great ways to learn Tableau.

4. Navigate to **Connect > To a Server > More**

5. Select **Spark SQL** server from the list of servers.

Figure 50. Selecting Spark SQL Server



6. Populate the server connection pop up.

a. Enter `machine-login1` in the **Server** field, using the FQDN to ensure that it matches the domain name for the SSL certificate. *`machine`* is used as an example for the name of the machine and should be replaced with the actual machine name when following this step.

b. Enter `29208` in the **Port** field.

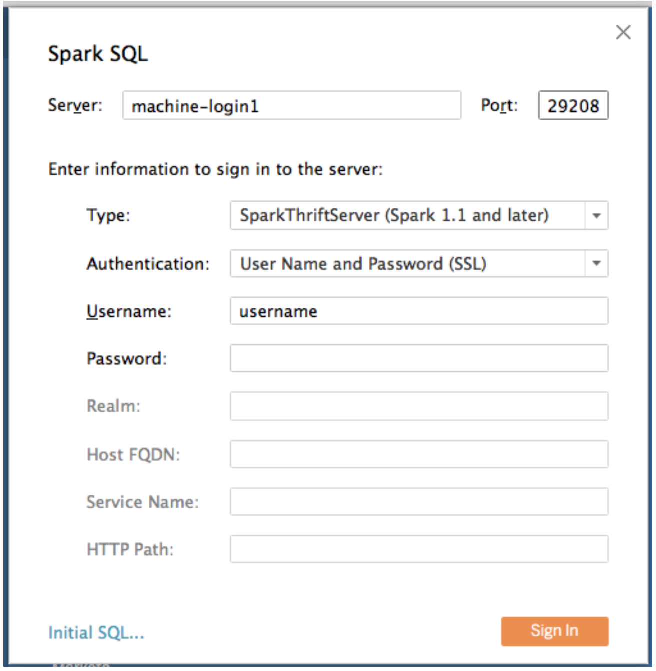
c. Select **SparkThriftServer (Spark 1.1 and later)** from the **Type** drop down.

d. Select **User Name and Password (SSL)** from the **Authentication** drop down.

e. Enter values in the **Username** and **Password** fields.

f. Select the **Sign In** button.

Figure 51. Connect Tableau to the Spark Thrift Server Using SSL



Spark SQL

Server: machine-login1 Port: 29208

Enter information to sign in to the server:

Type: SparkThriftServer (Spark 1.1 and later)

Authentication: User Name and Password (SSL)

Username: username

Password:

Realm:

Host FQDN:

Service Name:

HTTP Path:

7. Perform data visualization/exploration tasks as needed.
8. Request an administrator to stop the Spark Thrift server.

   Administrators should refer to the section titled, '*Control the Spark Thrift Server*' in the '*Urika-GX System Administration Guide*' to stop the Spark Thrift server. Cray recommends to have the Spark Thrift server stopped by administrators. In order to stop the Spark Thrift server non-admins have started without administrative privileges, non-admins should refer to '*Manage the Spark Thrift Server as a Non-Admin User*' of the '*Urika-GX Analytic Applications Guide*'.

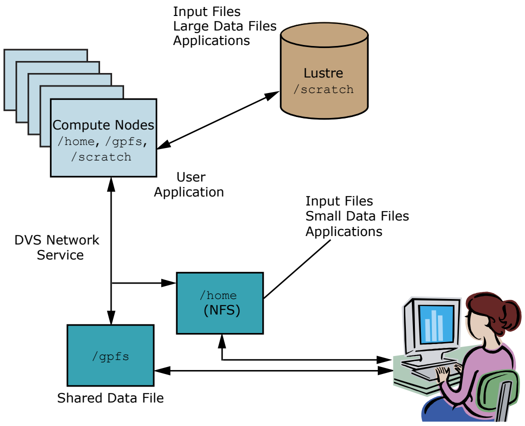
9 Cray DVS

9.1 Introduction to DVS

The Cray Data Virtualization Service (Cray DVS) is a distributed network service that provides transparent access to file systems residing on the service I/O nodes and remote servers in the data center. Cray DVS provides a service analogous to NFS™. It projects local file systems resident on I/O nodes or remote file servers to compute and service nodes within the Cray system. *Projecting* is simply the process of making a file system available on nodes where it does not physically reside. DVS-specific options to the `mount` command enable clients (compute nodes) to access a file system projected by DVS servers. Thus, Cray DVS, while not a file system, represents a software layer that provides scalable transport for file system services. See the `mount(8)` and `dvs(5)` man pages for more information.

Cray DVS uses the Linux-supplied VFS interface to process file system access operations. This allows DVS to project any POSIX-compliant file system.

Figure 52. Cray DVS Use Case

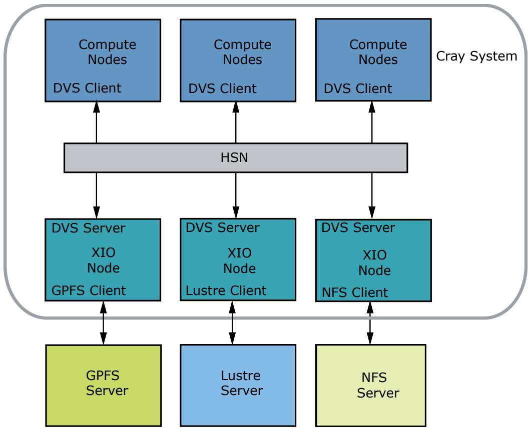


Cray DVS provides I/O performance and scalability to a large number of nodes, far beyond the typical number of clients supported by a single NFS server. Operating system noise and impact on compute node memory resources are both minimized in the Cray DVS configuration.

> **IMPORTANT:** DVS servers use unlimited amounts of CPU and memory resources based directly on the I/O requests sent from DVS clients. For this reason, DVS servers should be dedicated and not share nodes with other services (Lustre nodes, login nodes, etc.).

Administration of Cray DVS is very similar to configuring and mounting any Linux file system. For more information, see the `dvs(5)` man page. Here is a system administrator's view of Cray DVS.

Figure 53. Cray DVS In a Cray System



9.1.1 Use Cray DVS on Urika-GX

Cray has successfully experimented with connecting Urika-GX to GPFS and NFS filesystems via Cray DVS. For more information and guidance, please contact Cray Support and visit *https://cray.my.salesforce.com/ka3330000008gb3*.

Major Features of DVS

- DVS supports failover and failback for parallel modes. The topic describes how it works and includes example console messages.
- DVS periodic sync promotes data and application resiliency and is more efficient than the DVS mount option `closesync`. The topic describes how it works and how it can be tuned.
- DVS statistics enable analysis of DVS performance on client and server nodes in CLE. There are many per-mount statistics available with this release.
- DVS can log requests sent to servers to aid in debugging. The topic shows an example log file and describes how to enable, disable, and reset request logging.
- DVS lists outstanding client requests, including the DVS server node and the amount of time the request has been waiting for a response.

9.1.2 DVS ioctl Interfaces

The following are provided for advanced users who require DVS `ioctl` interfaces. Most are correlates of environment variable and mount options with the same name.

Variable Name	Argument Type/Size	Purpose
`DVS_GET_FILE_ATOMIC` / `DVS_SET_FILE_ATOMIC`	signed 16-bit (must be 0 or 1 for `SET`)	Retrieves/sets the `atomic` option value for a file on a DVS mount.
`DVS_GET_FILE_BLK_SIZE` / `DVS_SET_FILE_BLK_SIZE`	signed 32-bit (must be > 0 for `SET`)	Retrieves/sets the DVS block size for a file on a DVS mount.

Variable Name	Argument Type/Size	Purpose
DVS_GET_FILE_CACHE / DVS_SET_FILE_CACHE	signed 16-bit (must be 0 or 1 for SET)	Retrieves/sets the cache option for a file on a DVS mount. To set the file cache, read-only option must be set.
DVS_GET_FILE_CACHE_READ_SZ / DVS_SET_FILE_CACHE_READ_SZ	signed 32-bit (must be > 0 for SET)	Retrieves/sets the cache_read_sz value for a file on a DVS mount.
DVS_GET_FILE_CLOSESYNC / DVS_SET_FILE_CLOSESYNC	signed 16-bit (must be 0 or 1 for SET)	Retrieves/sets the closesync option for a file on a DVS mount.
DVS_GET_FILE_DATASYNC / DVS_SET_FILE_DATASYNC	signed 16-bit (must be 0 or 1 for SET)	Retrieves/sets the current datasync value for a file on a DVS mount.
DVS_GET_FILE_DEFEROPENS / DVS_SET_FILE_DEFEROPENS	signed 16-bit (must be 0 or 1 for SET)	Retrieves/sets the deferopens value for a file on a DVS mount.
DVS_GET_FILE_KILLPROCESS / DVS_SET_FILE_KILLPROCESS	signed 16-bit (must be 0 or 1 for SET)	Retrieves/sets the killprocess option for a file on a DVS mount.
DVS_GET_FILE_STRIPE_WIDTH / DVS_SET_FILE_STRIPE_WIDTH	signed 32-bit (must be > 0 for SET)	Retrieves/sets the stripe width size for a file on a DVS mount. To set the stripe width, loadbalance option must be set.
DVS_GET_NNODES	signed 32-bit	Retrieves the number of nodes currently available for a mount point.
DVS_GET_REMOTE_FS_MAGIC	unsigned 64-bit	Gets the remote file system type for a file on a DVS mount.
DVS_BCAST_IOCTL	struct dvs_ioctl_tunnel	Used for DataWarp to allow specialized ioctl calls to be passed through DVS to a remote server.
DVS_AUGMENTED_BCAST_IOCTL	struct dvs_augmented_ioctl_tunnel	Used for DataWarp to allow specialized ioctl calls to be passed through DVS to a remote server.
DVS_TUNNEL_IOCTL	struct dvs_ioctl_tunnel	Used for DataWarp to allow specialized ioctl calls to be passed through DVS to a remote server.
DVS_AUGMENTED_TUNNEL_IOCTL	struct dvs_augmented_ioctl_tunnel	Used for DataWarp to allow specialized ioctl calls to be passed through DVS to a remote server.

9.1.3 DVS Client Mount Point Options

atomic / noatomic

atomic enables atomic stripe parallel mode. This ensures that stripe parallel requests adhere to POSIX read/write atomicity rules. DVS clients send each I/O request to a single DVS server to ensure that the bytes are not interleaved with other requests from DVS clients. The DVS server used to perform the read, write, or metadata operation is selected using an internal hash involving the underlying file or directory inode number and the offset of data into the file relative to the DVS block size.

noatomic disables atomic stripe parallel mode. If *nodename* or *nodefile* lists multiple DVS servers, and neither loadbalance nor cluster parallel mode is specified, DVS stripes I/O requests across multiple servers and does not necessarily adhere to POSIX read/write atomicity rules if file locking is not used.

- Default setting: noatomic or 0
- Associated environment variable: *DVS_ATOMIC*
- Additional notes: none

attrcache_timeout

attrcache_timeout enables client-side attribute caching. File attributes and dentries for getattr requests, pathname lookups, etc. are read from DVS servers and cached on the DVS client for *n* seconds. Subsequent lookups or getattr requests use the cached attributes until the timeout expires, at which point they are read and cached again on first reference. Attribute caching can significantly increase performance, most notably in pathname lookup situations. When attribute caching is disabled, DVS clients must send a lookup request to a DVS server for every level of a pathname, and repeat this for every pathname operation. When it is enabled, it sends a lookup request to a DVS server for every level of a pathname once per *n* seconds.

- Default setting: 0
- Associated environment variable: none
- Additional notes: Not recommended for read-write files systems.

blksize=*n*

blksize=*n* sets the DVS block size to *n* bytes.

- Default setting: 32768
- Associated environment variable: *DVS_BLOCKSIZE*
- Additional notes: blksize is used in striping.

cache / nocache

cache enables client-side read caching. The client node performs caching of reads from the DVS server node and provides data to user applications from the page cache if possible, instead of performing a data transfer from the DVS server node.

nocache disables client-side read caching.

- Default setting: nocache or 0

- Associated environment variable: *`DVS_CACHE`*
- Additional notes: Cray DVS is not a clustered file system; no coherency is maintained among multiple DVS client nodes reading and writing to the same file. If cache is enabled and data consistency is required, applications must take care to synchronize their accesses to the shared file.

`cache_read_sz`

`cache_read_sz` is a limit that can be specified to prevent reads over this size from being cached in the Linux page cache.

- Default setting: `0`
- Associated environment variable: *`DVS_CACHE_READ_SZ`*
- Additional notes: none

`closesync` / `noclosesync`

`closesync` enables data synchronization on last close of a file. When a process performs the final close of a file descriptor, in addition to forwarding the close to the DVS server, the DVS server node waits until data has been written to the underlying media before indicating that the close has completed. Because DVS does not cache data on client nodes and has no replay capabilities, this ensures that data is not lost if a server node crashes after an application has exited.

`noclosesync` is the default behavior of DVS. In the default case, DVS returns a `close()` request immediately.

- Default setting: `noclosesync` or `0`
- Associated environment variable: *`DVS_CLOSESYNC`*
- Additional notes: When DVS periodic sync is enabled, it is redundant to use `closesync`. Moreover, periodic sync is more efficient because it tracks which files are "dirty."

`datasync` / `nodatasync`

`datasync` enables data synchronization. The DVS server node waits until data has been written to the underlying media before indicating that the write has completed.

`nodatasync` disables data synchronization. The DVS server node returns from a write request as soon as the user's data has been written into the page cache on the server node.

- Default setting: `nodatasync` or `0`
- Associated environment variable: *`DVS_DATASYNC`*
- Additional notes: `datasync` can significantly impact performance.

`deferopens`

`deferopens` defers DVS client open requests to DVS servers for a given set of conditions. When a file is open in stripe parallel mode or atomic stripe parallel mode, DVS clients send the open request to a single DVS server only. Additional open requests are sent as necessary when the DVS client performs a read or write to a different server for the first time. The `deferopens` option deviates from POSIX specifications. For example, if a file was removed after the initial open succeeded but before deferred opens were initiated by a read or write operation to a new server, the read or write operation would fail with `errno` set to `ENOENT` (because the open was unable to open the file).

`nodeferopens` disables the deferral of DVS client open requests to DVS servers. When a file is open in stripe parallel mode or atomic stripe parallel mode, DVS clients send open requests to all DVS servers denoted by nodename or nodefile.

- Default setting: `nodeferopens` or `0`
- Associated environment variable: *`DVS_DEFEROPENS`*
- Additional notes: none

`distribute_create_ops` / `nodistribute_create_ops`

`distribute_create_ops` caused DVS to change its hashing algorithm so that create and lookup requests are distributed across all of the servers, as opposed to being distribute to a single server. This applies to creates, mkdirs, lookups, mknods, links, and symlinks.

`nodistribute_create_ops` is the default, and DVS uses its normal algorithm of using just one target server.

- Default setting: `nodistribute_create_ops` or `0`
- Associated environment variable: none
- Additional notes: none

`dwfs` / `nodwfs`

`dwfs` causes DVS to change its behavior to support a DataWarp file system.

`nodwfs` is the default, where DVS does not support a DataWarp file system.

- Default setting: `nodwfs` or `off`.
- Associated environment variable: none
- Additional notes: none

`failover` / `nofailover`

`failover` enables failover and failback of DVS servers. If multiple DVS servers are listed for a single DVS mount point and one or more of the servers fails, operations for that mount point continue by using the subset of servers still available. When the downed servers are rebooted and start DVS, any client mount points that had performed failover operations failback to once again include the servers as valid nodes for I/O forwarding operations.

`nofailover` disables failover and failback of DVS servers. If one or more servers for a given mount point fail, operations for that mount point behave as described by the corresponding `retry` or `noretry` option specified for the mount point.

- Default setting: `failover` or `1`
- Associated environment variable: none
- Additional notes: The failover option cannot be specified at the same time as the `noretry` option. If all servers fail, operations for the mount point

behave as described by the `retry` option until at least one server is rebooted and has loaded DVS.

hash

The `hash` option has three possible values:

fnv-1a `hash=fnv-1a` offers the best overall performance with very little variation due to differing numbers of servers.

jenkins `hash=jenkins` is the hash that DVS previously used. It is included in the unlikely case of end-case pathological issues with the `fnv-1a` hash, but has worse overall performance.

modulo `hash=modulo` does not do any hash at all, but rather takes the modulo of the seed that it is given. This option can potentially have high load balancing characteristics, but is extremely vulnerable to pathological cases such as file systems that only allocate even numbered inodes or a prime number of servers.

- Default setting: `fnv-1a`
- Associated environment variable: none
- Additional notes: Except in cases of extremely advanced administrators or specific advice from DVS developers, do not use the `hash` mount option. The best course of action is to let DVS use its default value.

hash_on_nid

With `hash_on_nid` set to `on`, DVS uses the nid of the client as the hash seed instead of using the file inode number. This effectively causes all request traffic for the compute node to go to a single server. This can help metadata operation performance by avoiding lock thrashing in the underlying file system when each process on a set of DVS clients is using a separate file.

- Default setting: `off`
- Associated environment variable: none
- Additional notes: Setting `hash_on_nid=on` also sets `hash=modulo` by default. `hash_on_nid` is forced `off` when the loadbalance option is used.

killprocess / nokillprocess

`killprocess` enables killing processes that have one or more file descriptors with data that has not yet been written to the backing store. DVS provides this option to attempt to ensure that a process is not affected by silent data loss, such as when data still resides in the kernel or file system page cache on the DVS server after a write has completed.

`nokillprocess` disables the killing of processes that have written data to a DVS server when a server fails. When a server fails, processes that have written data to the server are not killed. If a process continues to perform operations with an open file descriptor that had been used to write data to the server, the operations fail (with `errno` set to `EHOSTDOWN`). A new open of the file is allowed, and subsequent operations with the corresponding file descriptor function normally.

- Default setting: `killprocess` or `1`

- Associated environment variable: *DVS_KILLPROCESS*
- Additional notes: If DVS periodic sync is enabled, DVS servers attempt to fsync dirty files to minimize the number of processes that are killed. DVS periodic sync will also fsync a file's data when the file is closed. While it is highly unlikely, if DVS periodic sync is not enabled, DVS cannot fully guarantee prevention of silent data loss with this option alone because a close() does not guarantee data has been transferred to the underlying media (see the closesync option).

loadbalance / noloadbalance

For a description of loadbalance mode, see *About DVS Loadbalance Mode* on page 143.

noloadbalance automatically sets the following mount options: maxnodes = 1, cache = 1, and hash_on_nid = 0.

- Default setting: noloadbalance or 0
- Associated environment variable: none
- Additional notes: none

magic

magic defines what the expected file system magic value for the projected file system on the DVS servers should be. When a DVS client attempts to mount the file system from a server, it verifies that the underlying file system has a magic value that matches the specified value. If not, the DVS client excludes that DVS server from the list of servers it uses for the mount point and prints a message to the system console. Once the configuration issue on the DVS server has been addressed and the client mounts the correct file system, DVS can be restarted on the server. All clients subsequently verify that the server is configured correctly and include the server for that mount point. Many file system magic values are defined in the /usr/include/linux/magic.h file. Commonly used magic values on Cray systems are:

NFS	0x6969
GPFS	0x47504653
Lustre servers	0x0bd00bd1
Lustre clients	0x0bd00bd0

- Default setting: the underlying file system's magic value
- Associated environment variable: none
- Additional notes: none

maxnodes

maxnodes is used in configuring DVS modes. See *About DVS Modes* on page 140.

- Default setting: number of nodes available (nnodes)
- Associated environment variable: *DVS_MAXNODES*
- Additional notes: none

`mds`

`mds` specifies which DVS server meta-data operations are sent to.

- Default setting: required (e.g., `server1`)
- Associated environment variable: none
- Additional notes: Only used for DataWarp file systems.

`nodefile`

`nodefile` is equivalent to *`nodename`* but allows the administrator to specify a list of server nodes in a file instead of placing them on the mount line directly. This is more convenient for large sites that use many DVS server nodes. Node names are separated by a new line or a colon (:) character and no spaces.

- Default setting: required (unless *`nodename`* is used)
- Associated environment variable: none
- Additional notes: none

`nodename`

`nodename` is equivalent to *`nodefile`* but the administrator specifies a list of server nodes on the mount line directly. Node names are separated by a colon (:) character and no spaces.

- Default setting: required (unless *`nodefile`* is used)
- Associated environment variable: none
- Additional notes: none

`path`

`path` specifies the path of the directory on the DVS server that is to be projected.

- Default setting: required
- Associated environment variable: none
- Additional notes: none

`retry` / `noretry`

`retry` enables the retry option, which affects how a DVS client node behaves in the event of a DVS server node going down. If `retry` is specified, any user I/O request is retried until it succeeds, receives an error other than a "node down" indication, or receives a signal to interrupt the I/O operation.

`noretry` disables retries of user I/O requests when the DVS server receiving the request is down.

- Default setting: `retry` or `1`
- Associated environment variable: none
- Additional notes: none

`ro_cache` / `no_ro_cache`

`ro_cache` enables read-only caching for files on writable mount points. Files opened with read-only permissions in `ro_cache` mode are treated as if they are on a DVS read-only cached mount point. If the file has any concurrent open that has write permissions, all instances of that file revert to the default `no_ro_cache` mode for the current and subsequent reads.

`no_ro_cache` disables read-only caching for files on writable mount points.

- Default setting: `no_ro_cache` or `0`
- Associated environment variable: none
- Additional notes: none

`userenv` / `nouserenv`

`userenv` argument specifies that DVS must honor end user environment variable overrides for DVS mount options.

`nouserenv` argument allows the administrator to block end user environment variable overrides for DVS mount options.

- Default setting: `userenv` or `1`
- Associated environment variable: none
- Additional notes: none

9.1.4 DVS Environment Variables

By default, user environment variables allow client override of options specified in the `/etc/fstab` entry and are evaluated a file is opened by DVS. However, if the `nouserenv` option is specified in the DVS entry, then user environment variables are disabled.

The following environment variables are for use in the default case:

Variable Name	Options	Purpose
`DVS_ATOMIC`	`on|off`	Overrides the `atomic` or `noatomic` mount options.
`DVS_BLOCKSIZE`	*n*	A nonzero number, *n* overrides the `blksize` mount option.
`DVS_CACHE`	`on|off`	Overrides the `cache` or `nocache` mount options. This option is available only for read-only mount points and is ignored for writeable mount points.
`DVS_CACHE_READ_SZ`	*n*	A positive integer, *n* overrides the `cache_read_sz` mount option.
`DVS_CLOSESYNC`	`on|off`	Overrides the `closesync` or `noclosesync` mount options.
`DVS_DATASYNC`	`on|off`	Overrides the `datasync` or `nodatasync` mount options. **NOTE:** Setting `DVS_DATASYNC` to `on` can slow down an application considerably. Consider using periodic sync.
`DVS_DEFEROPENS`	`on|off`	Overrides the `deferopens` or `nodeferopens` mount options.
`DVS_KILLPROCESS`	`on|off`	Overrides the `killprocess` or `nokillprocess` mount options.
`DVS_MAXNODES`	*n*	A nonzero number, *n* overrides the `maxnodes` mount option. The specified value of `maxnodes` must be greater than zero and less than or equal to the number of server nodes specified on the mount, otherwise the variable has no effect.

9.1.5 Modes

9.1.5.1 About DVS Modes

There are two primary ways to use Cray DVS: in serial mode or parallel mode, as indicated in the following table. In serial mode, one DVS server on a Cray service node projects a file system to multiple compute node clients. In parallel mode, multiple DVS servers—in configurations that vary in purpose, layout, and performance—project a file system to multiple compute node clients.

Table 16. Cray DVS Access Modes

Mode	Access Level	Pattern
Serial	Read/Write	Many clients, one server
Parallel	Read/Write	Many clients, many servers

DVS mode is not selected by a switch, but rather by configuration. It is determined by the system administrator's choice of DVS mount point options. A DVS mode is really just the name given to a collection of mount options chosen to achieve a particular goal. Users cannot choose among DVS modes unless the system administrator has configured the system to make more than one mode available. A system administrator can make several DVS modes available on the same compute node by mounting a file system with different mount point options on different mount points on that compute node. This table shows the rationale and an example mount entry for each DVS mode.

Mode	Rationale	Example Configuration Settings

Serial	Simplest implementation of DVS. Only option if no cluster/shared file system available.	`servers: r0s0c1n1`
		`options: maxnodes=1`

Cluster Parallel	Often used for a large file system, must be a shared file system such as GPFS (Spectrum Scale). Can distribute file I/O and metadata operations among several servers to avoid overloading any one server and to speed up operations. I/O for a single file goes only to the chosen server.	`servers: r0s1c1n1, r0s2c1n2,`
		`r0s2c0n1`
		`options: maxnodes=1`

Stripe Parallel	Used to distribute file I/O load at the granularity of a block of data within a file. Adds another level of parallelism to better distribute the load. I/O for a single file may go to multiple servers.	`servers: r0s1c1n1, r0s2c1n2,`
		`r0s2c0n1`
		`options: maxnodes=3`

Atomic Stripe Parallel	Used when stripe parallel makes sense and POSIX read/write atomicity required.	`servers: r0s1c1n1, r0s2c1n2,`
		`r0s2c0n1`
		`options: maxnodes=3,atomic`

Loadbalance	Used for near-optimal load distribution when a read-only file system is being used. By default, enables `readonly` and sets `cache=1`, `failover=1`, `maxnodes=1`, and `hash_on_nid=0`.	`servers: r0s1c1n1, r0s2c1n2,`
		`r0s2c0n1`
		`loadbalance: true`

Serial, cluster parallel, and atomic stripe parallel modes all adhere to POSIX read/write atomicity rules, but stripe parallel mode does not. POSIX read/write atomicity guarantees that all bytes associated with a read or write are not interleaved with bytes from other read or write operations.

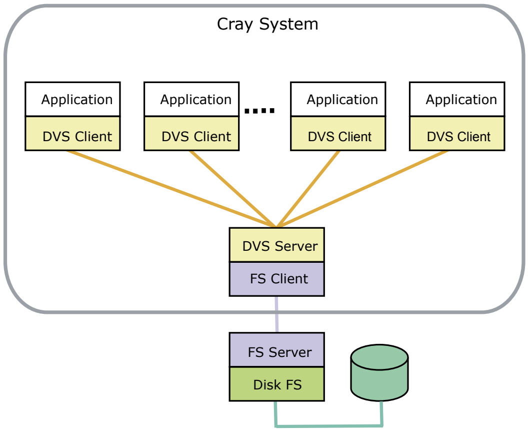
9.1.5.2 About DVS Serial Mode

Serial mode is the simplest implementation of DVS, where each file system is projected from a single DVS server to multiple clients (see figure). DVS can project multiple file systems in serial mode by assigning a new or existing DVS server to each additional file system in serial access mode and entering the appropriate mount point on the clients. The following example mount entry contains the mount options essential for serial mode: a single `nodename` and `maxnodes=1`.

```
mount -o nodename=server1, maxnodes=1
```

DVS serial mode adheres to POSIX read/write atomicity rules.

Figure 54. Cray DVS Serial Access Mode



9.1.5.3 About DVS Cluster Parallel Mode

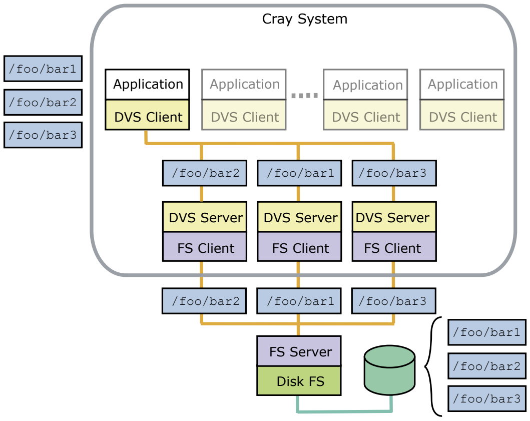
In cluster parallel access mode, each client interacts with multiple servers. For example, in the figure below, DVS is mounted to `/foo` on the DVS client, and three different files—`bar1`, `bar2`, and `bar3`—are handled by three different DVS servers, thus distributing the load. The server used to perform the read, write, or metadata operation is selected using an internal hash involving the underlying file or directory inode number. Once a server has been selected for a file, it looks similar to serial mode: all I/O from all clients involving that file routes to that server to prevent file system coherency thrash.

The following example mount entry contains the mount options essential for cluster parallel mode: more than one `nodename` and `maxnodes=1`.

```
mount -o nodename=server1:server2:server3, maxnodes=1
```

DVS cluster parallel mode adheres to POSIX read/write atomicity rules.

Figure 55. Cray DVS Cluster Parallel Access Mode



9.1.5.4 About DVS Loadbalance Mode

Loadbalance mode is a client access mode for DVS used to more evenly distribute loads across servers. The clients, Cray system compute nodes, automatically select the server based on a DVS-internal node ID (NID) from the list of available server nodes specified on the `/etc/fstab` line. Loadbalance mode is valid only for read-only mount points. Loadbalance mode automatically enables failover to another DVS server.

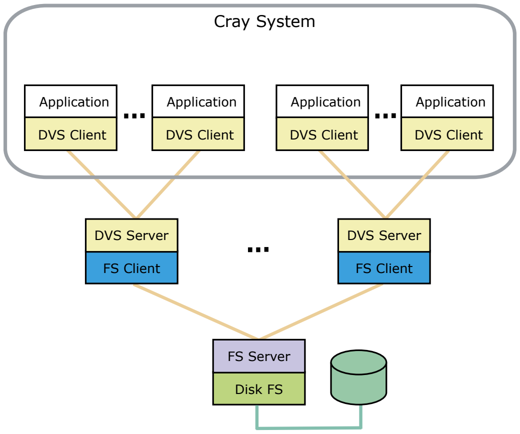
The following example mount entry contains the mount options essential for loadbalance mode: more than one `nodename`, `maxnodes=1`, and the `loadbalance` option.

```
mount -o nodename=server1:server2:server3, maxnodes=1, loadbalance
```

DVS automatically enables the `cache` mount option in loadbalance mode because it is a read-only mode. This means that a DVS client pulls data from the DVS server the first time it is referenced, but then the data is stored in the client's page cache. While the application is running, all future references to that data are local to the client's memory, and DVS will not be involved at all. However, if the node runs low on memory, the Linux kernel may remove these pages, and then the client must fetch the data from the DVS server on the next reference to repopulate the client's page cache.

To enable attribute caching as well, use the `attrcache_timeout` mount option for `loadbalance` mount points. This allows attribute-only file system operations to use local attribute data instead of sending the request to the DVS server. This is useful in loadbalance mode because with a read-only file system, attributes are not likely to change.

Figure 56. Cray DVS Loadbalance Mode



9.1.5.5 About DVS Stripe Parallel Mode

Stripe parallel mode builds upon cluster parallel mode to provide an extra level of parallelized I/O forwarding for clustered file systems. Each DVS server can serve all files, and DVS servers are automatically chosen based on the file inode and offsets of data within the file relative to the DVS block size value. For example, in the figure below, DVS is mounted to `/foo` on the DVS client, and the I/O for three different blocks (or segments) of data within file `bar`—`seg1`, `seg2`, and `seg3`—is handled by three different DVS servers, thus distributing the load at a more granular level than that achieved by cluster parallel mode. Note that while file I/O is distributed at the block level, file metadata operations are distributed as in cluster parallel mode: the metadata operations of a given file are always handled by the same DVS server. Stripe parallel mode provides the opportunity for greater aggregate I/O bandwidth when forwarding I/O from a coherent cluster file system. All I/O from all clients involving the same file routes each block of file data to the same server to prevent file system coherency thrash. GPFS has been tested extensively using this mode.

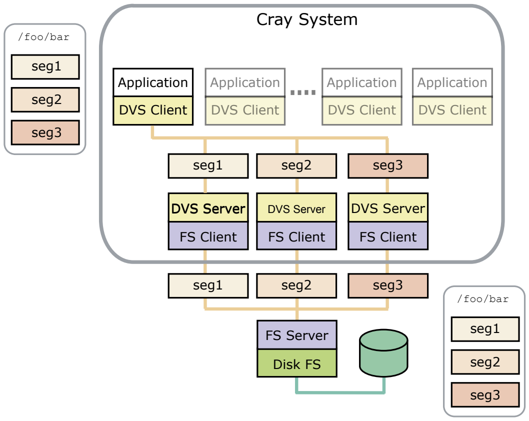
> **ATTENTION:** NFS cannot be used in stripe parallel mode because NFS implements close-to-open cache consistency; therefore striping data across the NFS clients could compromise data integrity.

The following example mount entry contains the mount options essential for stripe parallel mode: more than one `nodename` and `maxnodes` > 1.

```
mount -o nodename=server1:server2:server3, maxnodes=3
```

DVS stripe parallel mode does not adhere to POSIX read/write atomicity rules. See *About DVS Atomic Stripe Parallel Mode* for information about how to achieve POSIX read/write atomicity with this mode.

Figure 57. Cray DVS Stripe Parallel Mode



9.1.5.5.1 About DVS Atomic Stripe Parallel Mode

Stripe parallel mode provides parallelism within a file at the granularity of the DVS block size. However, when applications do not use their own file locking, stripe parallel mode cannot guarantee POSIX read/write atomicity. In contrast, *atomic* stripe parallel mode adheres to POSIX read/write atomicity rules while still allowing for possible parallelism within a file. It is similar to stripe parallel mode in that the server used to perform the read, write, or metadata operation is selected using an internal hash involving the underlying file or directory inode number, and the offset of data into the file is relative to the DVS block size. However, once that server is selected, the entire read or write request is handled by that server only. This ensures that all I/O requests are atomic while allowing DVS clients to access different servers for subsequent I/O requests if they have different starting offsets within the file.

The following example mount entry contains the mount options essential for atomic stripe parallel mode: more than one `nodename`, `maxnodes` > 1, and the `atomic` option.

```
mount -o nodename=server1:server2:server3, maxnodes=3, atomic
```

Users can request atomic stripe parallel mode by setting the `DVS_ATOMIC` user environment variable to `on`.

9.1.6 Resiliency and Diagnostics

9.1.6.1 About DVS Failover

DVS clients use resiliency communication agent (RCA) events to determine when server nodes have failed or when DVS has been unloaded from a server node and when server nodes have been booted and DVS is reloaded. This ensures that all clients are informed of server failures and reboots in the same manner at the same time, which reduces the underlying file system coherency traffic associated with rerouting I/O operations away from downed servers and back to rebooted servers.

Cray DVS supports failover and failback for parallel modes:

- For cluster, stripe, and atomic stripe parallel modes, add the `failover` option to the mount line or `/etc/fstab` entry to specify failover and failback.
- For loadbalance mode, failover and failback are specified by default.

DVS failover and failback are done in an active-active manner. Multiple servers must be specified in the `/etc/fstab` entry for failover and failback to function. When a server fails, it is taken out of the list of servers to use for the mount point until it is rebooted. All open and new files use the remaining servers as described by the cluster, stripe, and atomic stripe parallel sections. Files not using the failed server are not affected.

When failover occurs:

- If all servers fail, I/O is retried as described by the `retry` option (see *DVS Client Mount Point Options* on page 133).
- Any mount point using loadbalance mode automatically recalibrates the existing client-to-server routes to ensure that the clients are evenly distributed across the remaining servers. When failback occurs, this process is repeated.
- Any mount point using cluster parallel mode automatically redirects I/O to one of the remaining DVS servers for any file that previously routed to the now-down server. When failback occurs, files are rerouted to their original server.
- Any mount point using stripe parallel mode or atomic stripe parallel mode automatically restripes I/O across the remaining DVS servers in an even manner. When failback occurs, files are restriped to their original pattern.

Client System Console Message: "DVS: file_node_down: removing from list of available servers for 2 mount points"

The following message indicates that a DVS server has failed.

```
DVS: file_node_down: removing r0s1c1n3 from list of available
servers for 2 mount points
```

In this example, `r0s1c1n3` is the DVS server that has failed and has been removed from the list of available mount points provided in the `/etc/fstab` entry for the DVS projection.

After the issue is resolved, the following message is printed to the console log of each client of the projection:

```
DVS: file_node_up: adding r0s1c1n3 back to list of available servers
for 2 mount points
```

9.1.6.2 About DVS Periodic Sync

DVS periodic sync improves data resiliency and facilitates a degree of application resiliency so that applications may continue executing in the event of a stalled file system or DVS server failure. Without periodic sync, such an event would result in DVS clients killing any processes with open files that were written through the failed server. Any data written through that server that was only in the server's page cache and not written to disk would be lost, and processes using the file would see data corruption.

Periodic sync works by periodically performing `fsync` on individual files with dirty pages on the DVS servers, to ensure those files are written to disk. For each file, the DVS client tracks when a DVS server performs a file sync and when processes on DVS clients write to it, and then notifies the DVS server when `fsync` is needed.

DVS periodic sync makes the DVS `closesync` mount option redundant. Periodic sync is more efficient than `closesync` because it is aware of which files may have dirty pages.

Use the following three `/proc` files to tune DVS periodic sync behavior (`echo` desired value into each file):

`/proc/fs/dvs/sync_num_threads`

Specifies the number of threads on the DVS server that perform sync operations. There must be at least 1 thread and the maximum number is 32. The default value is 8.

`/proc/fs/dvs/sync_dirty_timeout_secs`

On DVS *servers*, specifies the number of seconds that must have passed since the file was written before DVS syncs it. The default value is 300. The objective is to reduce unnecessary sync operations for files actively being updated. Decreasing this number increases the likelihood that the file is in use when it is synced. Increasing this number increases the likelihood that processes are killed during a server failure.

On DVS *clients*, specifies the number of seconds that must have passed since the file was written before DVS asks the server for an updated sync time. The default value is 300. Decreasing this number increases the number of DVS requests being sent. Increasing this number increases the likelihood that processes are killed during a server failure.

`/proc/fs/dvs/sync_period_secs`

On DVS *servers*, specifies the number of seconds before the `sync_num_threads` syncs files on the DVS server (if necessary). The default value is 300.

On DVS *clients*, specifies the number of seconds between checks for dirty files that need to request the last sync time from the server. The default value is 600.

A fourth `/proc` file, `/procsfs/dvs/sync_stats`, collects statistics of the syncing behavior. This setting is not tunable (read only).

9.1.6.3 About DVS Statistics

The `/proc/fs/dvs/stats` file contains statistics for system operations that cannot be correlated to a specific DVS mount point, and is thus most interesting on DVS servers.

The same type of information is also available on DVS clients at the mount point (`/proc/fs/dvs/mounts/0/stats`, `/proc/fs/dvs/mounts/1/stats`, etc.) Each of these files contains the statistics for that specific mount point only. More information about each of these mount points can be obtained by viewing the mount file that resides in the same directory (e.g., `/proc/fs/dvs/mounts/0/mount`).

- The first section of the file contains remote procedure call (RPC) message-passing statistics. Each line displays a file system operation, followed by counts of successful and failed send operations of that type, counts of successful and failed receive operations of that type, the time it took to process the most recent operation of that type, and the maximum time to process that operation in the history of the system.
- The second section of the file contains statistics on virtual file system (VFS) operations. Each line displays a callback name, followed by counts of successful and failed callbacks of that name, the time it took to process the most recent callback of that name, and the maximum time to process that callback in the history of the system.
- The third section contains fields for the smallest and largest request sizes (in bytes) for read and write operations, and the number of successful and failed interprocess communication (IPC) requests, IPC asynchronous requests, and IPC replies.

In addition, the `/proc/fs/dvs/ipc/stats` file displays DVS IPC statistics such as bytes transferred and received, NAK counts, and so forth. It also displays message counts by type and size.

DVS statistics are enabled and collected by default.

- To disable a DVS statistics file, write a zero into the file:

  ```
  echo 0 > /proc/fs/dvs/stats
  ```

- To re-enable a DVS statistics file, write a 1 into the file:

  ```
  echo 1 > /proc/fs/dvs/stats
  ```

- To reset the statistics values to zero, write a 2 into the file:

  ```
  echo 2 > /proc/fs/dvs/stats
  ```

9.1.6.4 About DVS Client Requests

DVS provides a list of outstanding requests on client nodes in /proc/fs/dvs/ipc/requests, which lists the DVS server node, the request, the DVS file system path, uid, time that the request has been waiting for a response, and the associated apid. If the request is from a process that was not spawned through aprun, the request apid is 0. An example output of the file looks like:

```
% cat /proc/fs/dvs/ipc/requests
server: r0s1c1n3 request: RQ_LOOKUP path: /dsl/ufs/home user: 12795 time: 0.000 sec
apid: 3871
```

The file appears on DVS servers but returns an error when a user tries to access it.

9.1.7 Caveats

9.1.7.1 Caveat: Client Consistency

DVS supports close-to-open consistency, which means that files on client and server are consistent at open() and close(). However, while a file is open, DVS does not guarantee that the file on the client and the file on the server are consistent.

9.1.7.2 Caveat: DVS blksize Must Match or be a Multiple of GPFS Block Size

When projecting a general parallel file system (GPFS), the client mount option blksize must match or be a multiple of the GPFS blocksize. When projecting multiple GPFS file systems that have different block sizes, DVS must have a different /etc/fstab entry for each file system.

In the case of two GPFS file systems, one with a 64 kilobyte (KB) block size, and another with a 1024KB block size, the /etc/fstab entries for DVS would look like the following:

```
/gpfs1 /dvs1 dvs path=/dvs1,nodefile=/etc/nidlist1,blksize=65536
/gpfs2 /dvs2 dvs path=/dvs2,nodefile=/etc/nidlist2,blksize=1048576
```

9.1.7.3 Caveat: Expanded File System Support

Setting up and mounting target file systems on Cray service nodes is the sole responsibility of the customer or an agent of the customer. Cray Custom Engineering is available to provide a tailored file system solution. Please contact a Cray service representative for more information.

9.1.7.4 Caveat: flock() Not Supported

DVS does not support `flock()` system calls and will return an error. DVS will set `errno` to `ENOTSUPP` when a `flock()` call is attempted for a DVS-projected file system.

DVS supports file locking with `fcntl()`.

For more information, see the `fcntl(2)` man page.

9.1.7.5 Caveat: mmap() Support

DVS currently supports only read-only access when the `MAP_SHARED` flag is specified to the memory map function `mmap()`. This is because writable shared mmaps are cached in the Linux kernel page cache, and DVS does not maintain consistency between DVS clients and DVS servers. Therefore the file data cached on the DVS client may not be kept coherent with other accesses to the file data from other nodes. This may cause DVS to set `errno` to `ENOSYS`. Write access is expected to be available in the next release.

Write access is available when the `MAP_PRIVATE` flag is specified to `mmap()` because the file data is private to the process that performed the `mmap()` and therefore coherency with other processes is not a problem.

9.1.8 Administrative Tasks

9.1.8.1 Disable DVS Fairness of Service

About this task

DVS creates user- or job-specific request queues for clients. Originally, DVS used one queue to handle requests in a FIFO (first-in, first out) fashion. This meant that since all clients shared one queue, a demanding job could tax the server disproportionately and the other clients would have to wait until the demanding client's request(s) completed. Fairness of Service creates a *list* of queues—one queue for each client and/or job. The list of queues is processed in a circular fashion. When a message thread is available, it fetches the first queue on the list, moves that queue to the end of the list, and processes the first message in that queue. This helps to distribute the workload and potentially helps contending applications perform better.

Fairness of Service is enabled by default. This procedure describes how to disable Fairness of Service.

Procedure

1. Stop DVS on all servers.

   NOTE: This would typically be done only during a maintenance interval, because this is a drastic action.

2. Edit `/etc/modprobe.d/dvs.conf` file on all the DVS server NIDs configured in the cluster to enter the following line :

```
options dvsipc_single_msg_queue=1
```

3. Restart DVS on all servers.

9.1.8.2 Force a Cache Revalidation on a DVS Mount Point

About this task

Mounting DVS with the attrcache_timeout=[time_in_seconds] option can improve performance because cached file attributes on a DVS client preclude the need to make some requests of the DVS server. Unfortunately, if the file attributes of the DVS mounted file system changed, the only way to revalidate the cache was to wait the entire timeout, which is often as long as four hours. Users can force a cache revalidation at any time, not just when the timeout has expired, by using the following procedure.

Procedure

1. Force a cache revalidation on a DVS client using one of the following methods:

   - To revalidate all cached attributes on a single DVS mount point, echo 1 into that mount point's `drop_caches proc` file. The following example uses the second mount point on the client and uses the `cat` command first to confirm that is the desired mount point. To specify a different mount point, replace the `2` with `0-`*`n`*.

     ```
     cat /proc/fs/dvs/mounts/2/mount
     echo 1 > /proc/fs/dvs/mounts/2/drop_caches
     ```

   - To revalidate all attributes across all DVS mounts, echo 1 into the universal DVS `drop_caches proc` file. For example:

     ```
     echo 1 > /proc/fs/dvs/drop_caches
     ```

2. (Optional) Clear out other caches on the DVS client to ensure that all data is revalidated.

   ```
   echo 3 > /proc/sys/vm/drop_caches
   ```

3. (Optional) Clear out other caches on the DVS *server* to ensure that all data is revalidated.

   If an NFS file system is the underlying file system, it is also likely that the same procedure will be required on the DVS servers to allow all of the changes on the NFS file system to properly propagate out to the DVS clients. This has to do with NFS caching behavior.

   ```
   echo 3 > /proc/sys/vm/drop_caches
   ```

9.1.8.3 Project XFS over DVS

About this task

The following procedure is used to project an XFS file system over DVS to compute and service node clients in Cray systems.

Procedure

1. Edit the `/etc/exports` file on the DVS server node and add the appropriate export:

   /xfs/scratch *(rw,no_root_squash,no_subtree_check)

2. Find the attached XFS devices.

```
nid00006# ls -l /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a000004*
lrwxrwxrwx 1 root root 10 May 3 10:29 /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040b517a2609 \
-> ../../dm-3
lrwxrwxrwx 1 root root 10 May 3 10:29 /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040e517a261e \
-> ../../dm-4
lrwxrwxrwx 1 root root 10 May 3 10:30 /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a000004a851837c9b \
-> ../../dm-5
nid00006# fdisk -l /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a000004*
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040b517a2609: 7999.4
GB, 7999443697664 bytes
255 heads, 63 sectors/track, 972543 cylinders, total 15623913472 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040b517a2609 doesn't
contain a valid \
partition table
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040e517a261e: 7999.4
GB, 7999443697664 bytes
255 heads, 63 sectors/track, 972543 cylinders, total 15623913472 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040e517a261e doesn't
contain a valid \
partition table
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a000004a851837c9b: 1798.8
GB, 1798765019136 bytes
255 heads, 63 sectors/track, 218687 cylinders, total 3513212928 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000
Disk /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a000004a851837c9b doesn't
contain a valid partition table
```

3. Make a writable `/etc/lvm`.

```
nid00006# mkdir /tmp/lvm
nid00006# cp -rp /etc/lvm/* /tmp/lvm/
nid00006# cp /tmp/lvm/lvm.conf /tmp/lvm/lvm.tmp
nid00006# mv /tmp/lvm/lvm.tmp /tmp/lvm/lvm.conf
nid00006# mount -o bind /tmp/lvm /etc/lvm
```

4. Edit the `/etc/lvm/lvm.conf` file on the DVS server node.

a. Edit the `/etc/lvm/lvm.conf` file.

```
node/6# vi -n 6 /etc/lvm/lvm.conf
```

b. Add the following custom filter to the configuration file:

```
filter = [ "a|/dev/disk/by-id/dm-uuid-.*mpath-.*|", "r/.*/" ]
```

c. Remove any previous filters from the configuration file.

5. Edit the `/etc/sysconfig/lvm` file to append the following string.

```
LVM_ACTIVATED_ON_DISCOVERED="enable" #LVM_VGS_ACTIVATED_ON_BOOT="`grep '/dev/' /
etc/fstab | sed 's/\t.*//g' | sed 's,/*[^/]\+/*$,,' | sed '$!N; /^\(.*\)\n\1$/!
P; D'`" LVM_VGS_ACTIVATED_ON_BOOT="fs1"
```

6. Initialize LVM physical disks and verify intitialization.

For this configuration, all the disks in `/dev/disk/by-id/` are for the LVM volumes.

a. Initialize LVM physical disks (while logged on to `nid00006`).

```
nid00006# pvcreate /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040b517a2609
Physical volume "/dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040b517a2609" successfully created
nid00006# pvcreate /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040e517a261e
Physical volume "/dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040e517a261e" successfully
created
```

b. Display the volumes to verify that the disks have been initialized.

```
nid00006# pvdisplay
"/dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040b517a2609" is a new
physical \
volume of "7.28 TiB"
--- NEW Physical volume ---
PV Name /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040b517a2609
VG Name
PV Size 7.28 TiB
Allocatable NO
PE Size 0
Total PE 0
Free PE 0
Allocated PE 0
PV UUID Llb2m3-3AZC-LuWT-ttfH-2iB2-GH3J-oas5W1
"/dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040e517a261e" is a new
physical \
volume of "7.28 TiB"
--- NEW Physical volume ---
PV Name /dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040e517a261e
VG Name
PV Size 7.28 TiB
Allocatable NO
PE Size 0
Total PE 0
Free PE 0
```

```
Allocated PE 0
PV UUID PRCPkx-3Tan-IHgr-0ZLh-iTGt-XWzY-pBkUpM
```

7. Create the volume group. Keep the physical volumes in the same volume group.

```
nid00006# vgcreate fs1 /dev/disk/by-id/dm-uuid-
mpath-360080e50002ff41a0000040b517a2609
/dev/disk/by-id/dm-uuid-mpath-360080e50002ff41a0000040e517a261e
Volume group "fs1" successfully created
```

8. Create logical volumes.

```
nid00006# lvcreate --stripes 2 --stripesize 512k --extents 100%FREE --name fs1 fs1
Logical volume "fs1" created
```

9. Create the XFS file system using `mkfs`.

```
nid0006# mkfs -t xfs /dev/fs1/fs1
```

10. Mount the XFS file system and verify its availability.

    a. Mount the XFS file system to the service node.

    ```
    nid0006# mount -t xfs /dev/fs1/fs1 /mnt
    ```

    b. Display the mount to verify that the file system is available.

    ```
    nid00006# df -h --type xfs
    Filesystem Size Used Avail Use% Mounted on
    /dev/mapper/fs1-fs1 15T 34M 15T 1% /mnt
    ```

11. Edit the `/etc/fstab` file on the DVS server node to add the following:

    ```
    /dev/mapper/fs1-fs1 /scratch xfs defaults 1 0
    ```

    If there is a secondary XFS/DVS node used as a high-availability manual backup and failover device for the primary XFS/DVS node, do not add the mount definition entry to that node configuration. XFS is neither a clustered nor a shared file system and can be natively mounted on only one node at any given time. If the file system is mounted on more than one node, there is a great risk of data corruption.

9.1.8.4 Configure DVS Using `modeprobe.d`

About this task

Most DVS parameters are typically changed by adding lines to a `modprobe.d` configuration file or echoing values to a `/proc` file. Changes to a `modprobe.d` file are made prior to booting the affected nodes, and the changes take effect at boot.

The `dvs.conf` file is one of many files that are generated automatically and controlled by the Cray Configuration Management Framework (CMF). Such files can be identified by the warning statement in the file header.

In the following example, DVS request logging is enabled on a node with a node ID of `nid00023`.

Procedure

1. Create and change to the directory structure that is to be replicated on the target node.

   ```
   smw# mkdir -p etc/modprobe.d
   smw# cd etc/modprobe.d
   ```

2. Create and change to the directory structure that is to be replicated on the target node.

   ```
   smw# ssh nid00023
   smw# mkdir -p etc/modprobe.d/
   smw# cd etc/modprobe.d/
   ```

3. Create or edit the DVS configuration file and add the options line(s) for the parameter to be set/changed.

   For this example, the lines are from the `dvs_request_log_enabled` entry of the DVS kernel module parameters list below. Then comment/uncomment the appropriate lines, depending on which action is to be taken.

   ```
   # Disable DVS request log
   options dvsproc dvs_request_log_enabled=0

   # Enable DVS request log
   #options dvsproc dvs_request_log_enabled=1
   ```

9.1.8.5 Change Kernel Module Parameters Dynamically Using Proc Files

Some of the kernel module parameters in the following list can be changed dynamically by echoing values to `/proc` files on the appropriate nodes. Those that can be changed using that method are indicated in the list, including the name of the `/proc` file and the values to use. Note that such changes do not persist.

List of DVS Kernel Module Parameters

dvs_request_log_enabled Logs each DVS request sent to servers.

- Default value: 0 (disabled)
- To view read-only:
  cat `/sys/module/dvsproc/parameters/dvs_request_log_enabled`
- To change prior to boot, add these lines to
  `<`*`nid_of_choice`*`>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Disable DVS request log
  options dvsproc dvs_request_log_enabled=0

  # Enable DVS request log
  #options dvsproc dvs_request_log_enabled=1
  ```

- To change dynamically:

```
hostname# echo 0 > /proc/fs/dvs/request_log
hostname# echo 1 > /proc/fs/dvs/request_log
hostname# echo 2 > /proc/fs/dvs/request_log
```

The value "2" resets the log.

dvs_request_log_size_kb

Size (KB) of the request log buffer.

- Default value: 16384 KB (16384 * 1024 bytes)
- To view read-only:
  cat `/sys/module/dvsproc/parameters/dvs_request_log_size_kb`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

```
# Set size (in kb) of the request log buffer
options dvsproc dvs_request_log_size_kb=17000
```

- To change dynamically:

```
hostname# echo 17000 > /proc/fs/dvs/request_log_size_kb
```

dvs_instance_info

Contains the following fields, which are parameters for the DVS thread pool in the DVS IPC layer. Most of these fields can be changed through other module parameters (e.g., dvsipc_msg_thread_limit and dvsipc_single_msg_queue); however, this module parameter has priority over the individual ones and if set, will override them.

Field	Definition
thread_min	Number of threads created at startup.
thread_max	Maximum number of persistent threads.
thread_limit	Maximum number of valid threads that DVS IPC allows to exist at one time. DVS IPC will dynamically scale up the number of threads to this number as the load increases.
thread_concurrent_creates	Maximum number of IPC threads that can be in the process of forking a new thread.
thread_nice	Nice value for the threads.
single_msg_queue	Disables/enables fairness of service. Setting to 1 disables fairness of service by processing incoming requests with a FIFO method. Setting to 0 (default) groups requests into different queues (qhdrs) based on apid, and round-robbins the queues to maintain quality of service (QOS) among jobs.
init_free_qhdrs	Low water mark for the pool of unused qhdrs. When the pool falls below this number, more are allocated. Used only if single_msg_queue = 0.

Field	Definition
max_free_qhdrs	Maximum number of unused qhdrs that can exist before the system starts freeing them. Used only if single_msg_queue = 0.
Interactions among fields: thread_min <= thread_max <= thread_limit thread_concurrent_creates <= thread_limit init_free_qhdrs and max_free_qhdrs used only when single_msg_queue == 0	

IMPORTANT: For this parameter to be valid, values must be specified for all of the fields. To avoid unintentional changes, be careful when changing any field values.

- Default value: see modprobe.d examples
- To view read-only:
  cat `/sys/module/dvsipc/parameters/dvs_instance_info`
- To change prior to boot, add these lines to *`<nid_of_choice>`*`/etc/modprobe.d/dvs-local.conf` (comment out either the compute or service line, depending on the type of node(s) being configured):

  ```
  # Set parameters for DVS thread pool in DVS IPC layer
  # Defaults for compute nodes
  options dvsipc dvs_instance_info=4,16,1000,0,0,0,1,1

  # Defaults for service nodes
  options dvsipc
  dvs_instance_info=16,64,1000,0,0,0,64,2048
  ```

  For compute nodes, this translates to dvs_instance_info = thread_min = 4, thread_max = 16, thread_limit = 1000, thread_concurrent_creates = 0, thread_nice = 0, single_msg_queue = 0, init_free_qhdrs = 1, max_free_qhdrs = 1.

  For service nodes, this translates to dvs_instance_info = thread_min = 16, thread_max = 64, thread_limit = 1000, thread_concurrent_creates = 0, nice = 0, single_msg_queue = 0, init_free_qhdrs = 64, max_free_qhdrs = 2048.

  Note that if using the defaults for a compute node, ensure that dvsipc_config_type=0 is also set, and likewise, for a service node, ensure that dvsipc_config_type=1 for consistency.
- To change dynamically: N/A

dvsipc_config_type

Forces DVS to load in a mode optimized for DVS clients (0) or servers (1). This parameter can be used to make DVS load in a non-default manner. Frequently used for repurposed compute nodes.

- Default value: 0 for compute nodes, 1 for service nodes
- To view read-only:
  cat `/sys/module/dvsipc/parameters/dvsipc_config_type`
- To change prior to boot, add these lines to *<nid_of_choice>*`/etc/modprobe.d/dvs-local.conf` (comment out either the client or server line, depending on the type of node(s) being configured):

```
# Load DVS as a client
options dvsipc dvsipc_config_type=0

# Load DVS as a server
options dvsipc dvsipc_config_type=1
```

- To change dynamically:

```
hostname# echo 0 > /proc/fs/dvs/ipc/config-type
hostname# echo 1 > /proc/fs/dvs/ipc/config-type
```

dvsipc_single_msg_queue Used to disable fairness of service, which is enabled by default. Setting this parameter to 1 disables fairness of service by forcing DVS to use a single message queue instead of a list of queues.

- Default value: 0 (fairness of service enabled)
- To view read-only:
  cat `/sys/module/dvsipc/parameters/dvsipc_single_msg_queue`
- To change prior to boot, use the single_msg_queue field of the dvs_instance_info parameter. If no other fields in dvs_instance_info need to be changed, it may be easier to change the dvsipc_single_msg_queue parameter directly by adding these lines to *<nid_of_choice>*`/etc/modprobe.d/dvs-local.conf`:

```
# Disable fairness of service
options dvsipc dvsipc_single_msg_queue=1

# Enable fairness of service
#options dvsipc dvsipc_single_msg_queue=0
```

- To change dynamically: N/A

dvsof_concurrent_reads Controls how many threads are allowed into the read path on the server. A value of -1 disables, 0 uses the number of cores on the CPU, and any other positive number sets the number of threads. Set to 0 for best DataWarp performance.

- Default value: -1
- To view read-only:
  cat `/sys/module/dvs/parameters/dvsof_concurrent_reads`

- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

```
# Disable concurrent reads
#options dvs dvsof_concurrent_reads=-1

# Set number of threads able to do concurrent
# reads = number of cores on CPU
options dvs dvsof_concurrent_reads=0

# Set number of threads able to do concurrent
# reads = a positive number (e.g., 3)
#options dvs dvsof_concurrent_reads=3
```

- To change dynamically: N/A

dvsof_concurrent_writes

Controls how many threads are allowed into the write path on the server. A value of -1 disables, 0 uses the number of cores on the CPU, and any other positive number sets the number of threads. Set to 0 for best DataWarp performance.

- Default value: -1
- To view read-only: cat `/sys/module/dvs/parameters/dvsof_concurrent_writes`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

```
# Disable concurrent writes
#options dvs dvsof_concurrent_writes=-1

# Set number of threads able to do concurrent
# writes = number of cores on CPU
options dvs dvsof_concurrent_writes=0

# Set number of threads able to do concurrent
# writes = a positive number (e.g., 3)
#options dvs dvsof_concurrent_writes=3
```

- To change dynamically: N/A

dvsproc_stat_control

(deprecated) Controls DVS statistics. This legacy parameter has been maintained for backward compatibility, but values are overridden by dvsproc_stat_defaults, if specified.

- Default value: 1 (enabled)
- To view: cat `/sys/module/dvsproc/parameters/dvsproc_stat_control`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

```
# Disable DVS statistics
options dvsproc dvsproc_stat_control=0
```

```
# Enable DVS statistics
#options dvsproc dvsproc_stat_control=1
```

- To change dynamically:

  This is root writable at `/sys/module/dvsproc/parameters/dvsproc_stat_control`, but changes should be made only through the `/proc/fs/dvs/stats` interface, as shown in this example.

  ```
  hostname# echo 0 > /proc/fs/dvs/stats
  hostname# echo 1 > /proc/fs/dvs/stats
  hostname# echo 2 > /proc/fs/dvs/stats
  ```

dvsproc_stat_defaults

Controls DVS statistics. Use this parameter to disable/enable and format DVS statistics.

- Default values: enable, legacy, brief, plain, notest
- To view:
  cat `/sys/module/dvsproc/parameters/dvsproc_stat_defaults`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Disable/enable and format DVS statistics
  options dvsproc
  dvsproc_stat_defaults="enable,legacy,brief,plain,notest"
  ```

- To change dynamically:

  This is root writable at `/sys/module/dvsproc/parameters/dvsproc_stat_defaults`, but changes should be made only through the `/proc/fs/dvs/stats` interface, as shown in this example.

  ```
  hostname# echo disable > /proc/fs/dvs/stats
  hostname# echo enable > /proc/fs/dvs/stats
  hostname# echo reset > /proc/fs/dvs/stats
  hostname# echo json,pretty > /proc/fs/dvs/stats
  ```

estale_max_retry

Controls the number of times to retry an operation on the original server after it returns ESTALE.

- Default value: 36 iterations at a fixed 5 seconds per iteration (3 minutes)
- To view read-only:
  cat `/sys/module/dvsproc/parameters/estale_max_retry`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Set the number of times to retry an operation
  # on the original server after it returns ESTALE
  options dvsproc estale_max_retry=
  ```

- To change dynamically (example changes estale_max_retry to 40 for illustration only):

```
hostname# echo 40 > /proc/fs/dvs/estale_timeout_secs
```

estale_timeout_secs

Controls the time to wait between retries of an operation after it returns ESTALE.

- Default value: 300 seconds
- To view read-only:
  cat `/sys/module/dvsproc/parameters/estale_timeout_secs`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

```
# Set the time to wait between retries of an
# operation that returns ESTALE
options dvsproc estale_timeout_secs=
```

- To change dynamically (example changes estale_timeout_secs to 400 for illustration only):

```
hostname# echo 400 > /proc/fs/dvs/estale_timeout_secs
```

kdwfs_instance_info

Contains the following fields, which are parameters for the DataWarp thread pool in the DVS IPC layer.

Field	Definition
thread_min	Number of threads created at startup.
thread_max	Maximum number of persistent threads.
thread_limit	Maximum number of valid threads that DVS IPC allows to exist at one time. DVS IPC will dynamically scale up the number of threads to this number as the load increases.
thread_concurrent_creates	Maximum number of IPC threads that can be in the process of forking a new thread.
thread_nice	Nice value for the threads.
single_msg_queue	Disables/enables fairness of service. Setting to 1 disables fairness of service by processing incoming requests with a FIFO method. Setting to 0 (default) groups requests into different queues (qhdrs) based on apid, and round-robbins the queues to maintain quality of service (QOS) among jobs.
init_free_qhdrs	Low water mark for the pool of unused qhdrs. When the pool falls below this number, more are allocated. Used only if single_msg_queue = 0.

Field	Definition
max_free_qhdrs	Maximum number of unused qhdrs that can exist before the system starts freeing them. Used only if single_msg_queue = 0.
Interactions among fields: thread_min <= thread_max <= thread_limit (set all three equal for best DataWarp performance) thread_concurrent_creates <= thread_limit init_free_qhdrs and max_free_qhdrs used only when single_msg_queue == 0	

IMPORTANT: For this parameter to be valid, values must be specified for all of the fields. To avoid unintentional changes, be careful when changing any field values.

- Default value: 1,1,1024,4,-10,1,1,1
- To view read-only:
  cat `/sys/module/dvsipc/parameters/kdwfs_instance_info`
- To change prior to boot, add these lines to *<nid_of_choice>*`/etc/modprobe.d/dvs-dws.conf` (values shown are defaults):

```
# Set parameters for DataWarp thread pool in DVS IPC
layer
options dvsipc
kdwfs_instance_info=256,256,1024,4,-10,1,1,1
```

  This translates to kdwfs_instance_info thread_min = 256, thread_max = 256, thread_limit = 1024, thread_concurrent_creates = 4, nice = -10, single_msg_queue = 1, init_free_qhdrs = 1, max_free_qhdrs = 1.

- To change dynamically: N/A

lnd_name

`lnd_name` uniquely identifies the LNet network that DVS will use. DVS communicates it to the LNet service when DVS is being initialized. It must match the `cray_lnet.settings.local_lnet.data.lnet_name` value set in the `cray_lnet` service for DVS to boot properly.

- Default value: gni99
- To view read-only: not visible in `/sys/module`
- To change prior to boot, add these lines to *<nid_of_choice>*`/etc/modprobe.d/dvs-local.conf`, substituting for *gnix* the value found from the config set search:

```
# Set identifier of LNet network DVS will use
options dvsipc_lnet lnd_name=gnix
```

- To change dynamically: N/A

sync_dirty_timeout_secs

On DVS *servers*, specifies the number of seconds that must have passed since the file was written before DVS syncs it. The objective is to reduce unnecessary sync operations for files actively being updated. Decreasing this number increases the likelihood that the file is in use when it is synced. Increasing this number increases the likelihood that processes are killed during a server failure.

On DVS *clients*, specifies the number of seconds that must have passed since the file was written before DVS asks the server for an updated sync time. Decreasing this number increases the number of DVS requests being sent. Increasing this number increases the likelihood that processes are killed during a server failure.

This parameter is part of the periodic sync feature.

- Default value: 300 (servers and clients)
- To view read-only:
  cat `/sys/module/dvs/parameters/sync_dirty_timeout_secs`
- To change prior to boot, add these lines to
  `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Set the timeout (seconds) for syncing
  # dirty files on a DVS server or client
  options dvs sync_dirty_timeout_secs=300
  ```

- To change dynamically:

  ```
  hostname# echo 300 > /proc/fs/dvs/sync_dirty_timeout_secs
  ```

sync_num_threads

Specifies the number of threads on the DVS server that perform sync operations. The number of threads must be a minimum of 1 thread and a maximum of 32. Note that it can take up to `sync_period_secs` for changes to this value to take effect.

This parameter is part of the periodic sync feature.

- Default value: 8
- To view read-only:
  cat `/sys/module/dvs/parameters/sync_num_threads`
- To change prior to boot, add these lines to
  `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Set the number of threads that perform
  # sync operations on a DVS server
  options dvs sync_num_threads=8
  ```

- To change dynamically:

  ```
  hostname# echo 8 > /proc/fs/dvs/sync_num_threads
  ```

sync_period_secs

On DVS *servers*, specifies the number of seconds before the `sync_num_threads` syncs files on the DVS server (if necessary).

On DVS *clients*, specifies the number of seconds between checks for dirty files that need to request the last sync time from the server.

This parameter is part of the periodic sync feature.

- Default value: 300 (server), 600 (client)
- To view read-only:
  cat `/sys/module/dvs/parameters/sync_period_secs`
- To change prior to boot, add these lines to `<nid_of_choice>/etc/modprobe.d/dvs-local.conf`:

  ```
  # Set the sync period (seconds) on DVS server/client
  options dvs sync_period_secs=300
  ```

- To change dynamically:

  ```
  hostname# echo 300 > /proc/fs/dvs/sync_period_secs
  ```

9.1.8.6 About the Quiesce DVS-projected File System

Sites can use the DVS quiesce capability to temporarily suspend traffic to a DVS-projected file system on any number of DVS servers. When a directory is quiesced, the DVS server completes any outstanding requests but does not honor any new requests for that directory. Any outstanding requests for that directory are displayed in `/proc/fs/dvs/quiesce` file system interface. Administrators can read that proc file to know when it is safe to perform operations on the quiesced directory without any possibility of interference by a DVS client. DVS quiesce can be used when a file system needs to be repaired or to safely take a DVS server node out of service.

⚠ **CAUTION:** Because it may cause data corruption, do not use DVS quiesce to:

- quiesce a directory that is being used by DataWarp
- quiesce a directory on every DVS server

To use DVS quiesce, an administrator writes into and reads from `/proc/fs/dvs/quiesce`.

How Quiesce Works: the Userspace Application View

Userspace applications have no visibility into any specific quiesce information. A quiesced directory will present in one of two ways:

- Entirely normally, if the directory is quiesced only on servers that the application is not using.
- Useable but with degraded performance, if the application finds that its main server is quiesced and must query other servers.

How Quiesce Works: the Server View

To provide the quiesce capability, DVS servers keep a list of quiesced directories and the current outstanding requests on each quiesced directory. When an admin requests that DVS quiesce a directory on a server, DVS does the following:

- adds that directory to the server's list of quiesced directories
- iterates over all open files, closing any file that resides in the quiesced directory and setting a flag to indicate that the file was closed due to the directory being quiesced

When a DVS server receives a request from a client, DVS checks the request path against the list of quiesced directories. The comparison between the path name in the request and the quiesced directory is a simple string compare to avoid any access of the underlying file system that has been quiesced. If DVS finds that the request is for a quiesced file system, it sends a reply indicating that the request could not be completed due to a quiesce and noting which directory is quiesced. If the client request is for a file that has been closed due to quiesce, the server returns a reply to the client indicating that the request could not be completed due to a quiesce.

When an admin unquiesces a directory on a DVS server, DVS simply removes that directory from the server's list of quiesced directories and clears all quiesce-related flags for that directory.

How Quiesce Works: the Client View

When making a request of a server, a client may get back reply indicating that the request was for a file in a quiesced directory. The client then retries the operation on the next server in its server list. If it makes the request of every server in its server list and gets the same reply from each of them, then one of two things happens, depending on the type of request:

path name request If the request is a path name request (lookup, stat, file open, etc.), then DVS reattempts the operation on a different server in a round-robin fashion until it finds a server that allows the operation to complete successfully.

open file If the request is for an open file (read, write, lseek, etc.), then DVS attempts the operation on a different server. If the file is not open on any other servers, DVS attempts to open on the file on a server in a round robin fashion until it gets a successful open. DVS will then attempt to perform the operation.

If a client receives a reply indicating a quiesced directory, the client adds that directory to a list of quiesced directories held on the DVS superblock. This is intended to reduce network traffic by avoiding requests that target quiesced directories. The client's list of quiesced directories expires about every 60 seconds, thereby allowing clients to try those directories again in case one or more have been unquiesced during that time. This mechanism enables DVS to strike a balance between the timely unquiescing of a file system and a large reduction in network traffic and requests coming into the server. It also has the effect of naturally staggering clients when they start to use a server.

9.1.8.6.1 Use Case: Quiesce a Single Directory on a Single DVS Server

Prerequisites

This procedure requires administrative privileges.

About this task

The example provided in this procedure is for a scenario in which an admin wants to quiesce a directory `/gpfs/test/foo` on a DVS server. This is an unlikely use case, but an illustrative example.

Procedure

1. Quiesce the directory on the DVS server.

```
dvs1# echo quiesce /gpfs/test/foo > /proc/fs/dvs/quiesce
```

2. Ensure that the directory was properly quiesced and see if there are any outstanding requests. Repeat this occasionally to know when all outstanding requests have been cleared.

   ```
   dvs1# cat /proc/fs/dvs/quiesce
   /gpfs/test/foo/:   Outstanding_Requests 3
   ```

3. Unquiesce the directory when finished with it.

   ```
   dvs1# echo unquiesce /gpfs/test/foo > /proc/fs/dvs/quiesce
   ```

4. Ensure that the directory is no longer on the quiesced list.

   ```
   dvs1# cat /proc/fs/dvs/quiesce
   ```

9.1.8.6.2 Use Case: Quiesce All Directories on a DVS Server

Prerequisites

This procedure requires administrative privileges.

About this task

The example provided in this procedure is for a scenario in which an admin wants to remove a DVS server from service but wants to let any outstanding request complete first.

Procedure

1. Quiesce all directories on that server on the DVS server.

   ```
   dvs1# echo quiesce / > /proc/fs/dvs/quiesce
   ```

2. Look for any outstanding requests and repeat this occasionally to know when all outstanding requests have been cleared.

   When no outstanding requests remain, the server can be removed from service.

   ```
   dvs1# cat /proc/fs/dvs/quiesce
   /:           Outstanding_Requests 3
   ```

3. Unquiesce all of its projected directories to allow traffic to this server to resume.

   ```
   dvs1# echo unquiesce / > /proc/fs/dvs/quiesce
   ```

10 Troubleshooting

10.1 Clean Up Log Data

As jobs are executed on the system, a number of logs are generated, which need to be cleaned up, otherwise they may consume unnecessary space. Log data is useful for debugging issues, but if it is certain that this data is no longer needed, it can be deleted.

- **Mesos logs** - Mesos logs are stored under `var/log/mesos`, whereas the Mesos framework logs are stored under `/var/log/mesos/agent/slaves`. These logs need to be deleted manually.
- **Marathon logs** - Marathon logs are stored under `var/log/message` and need to be deleted manually.
- **HA Proxy logs** - HA Proxy logs are stored under `var/log/message` and need to be deleted manually.
- **Jupyter logs** - Juypter log file are located at `var/log/jupyterhub/jupyterhub.log` and need to be deleted manually.
- **Grafana and InfluxDB logs** - Grafana logs are stored under `var/log/grafana`, whereas InfluxDB logs are stored under `var/log/influxdb`. Influxdb log files are compressed. Both Grafana and InfluxDB use the `logrotate` utility to keep log files from using too much space. Log files are rolled daily by default, but if space is critical, logs can be deleted manually.
- **Spark logs** - Shuffle data files on the SSDs is automatically deleted on Urika-GX. Spark logs need to be deleted manually and are located at the following locations:
  - Spark event logs - Located at `hdfs://user/spark/applicationHistory`
  - Spark executor logs - Located on individual compute nodes at `/var/log/mesos/agent/slaves/`
- **Hadoop logs** - Hadoop log files are located in the following locations and need to be deleted manually:
  - Core Hadoop - Log files are generated under the following locations:
    - `var/log/hadoop/hdfs`
    - `var/log/hadoop/yarn`
    - `var/log/hadoop/mapreduce`
  - ZooKeeper - ZooKeeper logs are generated under `var/log/zookeeper`
  - Hive (metastore and hive server2) - These logs are generated under `var/log/hive`
  - Hive Webhcat - These logs are generated under `var/log/webhcat`
  - Oozie - Oozie logs are stored under `/var/log/oozie`
  - HUE - HUE logs are generated under `/var/log/hue`

- **Flex scripts (urika-yam-status, urika-yam-flexup, urika-yam-flexdown, urika-yam-flexdown-all)** - These scripts generate log files under `/var/log/urika-yam.log` and need to be deleted manually.
- **`mrun`** - `mrun` does not generate logs.
- **Cray Graph Engine (CGE) logs** - The path where CGE log files are located is specified via the `-l` parameter of the `cge-launch` command. Use the `cge-cli log-reconfigure` command to change the location after CGE is started with `cge-launch`. CGE logs need to be deleted manually. Users can also use `--log-level` argument to CGE CLI commands to set the log level on a per request basis. In addition, the `cge.server.DefaultLogLevel` parameter in the `cge.properties` file can be used to set the log level to the desired default.

10.2 Diagnose and Troubleshoot Orphaned Mesos Tasks

Prerequisites

This procedure requires root access.

About this task

The metrics displayed in Mesos UI can also be retrieved using CURL calls. Cray-developed scripts (for flexing up a YARN sub-cluster) and `mrun` use these curl calls in as they interoperate with Mesos for resource brokering. If the metrics displayed by Mesos UI and the metrics that the curl calls return different results Mesos may not work correctly and all the Mesos frameworks will be affected. As such, the aforementioned Cray-developed scripts and `mrun` will not be able to retrieve the needed resources. This behavior can be identified when:

- there is a disconnect between the CURL calls and the Mesos UI. Specifically, there will be an indication of orphaned Mesos tasks if the CURL call returns a higher number of CPUs used than that returned by the UI. Cray-developed scripts for flexing YARN sub-clusters use curl calls, and hence do not allow flexing up if there are not enough resources reported.
- there are orphaned Mesos tasks, as indicated in the Mesos Master and Mesos Slave logs at `/var/log/mesos`. Mesos Master will reject task status updates because it will not recognize the framework those tasks are being sent from.

If this behavior is encountered, follow the instructions listed in this procedure:

Procedure

1. Log on to the System Management Workstation (SMW) as root
2. Clear the slave meta data on all the nodes with Mesos slave processes running

   The following example can be used on a 3 sub-rack system:

   ```
   # pdsh -w nid000[00-47] -x nid000[00,16,30,31,32,46,47] \
   'rm -vf /var/log/mesos/agent/meta/slaves/latest'
   ```

3. Stop the cluster

   ```
   # urika-stop
   ```

4. Start the cluster

```
# urika-start
```

After following the aforementioned steps, the system should be restored to its original state. For additional information, contact Cray Support.

10.3 Troubleshoot Common Analytic Issues

The following table contains a list of some common error messages and their description. Please note that this is not an exhaustive list. Online documentation and logs should be referenced for additional debugging/ troubleshooting. For a list of Cray Graph Engine error messages and troubleshooting information, please refer to the Cray Graph Engine User Guide.

Table 17. Spark Error Messages

15/11/24 15:38:08 INFO mesos.CoarseMesosSchedulerBackend: Blacklisting Mesos slave 20151120-121737-1560611850-5050-20795-S0 due to too many failures; is Spark installed on it? 15/11/24 15:38:08 INFO mesos.CoarseMesosSchedulerBackend: Mesos task 30 is now TASK_FAILED	There may be something preventing a Mesos slave from starting the Spark executor. Common causes include: ● The SSD is too full ● The user does not have permission to write to Spark temporary files under `/var/spark/tmp/`	Refer to Spark logs.
Lost executor # on *`host`*	Something has caused the Spark executor to die. One of the reasons may be that there is not enough memory allocated to the executors.	Increase the memory allocated to executors via one of the following parameters: ● `--executor-memory` ● `spark.executor.memory configuration` Refer to Spark logs for additional information.

Table 18. Urika-GX System Management CLI Error Messages

ERROR: tag(s) not found in playbook: non_existent_service. possible values: collectl,grafana,hdfs,hdfs_dn,hdfs_nn,hdfs_sn,hdp_app_timeline,hdp_hist,hive,hive2,hive_met,hive_web,hue,influxdb,jupyterhub,marathon, mesos,nodemanager,oozie,spark_hist,yarn,yarn_rm, zookeeper	User has specified a service that does not exist to the `urika-stop` or `urika-start` command.	Use the correct name of the services by selecting one of the options listed in the error message.

Table 19.

The number of nodes you requested to flex up is greater than the total number of resources available. Please enter a valid number of nodes	The user is attempting to flex up more nodes than are available which using the `urika-yam-flexup` command.	Enter a lower number of nodes for the flex up request.
no time out specified by user through commandline argument, setting the timeout from /etc/urika-yam.conf file. in /etc/urika-yam.conf val: 15 minutes	The user has not specified a timeout while using the `urika-yam-flexup` command.	This error message can safely be ignored if it is required to use the default timeout value, which is 15 minutes. Otherwise, please specify the desired value when using the `urika-yam-flexup` command.
id names can only contain alphanumeric, dot '.' and dash '-' characters. '@' not allowed in jhoole@#$. Usage: urika-yam-flexup --nodes #nodes --identifier name --timeout timeoutInMinutes	The user has specified an incorrect identifier/application name when using the `urika-yam-flexup` command.	Reenter the command with the correct identifier.
Looks like there is some problem with flex up. Please try urika-yam-status or look at the logs to find the problem	The job failed to launch.	Review logs (stored at `/var/log/urika-yam.log` on login nodes) or execute the urika-yam-status command to identify if there is any problem. Please check if there are any issues related to Mesos and/or Marathon. If the Mesos and/or Marathon web UI cannot be accessed, contact the administrator, who should verify that the Mesos and Marathon daemons are up and running. If any of these daemons are not running for some reason, report the logs to Cray Support and restart the Mesos cluster using the `urika-start` command. For more information, see the `urika-start` man page.
Minimum timeout is 5 minutes. You cannot request for timeout less than the minimum timeout with an exception of zero timeout. Please note that you can request a zero timeout (set value of timeout to 0) by which you do not call timeout, you chose to flex down the nodes manually using urika-yam-flexdown. Please submit a new flex up request with valid timeout.	Incorrect minimum timeout was specified.	Submit a new flex up request with valid timeout (Request for timeout greater than minimum timeout).

Currently only "x" nodes are available in the cluster. Please wait till the number of nodes you require are available Or submit a new flex up request with nodes less than "x"	This error is seen when the number of nodes requested to flex up is not available.	Either wait till the number of nodes you require are available Or submit a new flex up request with nodes less than "x".
Invalid app name. Your app name can consist of a series of names separated by slashes. Each name must be at least 1 character. The name may only contain digits (0-9), dashes (-), dots (.), and lowercase letters (a-z). The name may not begin or end with a dash.	This error is seen when the identifier provided by user for the flex up request is invalid.	Follow the rules mentioned there and re-submit a new flex up request.
Total number of resources not set in the /etc/urika-yam.conf file, please re-check the configuration file	In `/etc/urika-yam.conf` file, the number of resources is set by default. The total number of resources may not have been set.	Re-check the status of mesos cluster.
Hostname is not set in the /etc/urika-yam.conf file, please re-check the configuration file.	In `/etc/urika-yam.conf` file, the parameter `hostname` is set by default. The value set may not be correct or may not have been set.	Ensure that this parameter is set, and the value is the same as default value.
Mesos port is not set in the /etc/urika-yam.conf file, please re-check the configuration file	In `/etc/urika-yam.conf` file, the parameter `marathon_port` is set by default. This parameter may not have been set or value set may not be set to the same as the default value.	Ensure that this parameter is set, and the value is the same as default value.
Marathon port is not set in the /etc/urika-yam.conf file, please re-check the configuration file.	In `/etc/urika-yam.conf` file, the parameter marathon_port is set by default. This parameter may not have been set or value set may not be set to the same as the default value..	It should be ensured that this parameter is set, and the value is the same as default value.
The number of nodes you requested to flex up is greater than the total number of resources available. Please enter a valid number of nodes	This error is seen when the number of nodes requested to flex up is more than the total number of nodes available in the cluster	Submit a new flex up request with nodes less than or equal to the number of nodes available in the cluster.
App '/$marathon_app_name' does not exist. Please re-check the identifier corresponding nodes you flex up, that you would like to flex down	The identifier provided for flex down does not exist.	Re-check the usage: if you are a root user, please provide the complete name as seen in urika-yam-status or as a non-root user, make sure you provide the same identifier used at the time of flex up. In addition, check if `/var/log/urika-yam.log` reflects any log messages where

		timeout criteria has been matched and there was a flex down of the app already.
Looks like there is some problem with flex up. Please try urika-yam-status or look at the logs to find the problem	The job failed to launch.	Review logs (stored at `/var/log/urika-yam.log` on login nodes) or execute the urika-yam-status command to identify if there is any problem. Please check if there are any issues related to Mesos and/or Marathon. If the Mesos and/or Marathon web UI cannot be accessed, contact the administrator, who should verify that the Mesos and Marathon daemons are up and running. If any of these daemons are not running for some reason, report the logs to Cray Support and restart the Mesos cluster using the `urika-start` command. For more information, see the `urika-start` man page.
Could not find the script urika-yam-start-nodemanager in hdfs. Looks like there is an error with your urika-yam installation Please contact your sysadmin	The `urika-yam-start-nodemanager` script is a component of the Cray developed scripts for flexing up a YARN cluster and is installed as part of the installation of these flex scripts.	If this issue is encountered, the administrator should verify that: ● HDFS is in a healthy state ● Marathon and Mesos services are up and running. The status of the aforementioned services can be checked using the `urika-state` command. For more information, see the `urika-state` man page. Contact support for additional information about resolving this issue.

Table 20. Marathon/Mesos/mrun Error Messages

Error Message	Description	Resolution
Mon Jul 11 2016 12:13:08.269371 UTC[][mrun]:ERROR:mrun: Force Terminated job /mrun/ 2016-193-12-13-03.174056 Cancelled due to Timeout Examples: ● error("mrun: --immediate timed out while waiting")	These errors indicate timeout and resource contention issues, such as the job timed out, the machine is busy, too many users running too many jobs, a user waiting for their job to start, but previous jobs have not freed up nodes, etc. Additionally, if a user set a job timeout's to 1 hour, and the job lasted longer than 1 hour, the user	Ensure that the there are enough resources available and that the timeout interval is set correctly.

Error Message	Description	Resolution
● error("mrun: Timed out waiting for mrund : %s" % appID) ● error("mrun: Force Terminated job %s Cancelled due to Timeout" %	would get a `Job Cancelled` timeout error.	
2016-06-17 14:10:43 | HWERR[r0s1c0n3][64]:0x4b14:The SSID received an unexpected response:Info1=0x191000000000003:Info2=0x7	Mesos is not able to talk to the Zookeeper cluster and is attempting to shut itself down.	Restart Mesos using the `urika-start` command.
16/07/11 23:43:49 WARN component.AbstractLifeCycle: FAILED SelectChannelConnector@0.0.0.0:4040: java.net.BindException: Address already in use	User is attempting to execute a job on a port that is already in use.	This message can be safely ignored.
Mon Jul 11 2016 11:39:43.601145 UTC[][mrun]:ERROR:Unexpected 'frameworks' data from Mesos ● Examples: ○ error("Mesos Response: %s" % ret) ○ error("Unexpected 'frameworks' data from Mesos") ○ error("mrun: Getting mrund state threw exception - %s" % ○ error("getting marathon controller state threw exception - %s" % ○ error("Unexpected 'apps' data from Marathon") ○ error("mrun: Launching mrund threw exception - %s" % (str(e))) ○ error("mrun: unexpected 'app' data from Marathon: exception - %s" % (str(e))) ○ error("mrun: startMrund failed") ○ error("mrun: Exception received while waiting for "	These errors occur when `mrun` is not able to connect/communicate with Mesos and/or Marathon.	Refer to online Mesos/Marathon documentation.

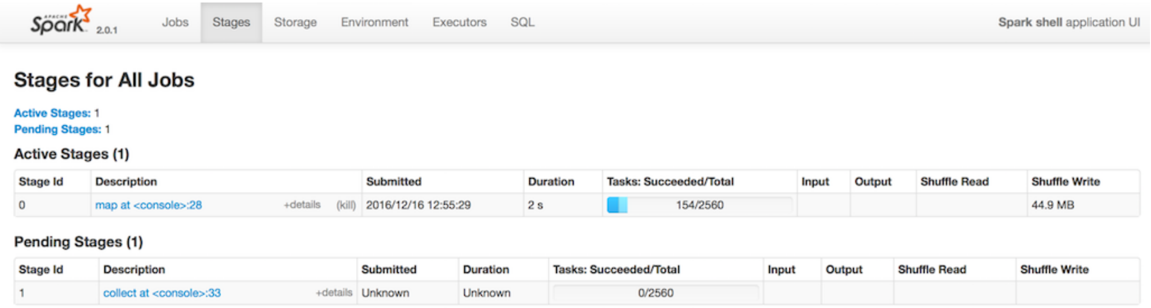
Error Message	Description	Resolution
● error("mrun: select(): Exception %s" % str(e)) ● error("mrun: error socket") ● error("mrund: ● error %r:%s died\n" % (err,args[0])) ● error("mrund: select(): Exception %s\n" % str(e))	These errors may be encountered in situations where an admin physically unplugs an Ethernet cable while a CGE job was running, or a node died, etc.	Ensure that the Ethernet cable is plugged while jobs are running.
● NCMD: Error leasing cookies MUNGE: ● Munge authentication failure [%s] (%s).\n	These error only occur if the specific system services have failed.	Refer to log messages under `/var/log/messages` on the node the message was encountered on.
Mon Jul 11 2016 11:47:22.281972 UTC[][mrun]:ERROR:Not enough CPUs for exclusive access. Available: 0 Needed: 1 Examples ● parser.error("Only --mem_bind=local supported") ● parser.error("Only --cpu-freq=high supported") ● parser.error("Only --kill-on-bad-exit=1 supported") ● parser.error("-n should equal (-N * --ntasks-per-node)") ● parser.error("-N nodes must be >= 1") ● parser.error("-n images must be >= -N nodes") ● parser.error("No command specified to launch"); error("Not enough CPUs. " ● error("Not enough CPUs for exclusive access. " ● error("Not enough nodes. " ● parser.error("name [%s] must only contain 'a-z','0-9','-' and '.'" ● parser.error("[%s] is not executable file" % args[0])	These errors are typically caused by user errors, typos and when not enough nodes are available to run a job.	Ensure that there are enough nodes available and there are no typos in the issues command.

Table 21. Hadoop Error Messages

<table>
<tr><th>Error Message</th><th>Description</th><th>Resolution</th></tr>
<tr><td>org.apache.hadoop.hdfs.server.\ namenode.SafeModeException: Cannot create or delete a file. Name node is in safe mode.</td><td>During the start up, the NameNode goes into a safe mode to check for under replicated and corrupted blocks. A Safe mode for the NameNode is essentially a read-only mode for the HDFS cluster, where it does not allow any modifications to file system or blocks. Normally, the NameNode disables the safe mode automatically, however, if there are there are too many corrupted blocks, it may not be able to get out of the safe mode by itself.</td><td>Force the NameNode out of safe mode by running the following command as a HDFS user:
<code>$ hdfs dfsadmin -safemode leave</code></td></tr>
<tr><td>Too many underreplicated blocks in the NameNode UI</td><td>Couple of dataNodes may be down. Please check the availability of all the dataNodes</td><td>If all the DataNodes are up and still there are under replicated blocks. Run the following 2 commands in order as a HDFS user:
<code>$ hdfs fsck / | grep 'Under replicated' |</code>
<code>awk -F':' '{print $1}' >> \</code>
<code>/tmp/under_replicated_files</code>
<code>$ for hdfsfile in `cat /tmp/</code><br><code>under_replicated_files`; \</code>
<code>do echo "Fixing $hdfsfile :" ; \</code>
<code>hadoop fs -setrep 3 $hdfsfile; \</code>
<code>done</code></td></tr>
<tr><td>Too many corrupt blocks in name node UI</td><td>The NameNode might not have access to at least one replication of the block.</td><td>Check if any of the DataNodes are down. If all the DataNodes are up and the files are no longer needed, execute the following command:
<code>$ hdfs fsck / -delete</code></td></tr>
<tr><td>org.apache.hadoop.ipc.\ RemoteException(java.io.IOException): \ File /tmp/test could only be replicated to \ 0 nodes instead of minReplication (=1).</td><td>HDFS space may have reached full capacity. Even though Urika-GX has a heterogeneous file system, the default storage type is DISK unless explicitly set to use SSD.
The user might have filled up the default storage, which is why HDFS would not be able to write more data to DISK.</td><td>To identify the used capacity by storage type, use the following commands:For both DISK and SSD, calculate the sum of usage on all the DataNodes.
For DISK:
<code>$ df /mnt/hdd-2/hdfs/dd | awk</code>
<code>'NR==2{print $3}'</code>
For SSD:
<code>$ df /mnt/ssd/hdfs/dd | awk</code>
<code>'NR==2{print $3}'</code></td></tr>
<tr><td>YARN job is not running. You can see the status of the job as ACCEPTED: waiting for AM container to be allocated, launched and register with RM.</td><td>The NodeManagers may not be running to launch the containers.</td><td>Check the number of available node managers by executing the following command:
<code>$ yarn node -list</code></td></tr>
</table>

Additional Information

- If for any reason, Marathon does not start after a system crash, as a result of the queue reaching full capacity, use the `urika-stop` and then `urika-start` to resolve the issue.
- If it is required to kill Spark jobs, use one of the following mechanisms:
  - via the UI - Click on the text **(kill)** in the **Description** column of the **Stages** tab of the Spark UI.



Stages for All Jobs

Active Stages: 1
Pending Stages: 1

Active Stages (1)

Stage Id	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
0	map at <console>:28 +details (kill)	2016/12/16 12:55:29	2 s	154/2560				44.9 MB

Pending Stages (1)

Stage Id	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
1	collect at <console>:33 +details	Unknown	Unknown	0/2560				

  - via the the Linux `kill` command
  - via the Ctrl+C keyboard keys.

10.4 Troubleshoot `mrun` Issues

Some common `mrun` error messages and their cause(s) are listed as following:

Issue related to Mesos/Marathon

Potential cause: - These errors occur when `mrun` is not able to connect/communicate with Mesos and/or Marathon. To troubleshoot these issues, refer to online Mesos/Marathon documentation.

- Format: `Mon Jul 11 2016 11:39:43.601145 UTC[][mrun]:ERROR:Unexpected 'frameworks' data from Mesos`
- Examples:
  - `error("Mesos Response: %s" % ret)`
  - `error("Unexpected 'frameworks' data from Mesos")`
  - `error("mrun: Getting mrund state threw exception - %s" %`
  - `error("getting marathon controller state threw exception - %s" %`
  - `error("Unexpected 'apps' data from Marathon")`
  - `error("mrun: Launching mrund threw exception - %s" % (str(e)))`
  - `error("mrun: unexpected 'app' data from Marathon: exception - %s" % (str(e)))`
  - `error("mrun: startMrund failed")`
  - `error("mrun: Exception received while waiting for "`

Command-line options Errors

Potential cause - These errors are typically caused by user errors, typos and when not enough nodes are availble to run a job.

- Format: `Mon Jul 11 2016 11:47:22.281972 UTC[][mrun]:ERROR:Not enough CPUs for exclusive access. Available: 0 Needed: 1`
- Examples:
  - `parser.error("Only --mem_bind=local supported")`
  - `parser.error("Only --cpu-freq=high supported")`
  - `parser.error("Only --kill-on-bad-exit=1 supported")`
  - `parser.error("-n should equal (-N * --ntasks-per-node)")`
  - `parser.error("-N nodes must be >= 1")`
  - `parser.error("-n images must be >= -N nodes")`
  - `parser.error("No command specified to launch");`
  - `error("Not enough CPUs. "`
  - `error("Not enough CPUs for exclusive access. "`
  - `error("Not enough nodes. "`
  - `parser.error("name [%s] must only contain 'a-z','0-9','-' and '.'"`
  - `parser.error("[%s] is not executable file" % args[0])`

Timeout errors

Cause- The errors indicate timeout and resource contention issues, such as, the job timed out, the machine is busy, too many users running too many jobs, a user waiting for their job to start, but previous jobs have not freed up nodes, etc. Additionally, if a user set a job timeout's to 1 hour, and the job lasted longer than 1 hour, they would get a `Job Cancelled` timeout error.

- Format: `Mon Jul 11 2016 12:13:08.269371 UTC[][mrun]:ERROR:mrun: Force Terminated job /mrun/2016-193-12-13-03.174056 Cancelled due to Timeout`
- Examples:
  - `error("mrun: --immediate timed out while waiting")`
  - `error("mrun: Timed out waiting for mrund : %s" % appID)`
  - `error("mrun: Force Terminated job %s Cancelled due to Timeout" %`

Network errors, such as socket, switch, TCP, node failure

Cause - These errors may be encountered in situations where an admin physically unplugs an Ethernet cable while a CGE job was running, or a node died, etc.

- Examples:
  - `error("mrun: select(): Exception %s" % str(e) )`
  - `error("mrun: error socket")`
  - `error %r:%s died\n" % (err,args[0]))`
  - `error("mrund: select(): Exception %s\n" % str(e) )`

System service errors

Cause - These errors only occur if the specific system services have failed. The cause of the issue may be identified by looking at the log messages under `/var/log/messages` on the node the message was encountered on.

- Examples:

- o NCMD: Error leasing cookies MUNGE:
- o Munge authentication failure [%s] (%s).\n

For more information, see the mrun(1) man page.

10.5 Troubleshoot: Application Hangs as a Result of NFS File Locking

About this task

Applications may hang when NFS file systems are projected through DVS and file locking is used. To avoid this issue:

Procedure

Specify the nolock option in the NFS mount point on DVS servers.

See the nfs(5) man page for more information on the nolock option.

10.6 Troubleshoot: DVS does not Start after Data Store Move

About this task

If DVS fails after the Cray system's data store is moved to a shared external Lustre file system, verify that DVS has the correct lnd_name that uniquely identifies the Cray system to the LNet router. The default value for lnd_name on a single-user Lustre file system is gni. Each system sharing an external Lustre file system must have a unique gni* identifier, such as gni0, gni1.

Procedure

Modify the /etc/modprobe.d/dvs.conf file to add the following line:

10.7 Troubleshoot: DVS Ignores User Environment Variables

If the nouserenv option has not been specified in the DVS entry, and a DVS user environment variable that was set does not override the associated DVS mount option, it appears as if DVS is ignoring user environment variables. This can be caused by the addition of a large number of user environment variables. Due to the nature of Linux, if a user adds a large number of user environment variables (large enough that the kernel needs to store that information somewhere other than the usual location), DVS may not be able to find and apply those user environment variables, producing unexpected results.

To define a large number of user environment variables, Cray recommends that users include those definitions in the user's shell so that they are available at startup and stored where DVS can always locate them.

10.8 Clear Leftover hugetlbf Files

Prerequisites

This procedure requires root privileges

About this task

Follow the instructions in this procedure if the system displays the error message, "`LIBDMAPP ERROR during create in _dmappi_get_sheap_addr_hugepages: Permission denied`". The node IDs shown in these examples are for a system containing 3 sub-racks. If a system with 2 sub-racks is being used, replace these with the node IDs for a 2 sub-rack system.

Procedure

1. Log on to the System Management Workstation (SMW) as root

2. Execute the following command to clear out any leftover `hugetlbf` files

```
# pdsh -w 'nid000[00-47]' '/bin/rm -f /var/lib/hugetlbfs/global/*/*DMAPP*'
```

3. Verify that the leftover `hugetlbf` files have been cleared

```
# pdsh -w 'nid000[00-47]' '/bin/ls -l /var/lib/hugetlbfs/global/*/*DMAPP*' 2>/dev/null|wc
0       0       0
```

10.9 Remove Temporary Spark Files from SSDs

Prerequisites

This procedure requires root privileges.

About this task

Spark writes temporary files to the SSDs of the compute nodes that the Spark executors run on. Ordinarily, these temporary files are cleaned up by Spark when its execution completes. However, sometimes Spark may fail to fully clean up its temporary files, such as, when the Spark executors is not shut down correctly. If this happens too many times, or with very large temporary files, the SSD may begin to fill up. This can cause Spark jobs to fail or slow down.

Urika-GX checks for any idle nodes once per hour, and cleans up any left over temporary files. This is handled by a cron job on one of the login nodes that executes the `/usr/sbin/cleanupssds.sh` script once per hour. Follow the instructions in this procedure if this automated cleaning ever proves to be insufficient.

Procedure

1. Log on to one of the login nodes as root.

2. Kill all the processes of running Spark jobs.

3. Execute the `/usr/sbin/cleanupssds.sh` script.

   ```
   # /usr/sbin/cleanupssds.sh
   ```

10.10 CSMS Troubleshooting Information

There are a number of mechanisms that can be used to debug CSMS issues.

General debugging tips

- Many OpenStack CLI commands provide the `--debug` and/or `--verbose` option(s), which may be useful if unexpected behavior is encountered.
- When determining the root cause of unexpected behavior, check if the command being executed has any `show` options, such as `heat stack-show`, `nova show`, `ironic node-show`, etc. If so, there may be useful information in the resulting output, often in a `fault` or `reason` field. For additional information, examine the OpenStack logs in the per-service `/var/log/` directories around the time of the failure for any messages that may indicate the source of the problem.

10.10.1 kdump utility

The `kdump` utility is installed and enabled by default to ensure that data is saved in the event of a server kernel panic. Refer to the RedHat Kernel Crash Dump Guide for details on customizing `kdump`.

The `crash` command is also installed and can be used to examine `crash` dump data. Kernel crash dumps are stored in `/var/crash/` by default. In order to use `crash` on the server, the `kernel-debuginfo` package must also be installed.

Users creating tenant images for deployment via OpenStack are responsible for configuring the tenant images with `kdump` support if desired. Administrators are also responsible for copying and/or removing `kdump` data from tenant nodes.

10.10.2 The cray_dumpsys Command

The `cray_dumpsys` script gathers data needed to debug the CSMS. It dumps the state of the OpenStack services, configuration and log files, and background information about the system. The files are compressed and the results are stored in the `/var/tmp/` directory. By default, only recent logs are dumped.

`cray_dumpsys` includes the `--all-logs` option to dump all rotated logs. Additionally, the `--days` option dumps logs up to a certain number of days. For example:

```
root@smw2# cray_dumpsys --days 4
/root/admin.openrc sourced!

sosreport (version 3.2)

This command will collect diagnostic and configuration information from
[...]
```

```
Setting up archive ...
Setting up plugins ...
Running plugins. Please wait ...
Running 1/12: memory...
Running 2/12: mysql...
Running 3/12: networking...
[...]
Running 12/12: newtplugin...

Creating compressed archive...

Your sosreport has been generated and saved in:
/var/tmp/sosreport-newt-20150923124808.tar.xz

The checksum is: bb87d9323f88813e07659e53aebb16b6

Please send this file to your support representative.
```

11 Security

11.1 Authentication Mechanisms

Table 22. Authentication Mechanisms

Application	Authentication Mechanism
Cray Application Management UI	LDAP. Users can also log in with the default account shipped with the system. This account has the following credentials: username: `admin` password: `admin`
Cray System Management UI	This application is only accessible to system administrators. The default credentials for logging on to this interface are: username: `admin` password: `initial0`
Urika-GX Applications Interface	Not available.
Documentation and Learning Resources UI	Not available.
Grafana UI	LDAP. The system also ships with a default account that can be used to log on to Grafana. The credentials of this account are: username: `admin` password: `admin`
Jupyter Notebook UI	LDAP. The system also ships with a default account that can be used to log on to Jupyter. The credentials of this account are: username: `crayadm` password: `initial0`
HUE UI	LDAP

Application	Authentication Mechanism
	The system also ships with a default admin account that can be used to log on to HUI. The credentials of this account are: username: `admin` password: `admin`
Hadoop/Spark related UIs, such as Spark History Server, Hadoop History Server, YARN Resource Manager, etc.	Not available
Mesos UI	Not available.
Marathon UI	Not available.
Spark Thrift Server	Urika-GX ships with LDAP authentication enabled for Spark Thrift server. SSL authentication can be set up using instructions documented in *Enable SSL on Urika-GX* on page 183. Storage based authorization is supported for Spark Thrift Server.
HiveServer2	LDAP authentication for HiveServer2 can be enabled using instructions documented in *Enable LDAP for Connecting Tableau to HiveServer2* on page 191. Storage based and SQL standard based authorizations are supported for HiveServer2. For more information, see *Enable SQL Standard based Authorization for HiveServer2* on page 192

11.2 Default Urika-GX System Accounts

Default System Management Workstation (SMW) Accounts

Table 23. Default SMW Accounts

Account Name	Password
`root`	`initial0`
`crayadm`	`crayadm`

Table 24. Default iDRAC Account

Account Name	Password
`root`	`initial0`

MariaDB/MySQL Accounts

Table 25. Default MariaDB/MySQL Accounts

Account Name	Password
`hssds`	`hssds`
`mysql`	Empty string
`mariadb`	Empty string

Default Cray System Management Software (CSMS) UI and CLI Account

Table 26. Default CSMS CLI and UI Account

Account Name	Password
`admin`	`initial0`

IMPORTANT: The SMW and CSMS accounts should not be set up with the local Urika-GX LDAP for security. The SMW can be connected directly to the corporate LDAP. However, connecting CSMS to corporate LDAP is not yet supported in this release.

11.3 Tableau Authorization and Authentication Mechanisms

Urika-GX ships with LDAP authentication enabled for Spark Thrift Server. LDAP authentication for Hiveserver2 can be enabled using instructions documented in *Enable LDAP for Connecting Tableau to HiveServer2* on page 191.

⚠ **CAUTION:** Enabling LDAP authentication for HiveServer2 may result in misconfiguration of HUE. To resolve this issue, please follow the instructions documented at *http://gethue.com*.

SSL authentication for Tableau can be set up using instructions documented in *Enable SSL on Urika-GX*.

Urika-GX ships without authorization enabled. To enable storage based authorization for connecting to HiveServer2, follow the instructions documented by Hive, see *https://cwiki.apache.org/confluence/display/Hive/Storage+Based+Authorization+in+the+Metastore+Server*.

To enable SQL standard based authorization for connecting to HiverServer2, follow the instructions documented in *Enable SQL Standard based Authorization for HiveServer2* on page 192.

To learn more about using Tableau, visit *http://www.tableau.com/*.

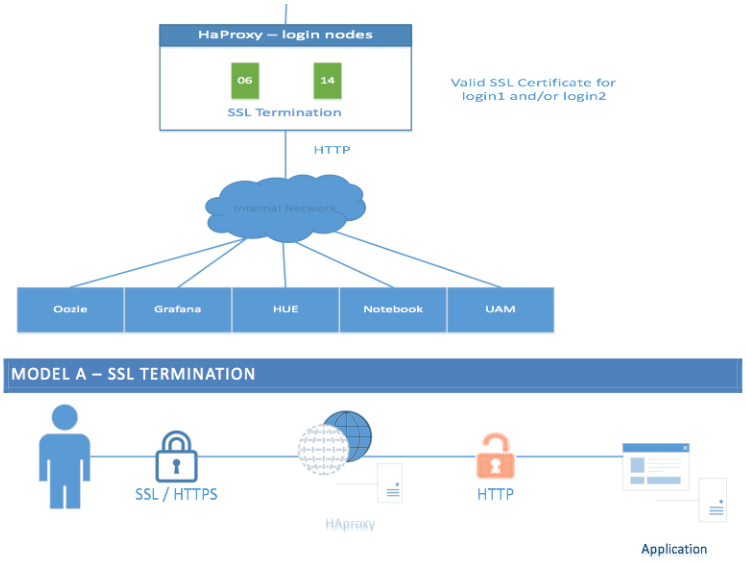
11.4 Enable SSL on Urika-GX

Prerequisites

This procedure requires root privileges and needs the hostname of the machine to be known. The hostname should resolve to the site's DNS.

About this task

Users access applications on Urika-GX by using the login1 node's `https://IP:PORT` using SSL. HA Proxy decrypts SSL and then forwards the HTTP communication to back end servers over the internal Aries or management network. Back-end applications send their communication back to HA Proxy via HTTP. HA Proxy then encrypts the response and send it back to the user using SSL. HA or redundant models are also supported so it is possible to multiple back-ends available, as long as the data is in sync. Urika-GX's SSL setup is depicted in the following figure:



Information sent over the Internet is passed through various servers before it reaches the destination. Any computer located between the source and destination can see usernames, passwords, and other sensitive information if it is not encrypted with an SSL certificate. Therefore, it is recommended to enable SSL, as described in this procedure.

Major steps involved in installing SSL include:

1. Acquire and install a valid SSL certificate.
2. Edit the HA Proxy configuration file by uncommenting the settings to enable SSL.
3. Edit the settings for the **Urika Applications Interface** by uncommenting some settings to enable SSL.

In the following instructions, it is assumed that the SSL certificate is being installed on Urika-GX system containing 48 nodes and `nid00030` is used as the node ID of login node 1.

⚠ **CAUTION:** SSL is only supported with certificates issued by a trusted Certificate Authority(CA), not with self-signed certificates

In the following instructions and code samples, *`hostname`* is used as an example and should be replaced with the actual hostname of the system.

Procedure

1. SSH into login node 1.

```
# ssh nid00030
```

2. Uncomment the following lines in `/etc/haproxy/haproxy.cfg` configuration file and replace all occurrences of `/opt/cray/certificate/`*`hostname`*`-login1.us.cray.com.pem` with the full path to the SSL certificate.

```
frontend hive_ssl
  bind *:29207 ssl crt /etc/hive/conf/server.pem
  mode tcp
  option forwardfor
  reqadd X-Forwarded-Proto:\ https
  default_backend hive_ssl_backend

backend hive_ssl_backend
  mode tcp
  balance source
  server server1 192.168.0.33:10000

frontend sparkthrift_ssl
  bind *:29208 ssl crt /etc/hive/conf/server.pem
  mode tcp
  option forwardfor
  reqadd X-Forwarded-Proto:\ https
  default_backend sparkthrift_ssl_backend

backend sparkthrift_ssl_backend
  mode tcp
  balance source
  server server1 192.168.0.33:10015

frontend grafana_ssl
  bind *:29201 ssl crt /opt/cray/certificate/hostname-login1.us.cray.com.pem
  mode http
  option forwardfor
  option http-server-close
  option httpclose
  reqadd X-Forwarded-Proto:\ https
  default_backend grafana_ssl_backend

backend grafana_ssl_backend
  mode http
  balance source
  server server1 192.168.0.47:3000

frontend hue_ssl
  bind *:29202 ssl crt /opt/cray/certificate/hostname-login1.us.cray.com.pem
  mode http
  option forwardfor
  option http-server-close
  option httpclose
  reqadd X-Forwarded-Proto:\ https
  reqadd X-Forwarded-Protocol:\ https
  default_backend hue_ssl_backend

backend hue_ssl_backend
```

```
  mode http
  balance source
  server server3  192.168.0.31:8888

frontend jupyter_ssl
  bind *:29204 ssl crt /opt/cray/certificate/hostname-login1.us.cray.com.pem
  mode http
  option forwardfor
  option http-server-close
  option httpclose
  reqadd X-Forwarded-Proto:\ https
  default_backend jupyter_ssl_backend

backend jupyter_ssl_backend
  mode http
  balance source
  server server4  192.168.0.31:7800

frontend csms_ssl
  bind *:29200 ssl crt /opt/cray/certificate/hostname-login1.us.cray.com.pem
  mode http
  option forwardfor
  option http-server-close
  option httpclose
  reqadd X-Forwarded-Proto:\ https
  default_backend csms_ssl_backend

backend csms_ssl_backend
  mode http
  balance source
  server server2 10.142.0.1:443 ssl verify none

frontend urika-app-magmt_ssl
  bind *:29203 ssl crt /opt/cray/certificate/hostname-login1.us.cray.com.pem
  mode http
  option forwardfor
  option http-server-close
  option httpclose
  reqadd X-Forwarded-Proto:\ https
  reqadd X-Forwarded-Protocol:\ https
  default_backend urika-app-magmt_ssl_backend

backend urika-app-magmt_ssl_backend
  mode http
  balance source
  server server1  192.168.0.31:8000
```

In the above file, `192.168.0.31` is the IP address of the node where HUE is running. 8888 is the port where HUE is running. If SSL is enabled, the HUE UI would be available at `https://hostname-login1:29202`. HUE would still be available at `http://hostname-login1:8888`, but this URL not secure. It is recommended to use `https://hostname-login1:29202`.

3. Save the `/etc/haproxy/haproxy.cfg` configuration file.

4. Restart HAProxy

```
# service haproxy restart
```

5. Uncomment the following lines and make sure they are set to `true` in `/etc/hue/conf/hue.ini`

   ```
   use_x_forwarded_host=true
   secure_proxy_ssl_header=true
   ```

6. Restart the HUE service.

   ```
   # service urika-hue restart
   ```

7. Uncomment the following lines (or add if they do not already exist) in `/opt/cray/ui-application-management/default/application_management/settings.py`

   ```
   SECURE_PROXY_SSL_HEADER = ('HTTP_X_FORWARDED_PROTO', 'https')
   USE_X_FORWADED_HOST = True
   ```

8. Set `USE_SECURE_URLS` to `True` in `/opt/cray/ui-application-management/default/application_management/settings.py`, as shown in the following example. This allows the **Urika-GX Applications Interface** page to load secure URLs (configured in the preceding steps) when HUE/Grafana/Jupyter/Cray System Management UI/**Urika-GX Application Management** UI are accessed from the **Urika-GX Applications Interface** page. If there is any change in the HAProxy port numbers, the following URLs in `settings.py` need to be updated:

   ```
   if USE_SECURE_URLS == True:
      GRAFANA_SERVER = "https://" + LOGIN1  + ":29201"
      CSMS = "https://" + LOGIN1 + ":29200/dashboard"
      JUPYTER = "https://" +  LOGIN1 + ":29204"
      HUE = "https://" +  LOGIN1 + ":29202"
      UAM = "https://" + LOGIN1 + ":29203/applications"
   ```

9. Update the `/etc/httpd/conf.d/uam.conf` configuration file as follows, replacing the the URL '`hostname-login1.us.cray.com`' with the FQDN of login node 1.

   ```
   WSGISocketPrefix run/wsgi
   WSGIScriptAlias / /opt/cray/ui-application-management/default/
   application_management/apache/wsgi.py
   Alias /static/ /opt/cray/ui-application-management/default/
   application_management/app_monitoring/static/
   <Directory /opt/cray/ui-application-management/default/application_management/
   apache>
     Require all granted
   </Directory>
   <VirtualHost *:80>
     Redirect  /applications https://hostname-login1.us.cray.com:29203/
   applications
   </VirtualHost>
   Listen 8000
   <VirtualHost *:8000>
   </VirtualHost>


   <Directory /opt/cray/ui-application-management/default/application_management/
   app_monitoring/static>
     Require all granted
   </Directory>
   ```

10. Restart Apache on login node 1.

```
# service httpd restart
```

11. SSH on to the SMW.

`hostname` is used in the following example as the machine name.

```
# ssh hostname-smw
```

12. Uncomment the following lines (or add if they do not already exist) in `/usr/share/openstack-dashboard/openstack_dashboard/settings.py`:

```
SECURE_PROXY_SSL_HEADER = ('HTTP_X_FORWARDED_PROTO', 'https')
USE_X_FORWADED_HOST = True
```

13. Restart Apache on the SMW

```
# service httpd restart
```

14. Verify that all the URLs of services are accessible.

11.5 Install a Trusted SSL Certificate on Urika-GX

Prerequisites

This procedure needs to be performed as root. The hostname needs to be known and needs to resolve to the site's DNS.

About this task

This procedure provides instructions for installing a SSL certificate that has been issued by a trusted Certificate Authority (CA). In the following instructions, `nid00030` is used as an exmaple for login node 1's ID. Please replace '*`hostname`*`-login1.us.cray.com`' in the following examples with the FQDN of login node 1.

Procedure

1. Log on to login node 1 as root.

2. Generate a key. Following is an example for generating a key using openssl

```
[root@nid00030~]# openssl genrsa -out hostname-login1.us.cray.com.key 2048
```

3. Generate a Certificate Signing Request (CSR). The system will prompt to enter information that will be incorporated into the certificate request.

```
[root@nid00030~]#  openssl req -new-key hostname-login1.us.cray.com.key -out
      hostname-login1.us.cray.com.csr
```

4. Store the CSR in a secure location on the system, such as `/opt/cray/certificate`

5. Send the CSR to the IT department to obtain a certifcate

6. Create a `PEM` file, which is the `crt + key` combined into 1 file.

   WARNING: The `PEM` file needs a linefeed bewteen crt and key. Use a vi editor or the `cat` command to combine the crt and key

   ```
   [root@nid00030~]# cat server.crt server.key > server.pem
   ```

7. Save the PEM file as *hostname*-login1.us.cray.com.pem under `/opt/cray/certificate`.

11.6 Enable LDAP Authentication on Urika-GX

Prerequisites

- This procedure requires root access.
- Ensure that the storage LDAP client points at login node 1, which is the LDAP server on Urika-GX. This ensures that the Urika-GX system and storage are authenticating to the same source.

  NOTE: This examples used in this procedure are intended for a 3 sub-rack system. Replace node IDs as needed when executing the following commands if using a system containing less than 3 sub-racks.

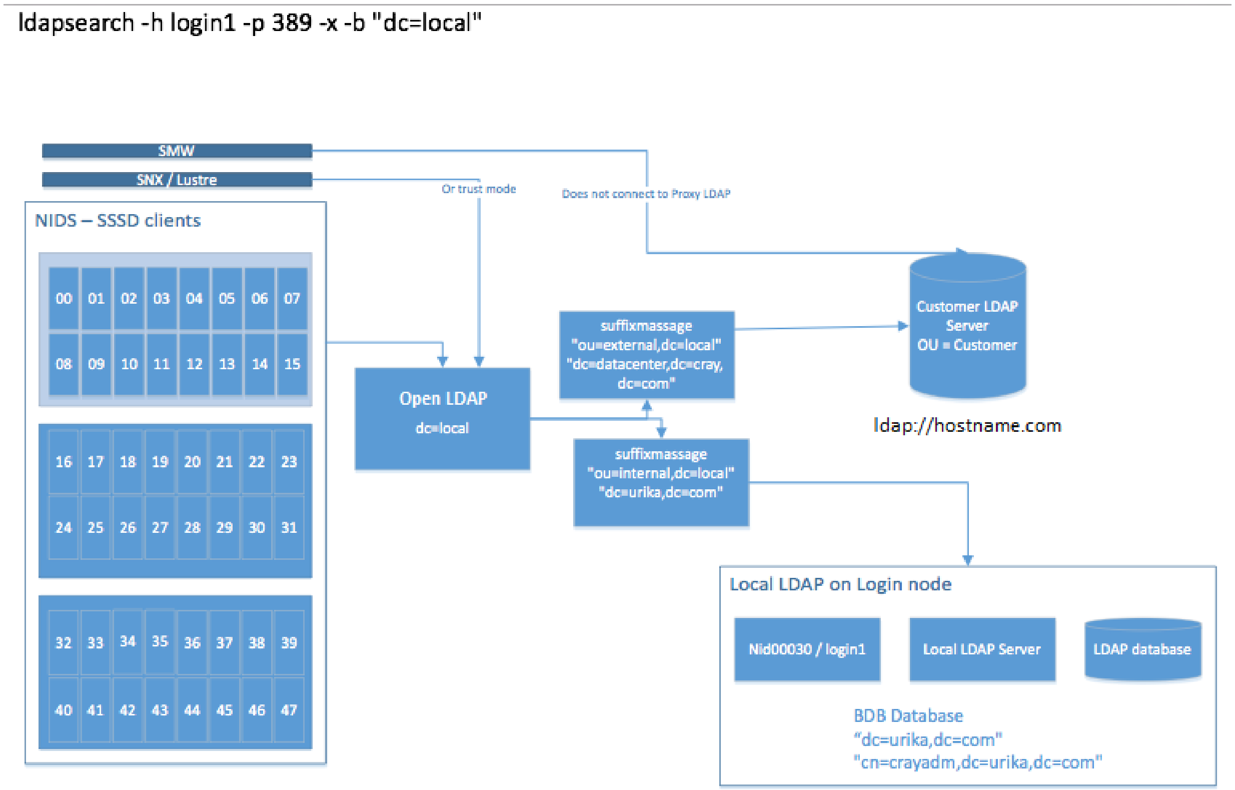
About this task

Urika-GX uses an internal LDAP server that comes with two basic user types:

- crayusr – This is the standard user type
- crayadm – Users of this type have root/admin privileges.

The Urika-GX LDAP setup is depicted in the following figure:

Figure 58. Urika-GX LDAP Setup



```
ldapsearch -h login1 -p 389 -x -b "dc=local"
```

The following procedure can be used to enable the LDAP server for every Urika®-GX node. In the following instructions, *login-1* is used as an example for the name of login node 1, which is where the LDAP service runs.

⚠ **CAUTION: Cray Support should be involved for all LDAP related procedures and changes.**

Procedure

1. Log on to login node 1 as root.

```
# ssh root@login-1
```

2. Edit the /usr/local/openldap/etc/openldap/slapd.conf file to uncomment the following lines, and replace [myldap] with the actual LDAP server's URL:

```
[root@login-1 ~]# vi /usr/local/openldap/etc/openldap/slapd.conf #uri"ldap://[myldap]/ou=external,dc=local"
#lastmod off
#suffixmassage"ou=external,dc=local" "[dc=datacenter,dc=cray,dc=com]"
```

NOTE: The square brackets, i.e. [ ] need to be omitted when replacing [myldap] with the actual LDAP server's URL.

For example, if the LDAP server's URL is hostname.com, the line:

```
# uri"ldap://[myldap]/ou=external,dc=local"
```

should be uncommented and customized to look like the following:

```
uri"ldap://hostname.com/ou=external,dc=local"
```

3. Save the /usr/local/openldap/etc/openldap/slapd.conf file.

4. Restart the slapd daemon, which listens for LDAP connections.

   ```
   [root@login-1 ~]# service slapd restart
   ```

5. Restart the oddjobd daemon, which provides a means for invoking and taking limited control of applications.

   ```
   [root@login-1 ~]# service oddjobd restart
   ```

6. Ensure that LDAP has been set up properly

   a. Log on to the System Management Workstation (SMW) as root.

   b. Verify that the users registered with LDAP are listed on all the nodes.

      In the following example, *system-smw* is used as an example for the SMW's hostname and *username* is used as an example of an LDAP user's username.

      ```
      # root@system-smw pdsh -w nid000[00-47] 'id username'
      ```

   c. Log on to login node 1.

      ```
      # ssh root@login-1
      ```

   d. Verify that all LDAP users are listed when the ldapsearch command is executed for all entries:

      ```
      [root@nid00030 ~]# ldapsearch -h 127.0.0.1 -D "cn=crayadm,dc=local" -w initial0 -b "dc=local"
      ```

   For information about internal LDAP or the LDAP server, contact Cray Support. For advanced configuration settings, see the OpenLDAP Software Administrator’s guide at *http://www.openldap.org*.

11.6.1 Enable LDAP for Connecting Tableau to HiveServer2

Prerequisites

This procedure requires root privileges.

About this task

This procedure provides instructions for enabling LDAP for connecting HiveServer2 to Tableau or other external clients.

Procedure

1. Log on to the SMW.

2. Stop the HiveServer2 service.

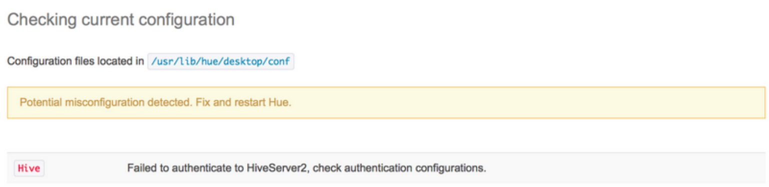
   ```
   # urika-stop -s hive
   ```

3. Connect to a node where the HiveServer2 service is running.

4. Edit the `/etc/hive/conf/hive-site.xml` file and change the authentication mode from `NONE` to `LDAP`

```
<property>
 <name>hive.server2.authentication</name>
 <value>NONE</value>
</property>
```

CAUTION: Enabling LDAP authentication for HiveServer2 may result in misconfiguration of HUE, as shown in the following figure. To resolve this issue, please follow the instructions documented at *http://gethue.com*.



Checking current configuration

Configuration files located in `/usr/lib/hue/desktop/conf`

Potential misconfiguration detected. Fix and restart Hue.

Hive Failed to authenticate to HiveServer2, check authentication configurations.

5. Log on to the SMW.

6. Restart HiveServer2 service.

```
# urika-start -s hive
```

11.7 Enable SQL Standard based Authorization for HiveServer2

Prerequisites

This procedure requires root privileges.

About this task

SQL standard based authentication for connecting to HiverServer2 is not enabled by default on Urika-GX. Follow the instructions in this procedure to enable it.

Procedure

1. Log on to the SMW as root.

2. Stop the Hive service.

```
# urika-stop -s hive
```

3. Follow the Hive instructions documented at *https://cwiki.apache.org/confluence/display/Hive/SQL+Standard+Based+Hive+Authorization#SQLStandardBasedHiveAuthorization-ForHive0.14andNewer* with the following exceptions:

    1. Edit the `hive-site.xml` file and set the value of `hive.metastore.uris` to `thrift://192.168.0.33:9083`

2. Use either or both of the values defined in the Hive documentation for the `hive.security.authorization.manager` configuration parameter.
3. Edit `hive-site.xml` to set values of properties, as opposed to the Hive documentation, which instructs users to set these properties in `hiveserver2-site.xml`

   NOTE: Even though the documentation at *https://cwiki.apache.org/confluence/display/Hive/SQL+Standard+Based+Hive+Authorization#SQLStandardBasedHiveAuthorization-ForHive0.14andNewer* instructs users to put some settings into `hiveserver2-site.xml`, all of the properties listed in the linked documentation should go in `hive-site.xml`.

   There is no need to modify other parameters of the `hive-site.xml` file that are documented in the Hive documentation, as they are already configured on the Urika-GX system.

4. Start the Hive service.

```
# urika-start -s hive
```

5. Reconnect to HiveServer2.

11.8 Change LDAP Password on Urika-GX

Prerequisites

This procedure requires root privileges.

About this task

Follow the instructions in this procedure to change the LDAP password on Urika-GX

Procedure

1. Log on to `nid00030`, which is a login node.

2. Edit the `slapd.conf` file and add in ACLs to allow users to modify the LDAP password.

```
[root@nid0003~]# vim /usr/local/openldap/etc/openldap/slapd
# Define global ACLs to disable default read access.
access to *
 by self write
 by * read
 by anonymous auth
```

3. Restart `slapd`

```
[root@nid00030]# ldappasswd -H ldap://127.0.0.1 -x -D \
"uid=crayusr,ou=users,dc=urika,dc=com" -w initial0 -a initial0 -S
```

4. Login as `crayusr` to test changing password by entering it when prompted.

```
[crayusr@nid0003~]# ldappasswd -H ldap://127.0.0.1 -x -D
"uid=crayusr,ou=users,dc=urika,dc=com" \
-w initial0 -a initial0 -S
```

```
New password: Re-enter new
password:
```

11.9 File System Permissions

This section provides details on user restrictions and access controls implemented on Urika-GX for the three Urika-GX file systems.

- **Internal file systems**
  - Hadoop Distributed File System (HDFS) - Apache Hadoop HDFS implements authentication and authorization model similar to POSIX model, where each file is associated with an owner and a group. Urika-GX implements a simple mode of user authentication. In this mode, the identify of a client process is determined by the OS's user name, which can be retrieved via the `whoami` command. The user authentication is managed by Open LDAP server running on login node 1. Groups and user credential are inherited from the Open LDAP.
  - Network File System (NFS) - The SMW provides the NFS mount, which has the same groups and user permissions as those of the host operating system.
- **External file system (Lustre)** - If Lustre is used on Urika-GX, it inherits Linux group permissions from the login node.

11.10 Urika-GX Security Quick Reference Information

Configuration of LDAP Settings on Urika-GX

The Open LDAP server on Urika-GX runs on login node 1. For example, if the system's hostname is `hostnatme`, then the Open LDAP service would run on `hostname-login1`. The particular ID of the login node (such as `nid00030` on a 48 node system) would change, based on the number of nodes in the system i.e. 16N, 32N or 48N. The Open LDAP server and can be connected with the site corporate LDAP server from which, groups, permissions and user credentials will be inherited. Please refer to the site specific LDAP server documentation for details on setup and configuration.

LDAP and User management Information

For details of how to add, enable and manage users on LDAP please refer to *http://www.openldap.org*.

- **Configure LDAP settings** - The Open LDAP server on Urika-GX can be connected with the site/corporate LDAP server, from which groups, permissions, and user credentials will be inherited.
- **Open LDAP service node** - The Open LDAP service runs on login node 1 of Urika-GX system. For example, if the hostname of your Urika-GX is *`hostname`* then Open LDAP service is running on *`hostname`*-login1. The particular node (such as: nid00030) would change, based on the number of nodes in the system i.e. 16N, 32N or 48N
- **Authenticate users** - Urika-GX uses LDAP based authentication. System administrators can use LDAP servers to setup user authentication.
- **Add a user to a group** - Use the `usermod` command to add a user to an existing group.

- **Add a user to LDAP** - Use the `ldapadd` command to add a user to LDAP.
- **Create a group on each node** - In order to enable group permissions in HDFS, the changes on the Linux system need to take place on the server that is running the NameNode service. If it is unclear which node is running the NameNode service, run the `urika-inventory` command from the SMW. For consistency, it is recommended to set up group(s) from the SMW on all nodes via `pdsh`. Use the `groupadd` command to create a group on each node and the `hdfs groups` command to confirm that HDFS recognizes the new group.
- **Change user passwords** - Use the `ldappasswd` command to change user passwords.
- **Create HDFS home directory** - Use the `hdfs dfs -mkdir` command to create a HDFS home directory.
- **Change user permissions** - Use the `hadoop dfs -chown` command to change permissions on directory to make new user the owner of home directory

11.11 Modify the Secret of a Mesos Framework

Prerequisites

This procedure requires root privileges.

About this task

The `urika-mesos-change-secret` command is used to change the secret of the Spark and/or Marathon frameworks, which are registered with Mesos on Urika-GX. This script needs to be run as root from the SMW. The secret entered needs to be in plain text. The Mesos cluster needs to be stopped (via `urika-stop -s mesos_cluster`) before running this script and then restarted (via urika-start -s mesos_cluster) after the script finishes executing. If the Mesos cluster is not restarted after running this script, the framework will not authenticate. The following list of items, which is subject to change, needs to be kept under consideration when creating a new secret for a framework:

- All lowercase and uppercase letters and numbers are allowed in secrets. `-`, `_`, and `.` are allowed at any position in the secret
- ! can be used, but should not be the first character
- Other punctuation characters can cause authentication issues and are not recommended
- White space in the secret is not allowed. White space at the end of the string will get trimmed
- An empty space secret will not authenticate.

This command accepts the following options:

- `-spark` *`secret`* - Use this option to update the secret of the Spark framework. secret refers to the text used to specify the new secret for the framework under consideration.
- `-marathon` *`secret`* - Use this option to update the secret of the Marathon framework. secret refers to the text used to specify the new secret for the framework under consideration.

Use the `-h` or `--h` options for more information.

On Urika-GX, the following frameworks need authenticate with Mesos:

- Spark
- Marathon

A principal can be thought of as an identifier for a framework, whereas a secret refers to secret information that authenticates the framework's principal. In order to update the secret information, the credential information of Mesos as well as that of the framework needs to get updated.

Procedure

1. Log on to the SMW as root.

2. Stop the Mesos cluster.

   ```
   # urika-stop -s mesos_cluster
   ```

3. Execute the `urika-change-mesos-secret` script, specifying the framework and new secret.

   Modify Spark's secret:

   ```
   # urika-change-mesos-secret -spark secret
   ```

   Modify Marathon's secret:

   ```
   # urika-change-mesos-secret -marathon secret
   ```

   The system will return an error if no secret is specified or if the secret is not entered in plain text.

4. Start the Mesos cluster.

   ⚠ **CAUTION:** The Mesos cluster needs to be restarted after running the `urika-mesos-change-secret` command, otherwise the framework will not authenticate.

   ```
   # urika-start -s mesos_cluster
   ```

11.12 Reset a Forgotten Password for the Cray Application Management UI

Prerequisites

This proedure requries root privileges and assumes that it is being carried out on a 48-node system. The node IDs should be replaced with acutal ones to reflect actual system configuration.

About this task

Follow the instructions in this procedure if the password has been forgotten and needs to be reset.

Procedure

1. Log on to login node 1.

```
# ssh nid00030
```

2. Switch to the `/opt/cray/ui-application-management/default` directory.

```
# cd /opt/cray/ui-application-management/default
```

3. Run the `./manage.py` script to reset the password and enter the new password when prompted.

```
# ./manage.py changepassword admin
Changing password for user 'admin'
Password:
```

11.13 Port Assignments

Table 27. Services Running on the System Management Workstation (SMW)

Service Name	Default Port
SSH	22

Table 28. Services Running on the I/O Nodes

Service Name	Default Port
SSH	22

Table 29. Services Running on the Compute Nodes

Service Name	Default Port
ssh	22
YARN Node Managers, if they are running under Mesos	8040, 8042, 45454, and 13562
Mesos slaves on all compute nodes	5051
DataNode Web UI to access the status, logs and other information	50075
DataNode use for data transfers	50010
DataNode used for metadata operations.	8010

Table 30. Services Accessible via the Login Nodes via the Hostname

Service	Default Port
Mesos Master UI	5050. This UI is user-visible.
Spark History Server's web UI	18080. This UI is user-visible.
HDFS NameNode UI for viewing health information	50070. This UI is user-visible.
Secondary NameNode web UI	50090. This UI is user-visible.
Web UI for Hadoop Application Timeline Server	8188. This UI is user-visible.
YARN Resource Manager web UI	8088. This UI is user-visible.
Marathon web UI	8080. This UI is user-visible.
HiveServer2	SSL - 29207 Non-SSL - 10000
Hive Metastore	9083.
Hive WebHCat	50111.
Oozie server	11000. The Oozie dashboard UI runs on this port and is user-visible.
Hadoop Job History Server	19888 on nid00016. This is a user-visible web UI.
HUE server	8888 on login1 and login2. The web UI for the HUE dashboard runs on this port and is user-visible.
CGE `cge-launch` command	3750. See S-3010, "*Cray® Graph Engine Users Guide*" for more information about the `cge-launch` command or see the `cge-launch` man page.
CGE Web UI and SPARQL endpoints	3756
Spark Web UI	4040. This port is valid only when a Spark job is running. If the port is already in use, the port number's value is incremented until an open port is found. Spark Web UI runs on whichever login node (1 or 2) that the user executes `spark-submit/spark-shell/spark-sql/pyspark` on. This UI is user-visible.
InfluxDB	8086 on login2. InfluxDB runs on nid00046 on three sub-rack, and on nid00030 on a two sub-rack system.
InfluxDB port for listening for `collectl` daemons on compute nodes	2003. InfluxDB runs on login node 2 on the Urika-GX system.
InfluxDB cluster communication	8084
Grafana	3000 on login2 (login node 2). The Grafana UI is a user-visible.
Web UI for Jupyter Notebook	7800. Jupyter Notebook internally uses HTTP proxy, which listens to ports `7881` and `7882`

Service	Default Port
Urika-GX Applications Interface	80 on login1 (login node 1).
Urika-GX Application Management	80 on login1 (login node 1).
Spark SQL Thrift Server	SSL - 29208 Non-SSL - 10015

Additional Ports and Services

Table 31. Additional Services and Ports They Run on

Service	Port
ZooKeeper	2181
Kafka (not configured by default)	9092
Flume (not configured by default)	41414
Port for SSH	22