



Hewlett Packard
Enterprise

Helion OpenStack Carrier Grade 4.0

INSTALLATION FOR CPE SYSTEMS

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Titanium Server

Cloud Administration, 16.10

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Titanium Server Installation

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Titanium Server Installation Overview

Installing Titanium Server involves loading and configuring the software on a combined controller/compute node, and then using this node to load the software on a second combined controller/compute node.

Before installation, ensure that you are familiar with the Titanium Server architecture, and that your hardware meets the minimum requirements. For more information, refer to the *Titanium Server Planning Guide*.

Review the *Wind River Titanium Server Release Notes* for any additional information pertaining to installation.

During installation, have ready the following items:

- the Titanium Server ISO image on bootable media, or a PXE boot server
- a configuration plan for use during the installation process
- a license file
- (optional) a CA-signed certificate, for secure HTTPS access for REST API applications and the web server
- (optional) A firewall rules file, if you need to override or augment the Titanium Server default firewall settings. Normally this is not required. For more information, refer to the *Titanium Server Planning Guide: Firewall Options*.
- (optional) a controller configuration input file, if you want to use automated initial configuration

Networks for a Titanium Server CPE System

For a Titanium Server CPE system, Wind River recommends a minimal network configuration.

Titanium Server CPE uses a small hardware footprint consisting of two hosts, plus a network switch for connectivity. Network loading is typically low. The following network configuration typically meets the requirements of such a system:

- An internal management network
- An OAM network, optionally consolidated on the management interface
- One or more data networks, optionally consolidated on the management interface



NOTE: You can enable secure HTTPS connectivity on the OAM network during system installation. For more information, see *Titanium Server System Administration: Secure HTTPS External Connectivity*.

Software Installation Workflow

Installing the Titanium Server software involves initializing and configuring a combined controller/compute node, and then using this node to initialize and configure a second controller/compute node.

For a CPE system, the following procedure is recommended:

1. Power off both nodes.
2. Install the first controller/compute node.
3. Configure provider networks (required in order to add data interfaces for the compute function).
4. Configure the first controller/compute node with data interfaces.
5. Configure local storage for the compute function on the first controller/compute node.
6. Install the second controller/compute node, and then configure its interfaces, Cinder storage, and local storage.



NOTE: To ensure you can correctly identify hosts as you install them, power on and configure each new host one at a time.

To prevent a host from repeatedly booting over the network, you may need to adjust the boot order for the host. For more information, see [Boot Sequence Considerations](#) on page 57. Terminal-server access to the hosts may be required to adjust the BIOS boot settings

After each host is configured, you can unlock it to make it operational.

To unlock a node, you must do the following:

1. Manually configure the OAM network interface, and the infrastructure network interface if used. This is required for the secondary controller only.
2. Configure the data interfaces. This is required for each of the controllers.
3. Configure local storage for the compute function. This is required for each of the controllers.

For complete installation instructions, refer to the *Titanium Server Installation Guide* that pertains to your configuration, either for a CPE system, a standard system with controller storage, or a standard system with dedicated storage.

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Controller-0 Installation and Provisioning

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Methods for Adding and Configuring the First Controller

Titanium Server supports more than one way of initializing and configuring **controller-0**.

You can initialize the first controller from a local device such as a DVD or USB flash drive. For more information, see [Initializing Controller-0 from a Local Device](#) on page 6.as follows:

After the first controller is initialized, you can configure it as follows:

- Interactively using a command-line script. For more information, see [Applying the Controller Configuration](#) on page 11.
- Using a prepared configuration file. For more information, see [Using a Controller Configuration Input File](#) on page 58.

Installing the First Controller

The first step in installing Titanium Server is to install and configure the first controller.

For an overview of methods, see [Methods for Adding and Configuring the First Controller](#) on page 5.

The configured host becomes **controller-0**.



NOTE: For the configuration to run successfully, the management interface on **controller-0** must be connected and operational.

Procedure

1. Using an ISO image of the Titanium Server software from an external source, such as a USB flash drive or a DVD, or a PXE boot server, initialize the controller host.

Initialization installs an operating system on the host's disk drive, and automatically boots the host from the drive.

2. Copy the installation files and any other required files to **controller-0**.
3. Apply any required software patches to **controller-0**.
4. Configure the host as a controller using the **config_controller** command-line script.

You can respond to the script interactively, or you can prepare and use a controller configuration input file. For more information, see [Using a Controller Configuration Input File](#) on page 58.

Postrequisites

Use **controller-0** to initialize and configure the second controller/compute node.

Initializing Controller-0 from a Local Device

You can initialize **controller-0** from a USB port, DVD, or other local device using the Titanium Server bootable ISO image.

Prerequisites

Before installing the software on the first controller, ensure the following:

- The host meets the hardware requirements for a controller.
- You have terminal-server access to the host, so that you can monitor messages during initialization.
- The management, OAM, and data networks are planned, set up, and connected.

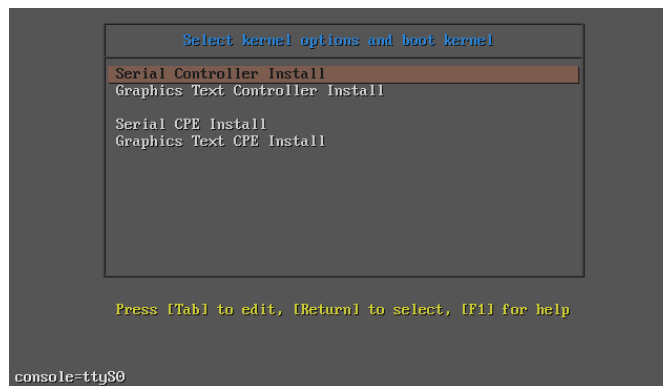
- All other hosts on the system are powered off.
- You have reviewed the Release Notes for any additional information pertaining to installation.

Procedure

1. Power on the host to be configured as **controller-0**.
2. Configure the host BIOS boot sequence to boot from a USB removable storage device.
3. Insert the USB flash drive and boot the host.

The installer is loaded, and the installer welcome screen appears.

Figure 1: Titanium Server Installer Welcome Screen



4. Select the type of installation and the display device to be used during initialization, and then press **Enter**.

To install Titanium Server CPE, select from the second group.

Serial Controller Install (default)

Installs the controller function on the host, using the serial port to display messages. You can monitor the port using the terminal server.

Graphics Text Controller Install

Installs the controller function on the host, using text mode to display messages. This is a safe option for nodes that do not support graphics mode.

Serial CPE Install (default)

Installs controller and compute functions on the host, using the serial port to display messages. You can monitor the port using the terminal server.

Graphics Text CPE Install

Installs controller and compute functions on the host, using text mode to display messages. This is a safe option for nodes that do not support graphics mode.



NOTE: The default rootfs device is **/dev/sda**. You can optionally change this (or other parameters) by selecting the installation mode, pressing the **Tab** key, modifying the command that appears, and then pressing **Enter**. A sample command is shown here; the actual parameters vary depending on the system configuration.

```
vmlinux rootwait console=ttyS0, 115200 root=LABEL=oe_iso_boot \
ngpt textinst serial ks=/mnt/install/source/ks.cfg boot_device=sda \
rootfs_device=sda initrd=initrd
```

5. Monitor the initialization until it is complete.

The installer initializes the target hard drive with the Titanium Server image. When initialization is complete, a reboot is initiated on the host.

6. Immediately remove the USB flash drive from the host to ensure that the host reboots from the hard drive.



CAUTION: If the USB flash drive is still attached when the host reboots, then unless the boot sequence has been configured to prevent it, the host will boot from the USB flash drive again instead of the hard drive.

After a few minutes, the host reboots from the hard drive, briefly displays a GNU GRUB screen, and then boots automatically into the Titanium Server image.

7. Log into the host as **wrsroot**, with password **wrsroot**.



NOTE: Typed responses to password prompts are suppressed and do not appear on the display.

The first time you log in as **wrsroot**, you are required to change your password.

```
Changing password for wrsroot.
(current) UNIX Password:
```

Enter the current password (**wrsroot**).

```
New password:
```

Enter a new password for the **wrsroot** account.

```
Retype new password:
```

Enter the new password again to confirm it.

The host is now ready for configuration as **controller-0**.

Copying the License and Optional Files to Controller-0

To configure **controller-0** for use, a license file and other optional files are required. You must copy these files to the host over the OAM network.

Procedure

1. Connect the controller to the OAM network.

```
$ sudo ip addr add OAM_IP_address/mask dev port
$ sudo ip link set port up
$ sudo ip route add default via gateway_addr
```



NOTE: To identify the controller-0 port and IP address, refer to your OAM network plan.

For example:

```
$ sudo ip addr add 10.10.10.3/24 dev eth0
$ sudo ip link set eth0 up
$ sudo ip route add default via 10.10.10.1
```

2. Plug a USB flash drive with content relevant to the software installation.

You may want to use a USB flash drive instead, or in addition to the connection to the OAM network, in order to retrieve needed files.

- a) Plug in the USB flash drive to one of the available USB ports on the controller.
- b) Determine the USB mount point.

The controller automounts the USB flash drive if it is properly formatted. Use the following command to determine the mount point in the file system:

```
$ mount | grep /media
/dev/sdc on /media/sdc type iso9660 (ro,relatime)
```

In this example the USB drive is mounted on **/media/sdc**. The path may be different on your controller.

3. Copy the license file to the controller node.
 - a) Connect a server containing the license file to the OAM network.
 - b) Copy the Titanium Server license file to **/home/wrsroot/license.lic** on the controller.

This is the default path offered during controller configuration. If you prefer, you can copy the file to a different path, and specify the path during configuration.

```
$ scp username@sourcehost:sourcepath/license.lic /home/wrsroot
```

Use the following command, adjusting the media mount point as needed, if you are using a USB flash drive instead:

```
$ cp /media/sdc/license.lic /home/wrsroot
```

4. Optional: Copy a digital certificate file to the controller node.

If you require secure REST API access using HTTPS, copy a CA-signed digital certificate (PEM file) to a directory on the controller. The recommended path is **/home/wrsroot**.

```
$ scp username@sourcehost:sourcepath/pem_file /home/wrsroot
```

Use the following command, adjusting the media mount point as needed, if you are using a USB flash drive instead:

```
$ cp sourcepath/pem_file /home/wrsroot
```

Applying Patches at Titanium Server Installation

To ensure that the Titanium Server software is fully up to date, apply any patches immediately after installing the software.

Patches are located on WindShare (<https://windshare.windriver.com/>) under **Products > Titanium Server 2 > Browse Titanium Server Downloads > Patches** and are labeled ***.patch**.

For more information about obtaining and using patches, refer to the *Titanium Server Patching and Upgrading Platform Software Guide: Managing Software Patches*.

Procedure

1. Copy the patches from a connected server.

```
$ scp username@sourcehost:sourcepath/patchfile /home/wrsroot
```

Use the following command, adjusting the media mount point as needed, if you are using a USB flash drive instead:

```
$ cp /media/sdc/patchfile /home/wrsroot
```

2. Upload the patches to the patch storage area.

```
$ sudo sw-patch upload ./patchfile
```

3. Apply the patches.

```
$ sudo sw-patch apply --all
```

4. Install the patches locally.

```
$ sudo sw-patch install-local
```

This command applies and installs all applied patches on **controller-0**.



NOTE: You must reboot the controller to ensure that it is running with the software fully patched.

5. Execute the following command to reboot **controller-0**.

```
$ sudo shutdown -r now
```

Patch installation is complete.

Applying the Controller Configuration

You can configure **controller-0** by running a script from the Linux command line.

You can perform the configuration interactively, as described in this section, or you can use a prepared configuration file.

The compute function on **controller-0** must be configured before the **controller-1** configuration is started.

Prerequisites

Before running the configuration script:

- Ensure that **controller-0** has been initialized. For more information, see [Initializing Controller-0 from a Local Device](#) on page 6.
- Ensure that the management interface is connected and operational.
- Ensure that the data interfaces are connected and operational.
- Copy the license file and other optional files to **controller-0**.
- Install system software patches if there are any available from Wind River.
- Prepare a configuration plan to use as a reference. For more information, see *Titanium Server Planning: Storage Planning*.

Procedure

1. Start the controller configuration script.

```
$ sudo config_controller
Titanium Server Configuration
=====
Enter Q at any prompt to abort...
```

You can optionally supply the name of a configuration file as a parameter.

2. Configure the controller options as requested by the configuration script.

If you are using a configuration file, this step is not applicable.

For information about the options, see [The Controller Configuration Script](#) on page 13.



NOTE: The configuration is applied only after all options have been specified. You can safely abort the configuration process at any time by pressing the **Q** key.

After a few minutes, the message **Configuration was applied** appears.

3. Change to the Keystone **admin** account.

Use the **source** command to become the Keystone **admin** user.

```
$ source /etc/nova/openrc
~(keystone_admin)$
```

4. Verify that the Titanium Server controller services are running.

```
~(keystone_admin)$ nova service-list
+-----+-----+-----+-----+-----+ ...
| Binary | Host | Zone | Status | State | ...
+-----+-----+-----+-----+-----+ ...
| nova-conductor | controller-0 | int... | enabled | up | ...
| nova-cert | controller-0 | int... | enabled | up | ...
| nova-consoleauth | controller-0 | int... | enabled | up | ...
| nova-scheduler | controller-0 | int... | enabled | up | ...
+-----+-----+-----+-----+-----+ ...
```



NOTE: For a Titanium Server CPE configuration, the **nova-compute** service is also listed.

5. Verify that the controller and compute subfunctions are present.

```
~(keystone_admin)$ system host-show 1 | grep subfunctions
| personality | controller,compute
```

6. Verify that **controller-0** is in the state **unlocked-enabled-available**.

```
~(keystone_admin)$ system host-list
+-----+-----+-----+-----+-----+-----+
| id | hostname | personality | administrative | operational | availability |
+-----+-----+-----+-----+-----+-----+
| 1 | controller-0 | controller | unlocked | enabled | available |
+-----+-----+-----+-----+-----+-----+
```

7. Optional: Synchronize the RAID array.

Normally, the RAID array is already synchronized. If you need to synchronize the RAID array manually, do so now. You may be able to do this by pressing a button on the unit, or using a special key combination on the console keyboard. For details, consult the OEM documentation for the RAID.

The host **controller-0** is now installed. It must be provisioned with network interfaces and storage resources.

Postrequisites

The `config_controller` file is no longer required. For improved security, delete it.

After running **config_controller**, you must obtain the ssh fingerprint of the server in order to verify its identity when connecting via ssh. For more information, see *Titanium Server System Administration: Verifying the Controller Identity for Secure SSH Access*.

The Controller Configuration Script

The `config_controller` script presents a series of prompts for initial configuration of the Titanium Server system.

The script is used to configure the first controller in the Titanium Server cluster as **controller-0**. The prompts are grouped by configuration area. Details for each area are described in the following tables. Review them carefully before committing configuration changes to the controller. For configuration planning information, see the *Titanium Server System Engineering Guidelines*.



NOTE: In many cases, you can accept the default values. Prompts requiring special attention are marked with an asterisk (*).

The configuration is applied only after all options have been specified. You can safely abort the configuration process at any time by pressing the **Q** key.



NOTE: As an alternative to interacting with the script, you can prepare and use a controller configuration input file. For more information, see [Using a Controller Configuration Input File](#) on page 58.

Prompt	Comment
System date and time:	
Is the current date and time correct? [y/n]:	Confirmation for the system date and time. The controller periodically synchronizes the local system date and time with reference time servers configured later in the script. If the local time is not within about 15 minutes of the reference UTC time, the controller does not make the synchronization.
Enter new system date and time (UTC) in YYYY-MM-DD HH:MM:SS format:	The date and time to apply locally, if the current system setting needs updating. incorrect.
Storage:	
Cinder storage backend [lvm]*:	The storage resource type for VMs and VM data.
	<hr/> CAUTION: The Cinder storage type cannot be changed after the system is installed. <hr/>

Prompt	Comment
	<ul style="list-style-type: none"> For a system with storage nodes, type ceph. For a system without storage nodes, type lvm. (This uses shares on the controller secondary disk).
	<p>lvm</p> <p>Provides a small-scale storage solution using LVM/iSCSI shares on the controller node. Note that this option does not use or support storage nodes in the Titanium Server cluster.</p>
	<p>ceph</p> <p>Provides a large-scale storage solution using a Ceph storage system. This option uses dedicated storage nodes in the Titanium Server cluster.</p>
	<hr/> <p>NOTE: For Ceph storage, an infrastructure network is required.</p> <hr/>
	<p>After the system is installed, you can selectively implement local compute node storage for VM data. For more information, see <i>Titanium Server System Administration: Storage on Compute Hosts</i>.</p>
Database storage in GiB [20]*:	<p>The storage allotment for the OpenStack database. As a reference point, a system with six hosts, 40 VMs and 120 tenant networks requires about 9 GiB. For more details, see the <i>Titanium Server System Engineering Guidelines</i>.</p>
Image storage in GiB [19]*:	<p>(For LVM storage only) The size of the partition to use for image storage. Consider the expected number of images and their storage requirements. A minimum of 10 GiB is recommended. The prompt shows the current available disk space.</p>
Image conversion space in GiB [8]*:	<p>The size of the partition to use for image caching and temporary image conversions.</p>
Backup storage in GiB [20]*:	<p>The storage allotment for backup operations. For details, see the <i>Titanium Server System Engineering Guidelines</i>.</p>

Prompt	Comment
Volume storage location [0]:	<p>(For LVM storage only) The disk to use for a storage volume on controller-0. A numbered list of available disks is displayed. Type the number for the disk you want to assign. Note that the primary disk is not included in this list.</p> <hr/> <p>NOTE: The disk to use on controller-1 is assigned independently during controller-1 setup</p> <hr/>
Volume storage in GiB [500]:	<p>(For LVM storage only) The storage allotment for all volumes used by the guest instances. The prompt shows the current available disk space.</p>
Configure LVM Provisioning type: thick or thin	
Cinder LVM Type [thin]:	<p>The method for provisioning Cinder volumes.</p> <p>thin</p> <p>Use a dynamically sized volume. This offers support for secure deletion, but slower volume creation. You can improve volume creation times by using SSDs for the underlying physical disks.</p> <p>thick</p> <p>Use a fixed-size volume. This offers faster volume creation than thin provisioning. Secure deletion is not supported.</p> <hr/> <p>CAUTION: This selection cannot be changed after installation.</p> <hr/>
Enable SDN Network configuration [y/N]:	<p>An option to use software defined networking as the Neutron network backend instead of locally managed traditional networking. For support details, see the <i>Titanium Server Release Notes</i>. For additional documentation, see the <i>Titanium Server Software Defined Networking</i> guide.</p> <p>If SDN is enabled, then an SDN controller connection must be defined before you can unlock compute nodes.</p>

Prompt	Comment
	CAUTION: This selection cannot be changed after installation.
PXEBoot Network:	
Configure a separate PXEBoot network [y/N]:	An option to configure a dedicated subnet for PXE booting over the internal management interface. This is for use where the internal network is VLAN-tagged. This is required when using IPv6 addressing on the management network.
PXEBoot subnet [192.168.202.0/24]:	The subnet to use for the PXE boot network.
Management Network:	
Management interface link aggregation [y/N]*:	<p>An option to use LAG for the internal management network. If using LAG, you are asked for the name of the bonding interface, the bonding policy, and the name of an additional physical interface.</p> <p>If using LAG, you are asked for the name of the bonding interface to be created, the name of an additional physical interface to use for bonding, and the link aggregation mode to use. For more information, see Link Aggregation Settings on page 90.</p>
Management Interface [enp0s8]:	<p>The controller interface used for the internal management network.</p> <p>The name of the physical interface to use to connect to the internal management network in non-LAG mode.</p>
Management Interface MTU [1500]:	The maximum transmission unit for the internal management network. The default value is 1500.
Management Interface link capacity Mbps [1000]:	The bandwidth supported by the interface hardware. This is used to calculate the DRBD sync rate. The default is 10000 Mbps; adjust this setting if using hardware with a different link capacity.

Prompt	Comment
	<hr/> <p>NOTE: If an infrastructure network is present, the DRBD sync rate is calculated based on the infrastructure interface link capacity, configured later in the script.</p> <hr/>
Management VLAN Identifier []:	(For PXE boot network only) The VLAN ID for the internal management network. This is required if a PXE boot network has been configured.
Management subnet [192.168.204.0/24]:	The subnet to use for the internal management network. The network does not need to be publicly routed, and therefore can be allocated from a private address range.
Use entire management subnet [Y/n]:	An option to reserve all or part of the management subnet for allocation by Titanium Server. By default, the entire subnet is available.
Management network start address [192.168.204.2]:	(shown only if Use entire management subnet is set to n) The start of the internal management IP address range owned by Titanium Server.
Management network end address [192.168.204.254]:	(shown only if Use entire management subnet is set to n) The end of the internal management IP address range owned by Titanium Server.
Dynamic IP address allocation [Y/n]:	<p>An option to use dynamic or static IP addressing on the management and infrastructure networks. By default, dynamic addressing is used. If static assignment is used, new hosts are <i>not</i> automatically added to the inventory when they are powered on. You must use the system host-add command to add them, and to assign IP addresses manually.</p> <hr/> <p>NOTE: The infrastructure network is automatically assigned the same type of address assignment as the internal management network.</p> <hr/>

Prompt	Comment
Management Network Multicast subnet (239.1.1.0/28):	<p>The range of addresses that the system can use for multicast messaging on the management network. You can use this to prevent multicast leaks in multi-region environments. Addresses for the affected services are allocated automatically from the range.</p> <hr/> <p>NOTE: This value is also used for the range of addresses the system can use on the infrastructure network.</p> <hr/>
Board Management Control Network:	
Configure board management control network [y/N]:*	<p>An option to use an internal baseboard management network for hosts equipped with iLO3, iLO4 or Quanta modules.</p> <p>Select whether to configure an internal baseboard management network. This option is for use with hosts equipped with iLO (Integrated Lights-Out) modules.</p> <hr/> <p>NOTE: To use an external baseboard management network (accessible from the OAM network), type N. For more information, see <i>Titanium Server Planning: The Board Management Network</i></p> <hr/>
Board management control VLAN Identifier []:*	<p>The VLAN ID designated for the board management control network.</p> <p>The VLAN number designated for board management control traffic on the internal management network. For more information, see <i>Titanium Server Planning: Shared (VLAN) Ethernet Interfaces</i>.</p>
Board management control interface MTU [1496]:	<p>The maximum transmission unit for the board management control network. This must be at least 4 bytes less than the internal management network MTU. If the internal management network MTU is greater than 1504, then the board management control MTU default value is 1500. Otherwise, the default value is 1496.</p>

Prompt	Comment
Board management control subnet [192.168.203.0/24]:	The subnet to use for the board management control network. You can safely accept the default value assigned to this internal network. The suggested value belongs to the 16-bit block of private networks specified in RFC 1918. Use the suggested value, or any other 16-bit private address block.
Infrastructure Network:	
Configure an infrastructure interface [y/N]:*	<p>An option to use an infrastructure network. Select whether to configure an Ethernet interface for access to an infrastructure network.</p> <p>For a system using Ceph storage, an infrastructure network is required.</p> <hr/> <p>CAUTION: This choice cannot be changed after the system is installed.</p> <hr/>
Infrastructure interface link aggregation [y/N]:*	<p>An option to use LAG for the infrastructure network. If using LAG, you are asked for the name of the bonding interface, the bonding policy, and the name of an additional physical interface..</p> <p>If using LAG, you are asked for the name of the bonding interface to be created, the name of an additional physical interface to use for bonding, and the link aggregation mode to use. For more information, see Link Aggregation Settings on page 90.</p>
Infrastructure interface []:*	<p>The controller interface used for the infrastructure network. You can optionally share the interface assigned for the management or OAM network.</p> <p>The name of the physical interface to use to connect to the infrastructure network in non-LAG mode. You can use a dedicated interface, or share the interface used for the management or OAM network. For a shared interface, a VLAN ID is required.</p>
Configure an infrastructure VLAN [y/N]:	An option to implement this network on the selected interface using VLAN tagging. If the same interface has already been selected for an untagged network, you must answer 'y' or abort the configuration.

Prompt	Comment
Infrastructure VLAN identifier []:	The VLAN ID, if VLAN tagging is used.
Infrastructure interface MTU [1500]:	The maximum transmission unit for the infrastructure network. The default value is 1500.
Infrastructure interface link capacity Mbps [10000]:	The bandwidth supported by the interface hardware. This is used to calculate the DRBD sync rate. The default is 10000 Mbps; adjust this setting if using hardware with a different link capacity.
Infrastructure subnet [192.168.205.0/24]:	The subnet to use for the infrastructure network. The network does not need to be publicly routed, and therefore can be allocated from a private address range.
Use entire infrastructure subnet [Y/n]:	An option to reserve all or part of the infrastructure subnet for allocation by Titanium Server. By default, the entire subnet is available.
Infrastructure network start address [192.168.205.2]:	The start of the infrastructure IP address range owned by Titanium Server.
Infrastructure network end address [192.168.205.254]:	The end of the infrastructure IP address range owned by Titanium Server.
External OAM Network:	
External OAM interface Link aggregation [y/N]:*	<p>An option to use LAG for the external OAM network. If using LAG, you are asked for the name of the bonding interface, the names of two physical interfaces to use, and the bonding policy.</p> <p>If using LAG, you are asked for the name of the bonding interface to be created, the name of an additional physical interface to use for bonding, and the link aggregation mode to use. For more information, see Link Aggregation Settings on page 90.</p>
External OAM interface [enp0s3]:*	<p>The controller interface used for the external OAM network. You can optionally share the interface assigned for the management or infrastructure network.</p> <p>The name of the physical interface to use to connect to the OAM network in non-LAG mode. You can use a dedicated interface, or share the interface used for the management or infrastructure network. For a shared interface, a VLAN ID is required.</p>

Prompt	Comment
Configure an external OAM VLAN [y/N]:	An option to implement this network on the selected interface using VLAN tagging. If the same interface has already been selected for an untagged network, you must answer 'y' or abort the configuration.
External OAM VLAN identifier []:	The VLAN ID, if VLAN tagging is used.
External OAM interface MTU [1500]:	The maximum transmission unit for the OAM network. The default value is 1500.
External OAM subnet [10.10.10.0/24]:*	The subnet to use for the OAM network. You must provide a value for this external network, in accordance with your OAM network addressing plan. Note that the default value provided by the script is probably not appropriate. Provide a valid subnet value as per your OAM Network's IP address plan.
External OAM gateway address [10.10.10.1]:*	The IP address for the OAM subnet's default gateway. You must provide a value in accordance with your OAM network address plan.
External OAM floating address [10.10.10.2]*	The floating IP address for the OAM network. This is the address used to access the web administration interface or the controller console. You must provide a value in accordance with your OAM network address plan.
External OAM address for first controller node [10.10.10.3]:*	<p>The IP address for the first controller on the OAM network. You must provide a value in accordance with your OAM network address plan.</p> <p>The IP address to be assigned to the first controller on the OAM network. You must provide a value in accordance with your OAM network address plan.</p>
External OAM address for second controller node [10.10.10.4]:*	<p>The IP address for the second controller on the OAM network. You must provide a value in accordance with your OAM network address plan.</p> <p>The IP address to be assigned to the second controller on the OAM network. You must provide a value in accordance with your OAM network address plan.</p>
External OAM Network Multicast subnet (239.1.1.0/28):	The range of addresses that the system can use for multicast messaging on the OAM

Prompt	Comment
	network. You can use this to prevent multicast leaks in multi-region environments.
Domain Name System (DNS):	
Nameserver 1 [8.8.8.8]:	The IP addresses of up to three DNS servers. The default values are addresses of public DNS servers available from Google. To continue without configuring DNS servers, press the C key.
Nameserver 2 [8.8.4.4]:	
Nameserver 3 []:	
Network Time Protocol (NTP):	
NTP server 1 [0.pool.ntp.org]:	The IP addresses of up to three NTP servers used to synchronize the Titanium Server cluster. The default values are addresses of public NTP servers available from the NTP Pool Project .
NTP server 2 [1.pool.ntp.org]:	
NTP server 3 [2.pool.ntp.org]:	
	The use of an NTP server is recommended. If no NTP server is available, the controller clock is used to synchronize the cluster. If necessary, you can continue without configuring NTP servers by pressing the C key.
	<hr/> NOTE: To resynchronize individual hosts to an NTP server if necessary, see <i>Titanium Server System Administration: Resynchronizing a Host to the NTP Server</i> . <hr/>
Licensing:	
License File [/home/wrsroot/license.lic]:	The path to a valid Titanium Server license file. The file name may differ from the default.
Security:	
Enter wrsroot password age (in days) [45]:	The number of days before the wrsroot password expires.
Use secure (https) external connection [y/N]:	An option to enable secure access for external REST APIs and the web server.
Install custom firewall rules [y/N]:	An option to change the firewall rules for the OAM network. The default rules included with Titanium Server are recommended for most applications. If

Prompt	Comment
	required, you can override or augment them. For more information, see the <i>Titanium Server System Administration: Firewall Options</i> .
Firewall rules file:	The path to a file that defines custom firewall rules for the OAM network.
Use WRS provided self-signed certificate [y/N]:	An option to use a self-signed certificate included with Titanium Server for secure REST API and web server access. This certificate is provided for evaluation purposes, and is not recommended for deployed systems.
	CAUTION: For the current release, the certificate selected during controller configuration cannot be updated after installation.
CA-Signed Certificate and Key file:	The full path to a PEM file containing a certificate (signed by a Certificate Authority) and a Private Key (optionally password-protected) for secure REST API and web server access; for example, <code>/home/wrsroot/pp-combo.pem</code> .
Password for the CA-Signed certificate file [Enter <CR> for no password]:	The password for the CA-signed certificate, if a password-protected private key is used.
Authentication:	
Create admin user password:	The password for the cloud admin user. This account is used to log into the web administration interface.
Repeat admin user password:	Password confirmation.

Configuring Provider Networks at Installation

You must set up provider networks at installation so that you can attach data interfaces and unlock the second controller/compute node.

Procedure

1. Open the Titanium Server Web administration interface.

Using a browser, navigate to the OAM floating IP address, and log in as **admin**.

2. In the left-hand pane, select **Admin > Platform > Provider Networks**.

The Provider Networks list is displayed.

Provider Networks						
				Filter		Create Provider Network
Network Name	Status	Type	MTU	Segmentation Ranges	VLAN Transparent	Actions
No items to display.						

3. Create a provider network.

Click **Create Provider Network**.

In the Create Provider Network window, complete the fields as required.

Name

The name of the provider network.

Description

A free-text field for reference.

Type

The type of provider network to be created.

flat

mapped directly to the physical network

vlan

supports multiple tenant networks using VLAN IDs.

vxlan

supports multiple tenant networks using VXLAN VNIs.

MTU

The maximum transmission unit for the Ethernet segment used to access the network.

VLAN Transparent

Allow VLAN tagged packets to be encapsulated within a VXLAN segment without removing or modifying the guest VLAN tag.

Create Provider Network

Name *

Description

Type *

Select a network type

MTU *

1500

☐ VLAN Transparent

Description:

You can create a provider network and later segment this network for access by one or more tenant networks.

Cancel Create Provider Network

4. Commit the changes.

Click **Create Provider Network**.

The new provider network is added to the Provider Networks list.

Configuring Provider Networks Using the CLI

You can set up provider networks over physical networks using the **controller-0** command-line interface. The provider networks provide connectivity for tenant networks.

You must configure at least one provider network in order to assign data interfaces to compute nodes and unlock the hosts.

Prerequisites

Controller-0 must be installed and configured.

To create a provider network using the CLI, use the following command:

```
~(keystone_admin)$ neutron providernet-create name \  
--type=type --description=description mtu mtu_size \  
--vlan-transparent={True,False}
```

where

name

is a name for the provider network

type

is the type of provider network (**flat**, **vlan**, or **vxlan**)

description

is a brief description for reference purposes

mtu_size

is the maximum transmission unit size

For example, to add a VLAN provider network named providernet-a:

```
~(keystone_admin)$ neutron providernet-create providernet-a --type=vlan
Created a new providernet:
+-----+-----+
| Field          | Value                                     |
+-----+-----+
| description    |                                           |
| id             | a5938194-a296-4d92-af5f-c3a064b56f7f   |
| mtu            | 1500                                     |
| name           | providernet-a                           |
| ranges         |                                           |
| status         | DOWN                                    |
| type           | vlan                                     |
| vlan_transparent | False                                  |
+-----+-----+
```

You can obtain information about provider networks and segmentation ranges using the following commands.

```
~(keystone_admin)$ neutron net-list-on-providernet providernet
```

```
~(keystone_admin)$ neutron providernet-range-show providernet-range
```

Provisioning Controller-0

On a Titanium Server CPE system, you must provision data interfaces and local storage resources for the compute function.

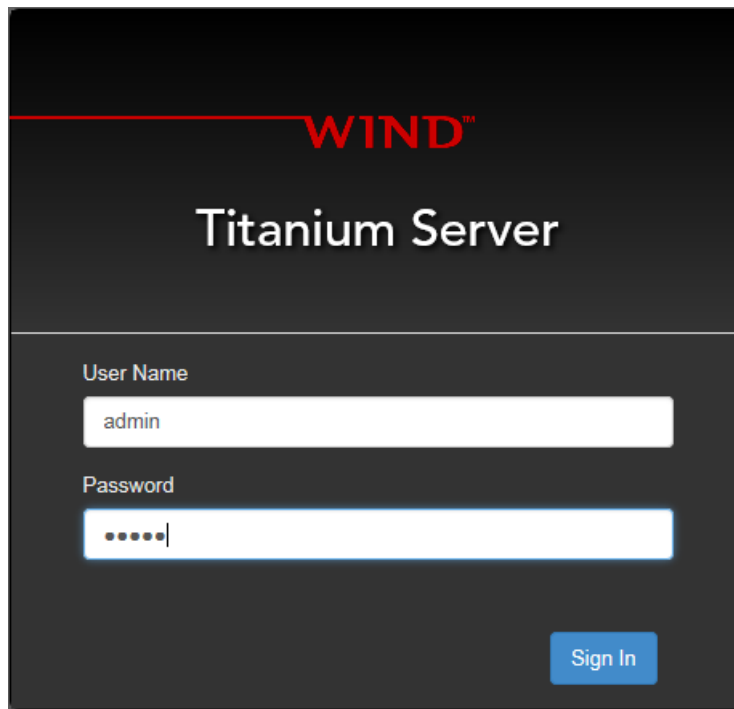
Procedure

1. Using a Web browser, navigate to the OAM floating IP address to verify that the Titanium Server web administration interface is available.

To identify the OAM floating IP address, consult your configuration plan.

The Wind River Titanium Server login screen appears.

Figure 2: Wind River Titanium Server login screen

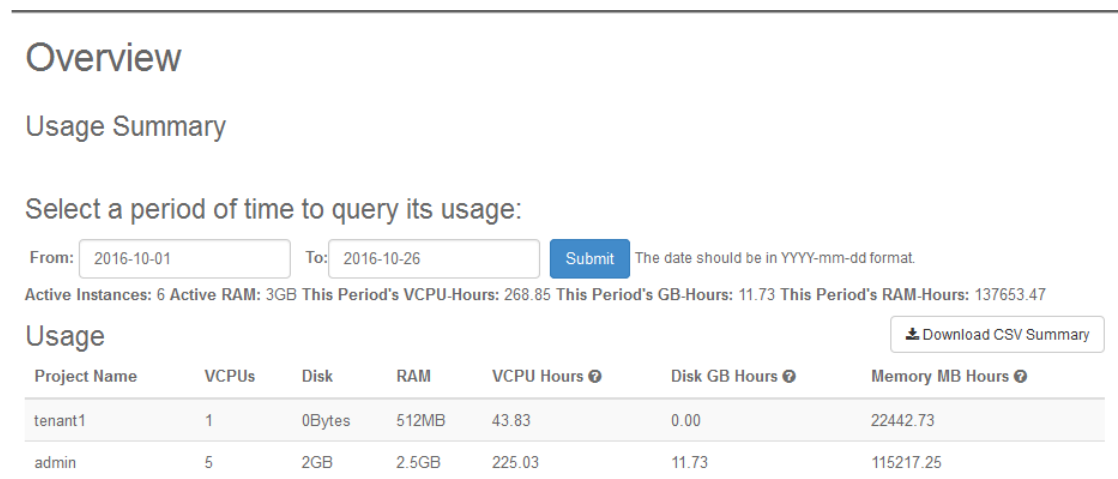


The login screen features the Wind River logo at the top, followed by the text 'Titanium Server'. Below this, there are two input fields: 'User Name' with the value 'admin' and 'Password' with masked characters. A 'Sign In' button is located at the bottom right.

2. Log in using the cloud **admin** account.

The Wind River Titanium Server web administration interface appears.

Figure 3: Wind River Titanium Server web administration interface



The interface shows an 'Overview' section with a 'Usage Summary' card. The card includes a date range selector (From: 2016-10-01, To: 2016-10-26) and a 'Submit' button. Below the selector, it displays usage statistics: Active Instances: 6, Active RAM: 3GB, This Period's VCPU-Hours: 268.85, This Period's GB-Hours: 11.73, and This Period's RAM-Hours: 137653.47. A 'Download CSV Summary' button is also present. Below the summary is a table titled 'Usage' with columns for Project Name, VCPUs, Disk, RAM, VCPU Hours, Disk GB Hours, and Memory MB Hours. The table contains two rows: 'tenant1' and 'admin'.

Project Name	VCPUs	Disk	RAM	VCPU Hours	Disk GB Hours	Memory MB Hours
tenant1	1	0Bytes	512MB	43.83	0.00	22442.73
admin	5	2GB	2.5GB	225.03	11.73	115217.25

3. In the left-hand pane, select **Admin > Platform > Host Inventory**, and then select the **Hosts** tab.

Controller-0 is reported in the hosts inventory list.

Hosts	Cpu Profiles	Interface Profiles	Storage Profiles	Memory Profiles	Device Usage
-------	--------------	--------------------	------------------	-----------------	--------------

Controller: 1 Degraded: 0 Failed: 0

Controller Hosts

Host Name	Personality	Admin State	Operational State	Availability State	Uptime	Status	Actions
controller-0	Controller-Active	Unlocked	Enabled	Available	18 hours, 51 minutes		Edit Host ▾

Displaying 1 item



NOTE: For a Titanium Server CPE configuration, the **Status** shows "Compute config required."

4. Configure the data interfaces on **controller-0**.

For the compute function to be configured, the data interfaces must be attached to provider networks.

a) Create the required provider networks.

For detailed instructions, see [Configuring Provider Networks at Installation](#) on page 23.

b) Using the CLI, attach the data interfaces to the provider networks.

The Titanium Server CPE configuration allows you to define data interfaces on the unlocked **controller-0** from the CLI during initial setup. (You cannot do this from the web administration interface.)

For details, see [Network Interface Provisioning Using the CLI](#) on page 74.

For example, to attach an ethernet interface named **eth3** to a data network configured with provider network **providernet-a**:

```
~(keystone_admin)$ system host-if-modify -n eth3 -nt data controller-0 eth3 -p providernet-a
```

5. Add a local volume group to provide local storage for the compute function.

a) In the Hosts lists, click the host name (**controller-0**).

The Inventory Detail page for the host appears.

b) Click the **Storage** tab.

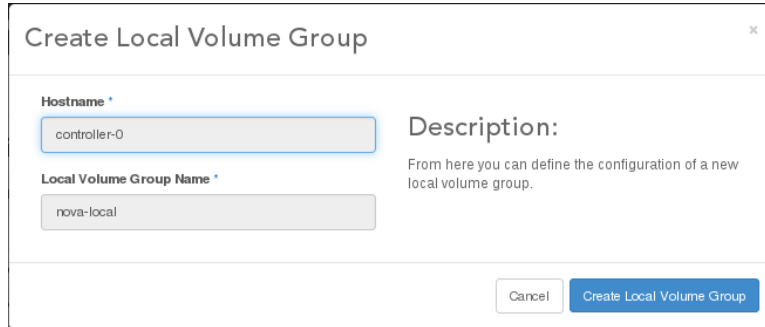
c) On the Storage page, add a **nova-local** Volume Group.

Click **Add Local Volume Group**.

Local Volume Groups							+ Add Local Volume Group
Name	State	Access	Size	Current Physical Volumes	Current Logical Volumes	Actions	
cgts-vg	provisioned	wz--n-	42.4 GB	1	7		
cinder-volumes	provisioned	wz--n-	9.0 GB	1	2		

Displaying 2 items

The Create Local Volume Group dialog box appears, set by default to add a **nova-local** group.



Create Local Volume Group

Hostname *
controller-0

Local Volume Group Name *
nova-local

Description:
From here you can define the configuration of a new local volume group.

Cancel Create Local Volume Group

Click **Create Local Volume Group**.

The **nova-local** group is added to the **Local Volume Groups** list.

6. Assign a physical volume for the local volume group.

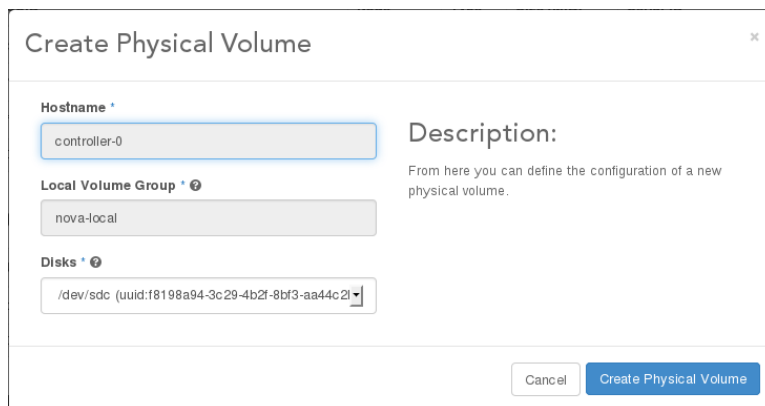
a) Click **Add Physical Volume**.

Physical Volumes

+ Add Physical Volume

Name	State	Type	Disk UUID	Disk Device Node	LVM Volume Group Name	Actions
/dev/drbd4	provisioned	partition	c8ee57e9-baab-4fac-be80-c2ee9f542804	/dev/sdb	cinder-volumes	
/dev/sda5	provisioned	partition	c283fc10-04de-4968-abea-65becd11ac2a	/dev/sda	cgfs-vg	

Displaying 2 items



Create Physical Volume

Hostname *
controller-0

Local Volume Group * ?
nova-local

Disks * ?
/dev/sdc (uuid:f8198a94-3c29-4b2f-8bf3-aa44c2l)

Description:
From here you can define the configuration of a new physical volume.

Cancel Create Physical Volume

The Create Physical Volume dialog box appears, with the **Local Volume Group** automatically set to **nova-local**.

b) Using the **Disks** drop-down menu, select a non-root disk to provide storage.

You can add any number of non-root disks to the **nova-local** group, limited only by the number of disks available.



CAUTION: Always use non-root disks for **nova-local** storage. Use of the root disk for this purpose is not a supported configuration.

c) Click **Create Physical Volume**.

The disk assignment is added to the **Physical Volumes** list.

7. Allocate resources on the physical volume for the local volume group.

a) In the **Local Volume Groups** list, click **nova-local** to open the Local Volume Group Detail page.

Overview

Parameters

nova-local

Info

UUID

bb204b7a-d897-4f17-8497-6a3cebf124d2

State

adding

Access

None

Size

0 bytes

Max Local Volumes

0

Current Local Volumes

0

Max Physical Volumes

0

Current Physical Volumes

0

Volume Group Total Physical Extents

0

Volume Group Free Physical Extents

0

Created At

2016-10-14T17:57:37.177110+00:00

Updated At

None

b) Select the **Parameters** tab.

Overview

Parameters

Name	Key	Value	Actions
Concurrent Disk Operations	concurrent_disk_operations	2	<div>Edit</div>
Instance Backing	instance_backing	image	<div>Edit</div>

Displaying 2 Items

c) Select the **Instance Backing** type.
Click **Edit** for the **Instance Backing** setting.

Edit Local Volume Group Parameter

Local Volume Group: nova-local

Parameters

Instance Backing

Local CoW Image backed

Description :

Update a parameter key-value pair for a Local Volume Group.

Cancel

Save

LVM backed

Local storage for instances is provided using LVM RAW disks to optimize run-time I/O performance.

CoW Image backed

Local storage for instances is provided using copy-on-write (CoW) image files to optimize launch and delete performance. This is the default.

For more information about the **Instance Backing** type, see *Titanium Server System Administration:Storage on Compute Hosts*.

After making your selection, click **Save** to return to the Parameters tab.

The Parameters list is updated to show the corresponding value (**lvm** or **image**).

If the **Instance Backing** parameter is set to **image**, the **Instances LV Size** parameter is no longer shown.

- d) If you are using LVM-backed storage, specify the **Instances LV Size**.



NOTE: The **Instances LV Size** parameter is available only if the **Instance Backing** is set to **lvm**.

Click **Edit**, and then set the **Instances Logical Volume Size**.

If the total space in the volume group is less than 80GB (81920 MiB), then you must allocate at least 2048 MiB. If it is greater or equal than 80GB (81920 MiB), then you must allocate at least 5120 MiB. The actual size is limited to ensure at least 50% free space in the volume group for creating disks for launched instances. The dialog box provides an acceptable parameter range for convenience.

For more information, see *Titanium Server System Administration:Storage on Compute Hosts*.

8. Apply the compute-function interface and storage configuration.

At the command prompt, type the following command:

```
~(keystone_admin)$ system compute-config-complete
```

The configuration is applied and the host is rebooted.



NOTE: The web administration interface connection is lost, and must be refreshed after the host has rebooted.

9. If you used a configuration file with the script, delete the file from the rebooted host.



CAUTION: The configuration file contains clear-text authentication data. For improved security, delete this file from the system after use.

The host **controller-0** is now fully operational.



NOTE: You can verify that the **nova-compute** service is running on the controller by using the **nova service-list** command.

3

Controller-1 Installation and Provisioning

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Methods for Adding and Configuring Hosts

Titanium Server supports more than one way of adding and configuring hosts.

After initializing and configuring an active controller, you can add and configure a backup controller and additional compute or storage hosts as follows:

- Using the web administration interface (Horizon).
With this method, you power on a new host, causing it to be auto-discovered and added to the system inventory, and then you use the Host Inventory in the web administration interface to assign a personality. For detailed instructions, see [Installing Software on Controller-1](#) on page 34.
- Using the **system host-update** command.
With this method, you power on a new host, causing it to be auto-discovered and added to the system inventory, and then you use **system host-update** to assign a personality. For detailed instructions, see [Installing Software on Controller-1 Using the CLI](#) on page 39.
- Using the **system host-add** command.
With this method, you add one or more host entries to the system inventory, assigning a personality, MAC address, IP address, and so on for each host, and then you power on the

hosts, causing them to be recognized and configured according to the system inventory entry. For more information, see [Adding Hosts Using the host-add Command](#) on page 63.

- Using the **system host-bulk-add** command

With this method, you define multiple hosts in an XML manifest, specifying personality, MAC address, IP address, and so on for each host, and then you use **system host-bulk-add** to add them to the system inventory and optionally power them on. For more information, see [Adding Hosts in Bulk](#) on page 65.

Installing Software on Controller-1

You must use **controller-0** to install software on other hosts.

For a CPE system, the only additional host used is **controller-1**.

Prerequisites

Before initializing a node, ensure that the following conditions are satisfied:

- The node must meet the hardware requirements for the personality to be assigned. For more information, see *Titanium Server Planning: Titanium Server Hardware Requirements*



CAUTION: Software RAID is not supported.

- Controller-0 must be installed and configured.
- The node must be connected to the internal management network or PXE boot network using an Ethernet interface configured for PXE boot.
- The node must be configured in the BIOS to boot from the internal management network or PXE boot network.

Procedure

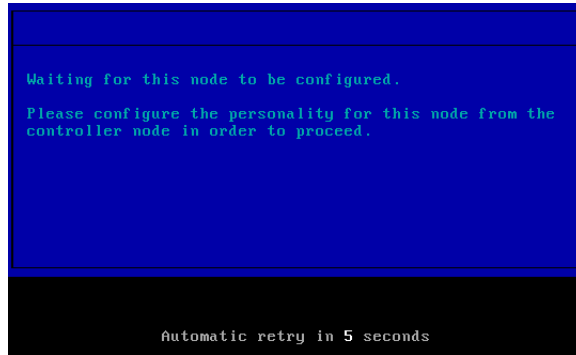
1. Power on the host.



NOTE: To ensure you can correctly identify hosts as you install them, power on and configure each new node one at a time.

With **controller-0** running, start the host.

The host boots from the network and then displays a message that it is waiting to be configured.



2. Open the Edit Host dialog box to begin provisioning the new host.

- a) Display the available hosts in the system.

Select the Hosts tab on the Host Inventory page, available from **Admin > Platform > Host Inventory** on the left-hand pane.

The new node is listed in the **UnProvisioned Hosts** list.

UnProvisioned Hosts

Host Name	Personality	Admin State	Operational State	Availability State	Uptime	Status	Actions
-	-	Locked	Disabled	Offline	0 minutes		Edit Host ▾
Displaying 1 item							

- b) Click **Edit Host** for the new host.

The Edit Host window appears.

Edit Host

Host Info

Installation Parameters

Board Management

Personality

Compute

Performance Profile

Standard

Host Name

Location

☐ Serial Console Data Carrier Detect

Cancel

Save

From here you can update the configuration of the current host.

Note: this will not affect the resources allocated to any existing instances using this host until the host is rebooted.

3. Assign the appropriate personality to the host.

By default, the **Compute** personality is selected. Use the **Personality** drop-down menu to specify the type of host you are installing (**Controller** or **Storage**).



NOTE: The **Storage** option is available only if an infrastructure network is present.

The window is updated for the personality.

For a controller host:

Edit Host

Host Info * Installation Parameters * Board Management

Personality *
Controller

Location ?

☐ Serial Console Data Carrier Detect ?

From here you can update the configuration of the current host.
Note: this will not affect the resources allocated to any existing instances using this host until the host is rebooted.

Cancel Save

For a storage host:

Edit Host

Host Info * Installation Parameters * Board Management

Personality *
Storage

Personality Sub-Type *
CEPH backing

Location ?

☐ Serial Console Data Carrier Detect ?

From here you can update the configuration of the current host.
Note: this will not affect the resources allocated to any existing instances using this host until the host is rebooted.

Cancel Save

4. Complete the remaining fields on the **Host Info** tab.

Performance Profile

(shown only for a **Compute** personality) The performance characteristic of the host.

Accept the default value (**Standard**). Other values are reserved for future use.

Host Name

(shown only for a **Compute** personality) An optional custom name for the compute host. The name appears in the Host Inventory and other places where the host is listed, and can be used in most CLI commands to specify the host.

Personality Sub-Type

(shown only for a **Storage** personality) The role of the host in a storage cluster. The following sub-types are available:

Ceph backing

Use this for a standard storage configuration.

Ceph tiering

Use this when implementing a cache tier.



NOTE: You cannot add a **Ceph tiering** host until cache tiering is configured on the system. For more information, see *Titanium Server System Administration: Cache Tiering*. In addition, the system must already have a **Ceph backing** host.

Location

An optional description of the host location (for example, its site or rack position) to help manage large systems.

5. Set the installation parameters for the node.



CAUTION: If the host uses any console port other than **ttys0** for output display, you must change settings on the **Installation Parameters** tab to ensure that the host uses the correct port.

On the **Host Info** tab:

- Type a physical **Location** for the node to help identify it.
- Specify whether to enable **Serial Console Data Carrier Detect**.

Select this option to have any active console session automatically logged out when the serial console cable is disconnected. The server must support data carrier detect on the serial console port.

On the **Installation Parameters** tab:

Edit Host

Host Info * Installation Parameters * Board Management

Boot Device * ⓘ
sda

Rootfs Device * ⓘ
sda

Installation Output *
text

Console ⓘ
ttyS0,115200

From here you can update the installation parameters of the current host.

Cancel Save

Boot Device

is the host device for boot partition, relative to **/dev**. The default is **sda**.

Rootfs Device

is the host device for rootfs partition, relative to **/dev**. The default is **sda**.

Installation Output

is the format for console output on the host (**text** or **graphical**). The default is **text**.



NOTE: The **graphical** option currently has no effect. Text-based installation is used regardless of this setting.

Console

is the output device to use for message display on the host (for example, **tty0**). The default is **ttys0, 115200**.

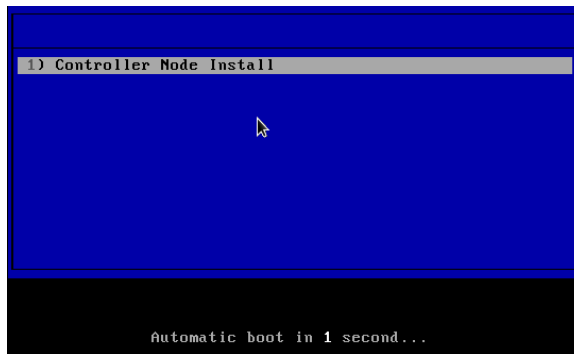


NOTE: This setting is *not* updated automatically to reflect changes to the **Installation Output** setting.

6. Save the settings.

- a) Click **Save** to initialize and configure the new node.

The node is restarted automatically, and a display-device menu appears on the node console.



- b) Wait while the node is configured and rebooted.

Up to 20 minutes may be required for a reboot.

The time required to configure and reboot controller-1 depends on the secondary disk partition size. Larger partitions require more time for synchronization with controller-0. For more information on DRBD synchronization and tuning, see [DRBD Sync Settings](#) on page 69.

When the reboot is complete, the node is reported as **Locked**, **Disabled**, and **Online**.



CAUTION: To ensure a successful installation, wait for the node to be reported as **Locked**, **Disabled**, and **Online**, and ensure that the login prompt appears on the host console. If the process is interrupted prematurely, the host installation can fail.

On the host console, a login screen is displayed.



NOTE: You must change your password immediately. To begin, provide the default password **wrsroot**. Then type a new password and confirm it.

The host is now configured with a personality.

Installing Software on Controller-1 Using the CLI

You can use the **controller-0** command-line interface to install the Titanium Server software on other hosts.

Except where noted, all the commands must be executed from the console of the active controller (here assumed to be **controller-0**).

Prerequisites

Before initializing a node, ensure that the following conditions are satisfied:

- The node must meet the hardware requirements for the personality to be assigned..



CAUTION: Software RAID is not supported.

- Controller-0 must be installed and configured.
- The node must be connected to the internal management network or PXE boot network using an Ethernet interface configured for PXE boot.
- The node must be configured in the BIOS to boot from the internal management network or PXE boot network.

Procedure

1. Add the host to the system inventory.



NOTE: The host must be added to the system inventory before it is powered on.

On **controller-0**, acquire Keystone administrative privileges:

```
$ source /etc/nova/openrc
```

Use the **system host-add** command to add a host and specify its personality. You can also specify the device used to display messages during boot.



NOTE: The **hostname** parameter is required for compute hosts. For controller and storage hosts, it is ignored.

```
~(keystone_admin)$ system host-add -n hostname \  
-p personality [-s subtype] \  
[-l location] [-o install_output[-c console]] [-b boot_device] \  
[-r rootfs_device] [-m mgmt_mac] [-i mgmt_ip] [-D ttys_dcd] \  
[-T bm_type -M bm_mac -I bm_ip -U bm_username -P bm_password]
```

where

hostname

is a name to assign to the host (used for compute nodes only)

personality

is the host type. The following are valid options:

- **controller**
- **compute** (not used for CPE systems)
- **storage** (not used for CPE systems or systems with controller storage)

subtype

is the host personality subtype (used only for a compute host or storage host).

- For a compute host, the only current valid value is **standard**.
- For a storage host, valid values are **ceph-backing** or **ceph-caching**.



NOTE: You cannot add a **ceph-caching** host until cache tiering is configured on the system. For more information, see *Titanium Server System Administration: Cache Tiering*. In addition, the system must already have a **ceph-backing** host.

location

is a string describing the location of the host

console

is the output device to use for message display on the host (for example, **tty0**). The default is **tty0, 115200**.

install_output

is the format for console output on the host (**text** or **graphical**). The default is **text**.



NOTE: The **graphical** option currently has no effect. Text-based installation is used regardless of this setting.

boot_device

is the host device for boot partition, relative to **/dev**. The default is **sda**.

rootfs_device

is the host device for rootfs partition, relative to **/dev**. The default is **sda**.

mgmt_mac

is the MAC address of the port connected to the internal management or PXE boot network.

mgmt_ip

is the IP address of the port connected to the internal management or PXE boot network, if static IP address allocation is used.

ttys_dcd

is set to **True** to have any active console session automatically logged out when the serial console cable is disconnected, or **False** to disable this behavior. The server must support data carrier detect on the serial console port.

bm_type

is the board management controller type (**iLO3**, **iOL4** or **Quanta**)

bm_mac

is the board management controller MAC address

bm_ip

is the board management controller IP address

bm_username

is the username for board management controller access

bm_password

is the password for board management controller access

For example:

```
~(keystone_admin)$ system host-add -n compute-1 -p compute -m 08:00:27:5C:97:DB
+-----+-----+
| Property | Value |
+-----+-----+
| action | none |
| administrative | locked |
| availability | offline |
| bm_ip | None |
| bm_mac | None |
| bm_type | None |
| bm_username | None |
| boot_device | sda |
| capabilities | {} |
| config_applied | None |
| config_status | None |
| config_target | None |
| console | ttyS0,115200 |
| created_at | 2016-10-24T20:33:50.998923+00:00 |
| hostname | compute-1 |
| id | 18 |
| install_output | text |
| invprovision | None |
| location | {} |
| mgmt_ip | 192.168.204.33 |
| mgmt_mac | 08:00:27:da:8b:59 |
| operational | disabled |
| personality | compute |
| reserved | False |
| rootfs_device | sda |
| serialid | None |
| software_load | 16.00 |
| task | None |
| ttys_dcd | None |
| updated_at | None |
| uptime | 0 |
| uuid | c3582323-2318-4c96-864a-6c2b525d4cea |
| vim_progress_status | None |
+-----+-----+
```

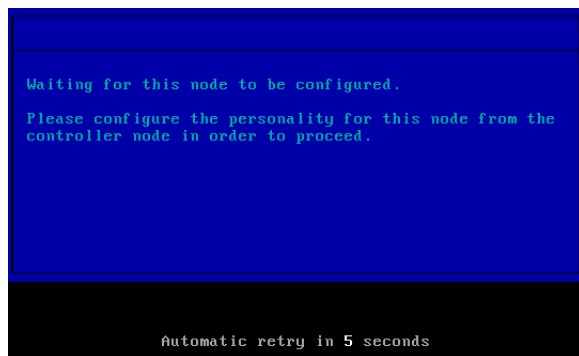
2. Power on the host.



NOTE: To ensure you can correctly identify hosts as you install them, power on and configure each new node one at a time.

With **controller-0** running, start the host.

The host boots from the network and then displays a message that it is waiting to be configured.



3. Obtain the host id.

The active controller assigns an **id** when the host is detected. To update the host with a personality from the command line, the **id** is required.

The **id** is shown in the first field of the **system host-list** command output:

```
~(keystone_admin)$ system host-list
```

id	hostname	personality	administrative	operational	availability
1	controller-0	controller	unlocked	enabled	available
2	None	None	locked	disabled	offline

This example shows the output when the first host is powered on after **controller-0** has been configured.

4. On the **controller-0** console, set the attributes of the host.

Use a command of the following form to specify the personality of the host, as well as the settings for displaying messages during boot:



NOTE: The **hostname** parameter is valid for compute hosts only. For controller and storage hosts, it is ignored.

```
~(keystone_admin)$ system host-update hostid hostname=hostname \
personality=personality sub-type=subtype [location=location] \
[console=console] [install_output=install_output] \
[ttys_dcd=ttys_dcd] [boot_device=boot_device] \
[rootfs_device=rootfs_device]
```

where

hostid

is the numeric id of the host obtained using the **system host-list** command

hostname

is a name to assign to the host (used for compute nodes only)

personality

is the host type. The following are valid options:

- **controller**
- **compute** (not used for CPE systems)
- **storage** (not used for CPE systems or systems with controller storage)

subtype

is the host personality subtype (used only for a compute host or storage host)

- For a compute host, valid values are **standard** or **low-latency**.
- For a storage host, valid values are **ceph-backing** or **ceph-caching**.



NOTE: You cannot add a **ceph-caching** host until cache tiering is configured on the system. For more information, see *Titanium Server System Administration: Cache Tiering*. In addition, the system must already have a **ceph-backing** host.

location

is a string describing the location of the host

console

is the output device to use for message display on the host (for example, **tty0**). The default is **ttys0, 115200**

install_output

is the format for console output on the host (**text** or **graphical**). The default is **text**.



NOTE: The **graphical** option currently has no effect. Text-based installation is used regardless of this setting.

ttys_dcd

is set to **True** to have any active console session automatically logged out when the serial console cable is disconnected, or **False** to disable this behavior. The server must support data carrier detect on the serial console port.

serial

is set to true to **True** to have any active console session automatically logged out when the serial console cable is disconnected, or **False** to disable this behavior. The server must support data carrier detect on the serial console port.

boot_device

is the host device for boot partition, relative to **/dev**. The default is **sda**.

rootfs_device

is the host device for rootfs partition, relative to **/dev**. The default is **sda**.

For example:

```
~(keystone_admin)$ system host-update 2 personality=controller
```

Property	Value
action	none
administrative	locked
availability	offline
bm_ip	
bm_mac	None
bm_type	None

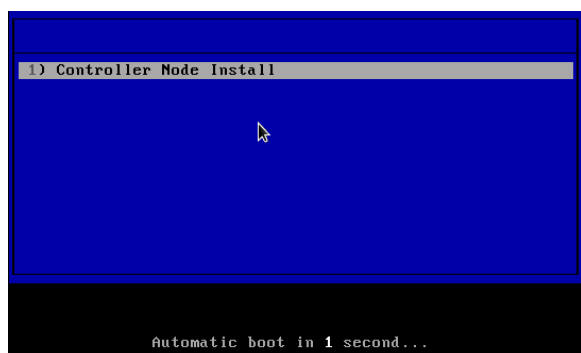
```

| bm_username      | |
| boot_device      | | sda
| capabilities      | | {}
| console           | | ttyS0, 115200
| created_at        | | 2015-01-09T15:54:40.313688+00:00
| cstatus           | | None
| hostname          | | controller-1
| iconfig_applied   | |
| iconfig_fini       | |
| iconfig_target     | |
| id                | | 2
| install_output     | | text
| invProvision       | | unprovisioned
| location           | | {}
| mgmt_ip            | | 192.168.204.4
| mgmt_mac           | | 08:00:27:1f:5e:e4
| operational        | | disabled
| personality        | | controller
| reserved           | | False
| rootfs_device      | | sda
| serialId           | | None
| task              | | None
| ttys_dcd           | | False
| updated_at         | | 2015-09-28T13:13:36.337484+00:00
| uptime            | | 242757
| uuid              | | 4e83bc2f-57d4-4508-9550-564d74dc32d4
+-----+-----+

```

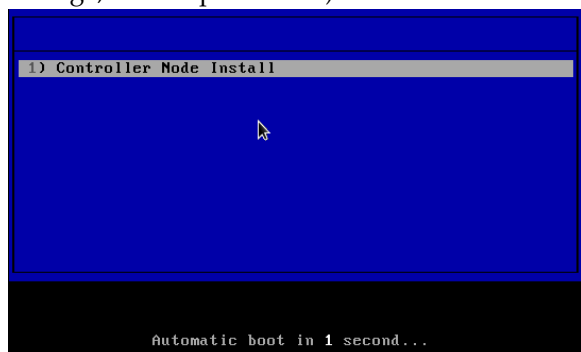
Controller-0 configures the required parameters and displays them as illustrated above. The host is still reported as offline, since the Titanium Server software has yet to be installed in its hard drive.

Controller-0 automatically pushes the Titanium Server installer image over the network for the host to boot. The console of the host displays the Titanium Server welcome screen.



5. Install the personality.

The node is assigned the personality specified in the **system host-add** parameters. A display-device menu appears on the console, with text customized for the personality (Controller, Storage, or Compute Node).



You can start the installation manually by pressing **Enter**. Otherwise, it is started automatically after a few seconds.

6. Wait for the host to reboot.

Up to 20 minutes may be required for a reboot.

The time required to configure and reboot controller-1 depends on the secondary disk partition size. Larger partitions require more time for synchronization with controller-0. For more information on DRBD synchronization and tuning, see [DRBD Sync Settings](#) on page 69.



NOTE: It may be necessary to reconfigure the BIOS manually to force the host to boot from the hard drive.

The host boots from the hard drive into the Titanium Server image and displays the GNU GRUB welcome screen.

After a brief delay, the system boots automatically into the Titanium Server image and presents a login prompt.

7. On the **controller-0** console, use the **system host-list** command to verify the status of the host.
 - For the second controller:

```
~(keystone_admin)$ system host-list
```

id	hostname	personality	administrative	operational	availability
1	controller-0	controller	unlocked	enabled	available
2	controller-1	controller	locked	disabled	offline

The host is still offline, but it is now reported as a controller node with name **controller-1**, in the **locked** administrative state.

Verify that the Titanium Server controller services are running on controller-1.

```
~(keystone_admin)$ nova service-list
```

Binary	Host	Zone	Status	State
nova-conductor	controller-0	int...	enabled	up
nova-cert	controller-0	int...	enabled	up
nova-consoleauth	controller-0	int...	enabled	up
nova-scheduler	controller-0	int...	enabled	up

Postrequisites

Before you can unlock a host, you must configure its network interfaces and storage resources.

Provisioning Network Interfaces on Controller-1

You must configure the network interfaces on a host before you can unlock it.

Procedure

1. Ensure that provider networks are available for the data interfaces. To create them, see [Configuring Provider Networks at Installation](#) on page 23.
2. Open the **Inventory Detail** page for the host.
 - a) Open the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane.
 - b) Select the **Hosts** tab, and then in the **Host Name** column, click the name of the host.
3. Select the **Interfaces** tab.

Overview Processor Memory Storage Ports **Interfaces** LLDP Sensors Devices

Create Interface Profile Create Interface

Name	Network Type	Type	Vlan ID	Port	Neighbors	Uses	Used By	Provider Network(s)	Attributes	Actions
enp0s3	-	ethernet	-	enp0s3	[u'08:00:27:d8:a5:e0']			-	MTU=1500	Edit Interface
mgmt0	mgmt	ethernet	-	enp0s8	[u'08:00:27:02:ec:c7']			-	MTU=1500	Edit Interface

Displaying 2 Items

4. Attach the OAM network interface.

You must manually configure the **controller-1** interface for the OAM network. .



NOTE: You must also configure any LAG interfaces in use, including those for the internal management network. For more information, see [Configuring Aggregated Ethernet Interfaces](#) on page 86.

- a) Click **Edit Interface** for the port connected to the OAM network.
The Edit Interface dialog box appears.
- b) In the **Network Type** list, select **oam**.



NOTE: Ensure that **none** is *not* selected. Clear it if necessary.

- c) Specify the **Interface Type**.
For an OAM network interface, you can select an **Ethernet**, **Aggregated Ethernet**, or **VLAN interface**.
 - d) Click **Save** to save the selection and close the dialog box.
5. Attach the data interfaces.
 - a) Click **Edit Interface** for a port connected to a data network.

The Edit Interface dialog box appears.

The screenshot shows the 'Edit Interface' dialog box. The 'Interface Name' field is set to 'eth0'. Under 'Network Type', the 'none' option is selected. The 'Interface Type' dropdown is set to 'ethernet'. The 'MTU' field is set to '1500'. The 'Description' field contains the text: 'From here you can update the configuration of the current interface.' The 'Port & LLDP Neighbors' section shows 'eth0 (08:00:27:47:ec:ea, 0000:00:09:0, eth0)' and a list item '1. e84d539d-71f4-4665-af7d-592ca56e6524 (vendor=0x1af4, device=0x1000)'. The 'Cancel' and 'Save' buttons are at the bottom right.

- b) In the **Network Type** list, select **data**.



NOTE: Ensure that **none** is *not* selected. Clear it if necessary.

When **data** is selected, additional controls appear in the dialog box, so that you can select a provider network and enable or disable IPv4 and IPv6 addressing modes:

- a **Provider Networks** list
- **IPv4 Addressing Mode** options
- **IPv6 Addressing Mode** options

- c) Specify the **Interface Type**.

This selection is set to **Ethernet** by default, and is active only if other choices are valid for the configuration. You can select **Ethernet**, **Aggregated Ethernet**, or **VLAN**.

- d) Select a **Provider Network** to use with the data interface.
- e) Optional: Set the **IPv4 Addressing Mode** and **IPv6 Addressing Mode** for the interface.

These selections are active only if the interface is attached to a VXLAN provider network.

- f) Click **Save** to save the selection and close the dialog box.

Provisioning Network Interfaces on Controller-1 Using the CLI

You can use the **controller-0** command-line interface to configure network interfaces on a host.

Procedure

1. Ensure that provider networks are available for the data interfaces. For more information, see [Configuring Provider Networks Using the CLI](#) on page 25.
2. Attach the OAM network interface.

For example, to attach an interface named **enp0s3** to the OAM network, using Ethernet interface **enp0s3** on **controller-1**:

```
~(keystone_admin)$ system host-if-modify -n enp0s3 \
-nt oam controller-1 enp0s3
```

Property	Value
ifname	enp0s3
networktype	oam
iftype	ethernet
ports	[u'enp0s3']
providernetworks	None
imac	08:00:27:58:0c:e5
mtu	1500
aemode	None
schedpolicy	None
txhashpolicy	None
uuid	14300770-13bf-48fd-b9af-756ec7d8adc1
ihost_uuid	e1c47086-3230-4b92-91d0-208c55130a52
vlan_id	None
uses	[]
used_by	[]
created_at	2015-12-10T14:24:25.967362+00:00
updated_at	2015-12-10T17:01:08.761323+00:00
sriov_numvfs	0
accelerated	[u'True']

3. If the cluster uses an infrastructure network, provision an infrastructure interface.

For example, to attach a VLAN interface named **infra0** with VLAN ID **22** to the infrastructure network, using Ethernet interface **enp0s8** on **storage-0**:

```
~(keystone_admin)$ system host-if-add controller-1 -V 22 -nt infra infra0 vlan
enp0s8
```

Property	Value
ifname	infra0
networktype	infra
iftype	vlan
ports	[]
providernetworks	None
imac	08:00:27:f2:0d:68
mtu	1500
aemode	None
schedpolicy	None
txhashpolicy	None
uuid	8ca9854e-a18e-4a3c-8afe-f050da702fdf
ihost_uuid	3d207384-7d30-4bc0-afffe-d68ab6a00a5b
vlan_id	22
uses	[u'enp0s8']
used_by	[]
created_at	2015-02-04T16:23:28.917084+00:00

updated_at	None	
+-----+	+-----+	+-----+

4. Provision the data interfaces.

For example, to attach an interface named **enp0s9** to a VLAN provider network named **providernet-a**, using Ethernet interface **enp0s9** on **compute-0**:

```
~(keystone_admin)$ system host-if-modify -n enp0s9 \
-nt data controller-1 enp0s9 -p providernet-a
```

Property	Value	
+-----+	+-----+	+-----+
ifname	enp0s9	
networktype	data	
iftype	ethernet	
ports	[u'enp0s9']	
providernetnetworks	providernet-a	
imac	08:00:27:66:38:c6	
imtu	1500	
aemode	None	
schedpolicy	None	
txhashpolicy	None	
uuid	4ff97cc5-8e59-4763-9a85-c4be3996ddbe	
ihost_uuid	327b2136-ffb6-4cd5-8fed-d2ec545302aa	
vlan_id	None	
uses	[]	
used_by	[]	
created_at	2015-12-23T13:04:49.768322+00:00	
updated_at	2015-12-23T16:16:19.540661+00:00	
sriov_numvfs	0	
ipv4_mode	disabled	
ipv6_mode	disabled	
accelerated	[u'True']	
+-----+	+-----+	+-----+

Provisioning Storage on Controller-1

You must configure the storage disks on a host before you can unlock it.

Procedure

1. Open the **Inventory Detail** page for the host.
 - a) Open the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane.
 - b) Select the **Hosts** tab, and then in the **Host Name** column, click the name of the host.
2. Select the **Storage** tab.

Overview

Processor

Memory

Storage

Ports

Interfaces

LLDP

Sensors

Devices

UUID	Device	Type	Size (MiB)	RPM	Serial ID	Model
eb5a2358-5942-4df0-ac78-32032daea594	/dev/sda	HDD	51200	Undetermined	VBddd19e55-8ad94be8	VBOX_HARDDISK
9081feff-dbf3-42db-b24b-5274c556d107	/dev/sdb	HDD	10240	Undetermined	VB7fe0f942-9007fa5a	VBOX_HARDDISK

Displaying 2 Items

Create Cinder Device

UUID	Function	Disk UUID
No items to display.		

3. Configure the Cinder storage on **controller-1**.

a) Click **Create Cinder Device**..

The Create Cinder Device dialog box appears.

Create Cinder Device

Hostname *

controller-1

Function

cinder

Disks *

/dev/sdb (uuid:0db998bd-63d7-42a4-be36-848bda)

Description:

From here you can define the configuration of the cinder device.

Cancel

Create Cinder Device

b) Using the **Disks** drop-down menu, select a disk to provide cinder storage.

The disk is added to the Cinder Device list.

Overview	Processor	Memory	Storage	Ports	Interfaces	LLDP	Sensors	Devices
UUID			Device	Type	Size (MiB)	RPM	Serial ID	Model
eb5a2358-5942-4df0-ac78-32032daea594			/dev/sda	HDD	51200	Undetermined	VBddd19e55-8ad94be8	VBOX_HARDDISK
9081feff-dbf3-42db-b24b-5274c556d107			/dev/sdb	HDD	10240	Undetermined	VB7fe0f942-9007fa5a	VBOX_HARDDISK
Displaying 2 items								
UUID				Function		Disk UUID		
efac9003-6238-4cd2-aebe-3cca008a6762				cinder		9081feff-dbf3-42db-b24b-5274c556d107		
Displaying 1 item								

4. Add a local volume group to provide local storage for the compute function.

a) On the Storage page, add a **nova-local** Volume Group.

Click **Add Local Volume Group**.

Local Volume Groups

+ Add Local Volume Group

Name	State	Access	Size	Current Physical Volumes	Current Logical Volumes	Actions
cgfs-vg	provisioned	wz--n-	42.4 GB	1	2	

Displaying 1 item

The Create Local Volume Group dialog box appears, set by default to add a **nova-local** group.

Create Local Volume Group

Hostname *

controller-1

Local Volume Group Name *

nova-local

Description:

From here you can define the configuration of a new local volume group.

Cancel

Create Local Volume Group

Click **Create Local Volume Group**.

The **nova-local** group is added to the **Local Volume Groups** list.

5. Assign a physical volume for the local volume group.

a) Click **Add Physical Volume**.

Physical Volumes

+ Add Physical Volume

Name	State	Type	Disk UUID	Disk Device Node	LVM Volume Group Name	Actions
/dev/drbd4	provisioned	partition	c8ee57e9-baab-4fac-be80-c2ee9f542804	/dev/sdb	cinder-volumes	
/dev/sda5	provisioned	partition	c283fcf0-04de-4968-abea-65becd11ac2a	/dev/sda	cgfs-vg	

Displaying 2 items

Create Physical Volume

Hostname *

controller-1

Local Volume Group * ?

nova-local

Disks * ?

/dev/sdc (uuid:f8198a94-3c29-4b2f-8bf3-aa44c23)

Description:

From here you can define the configuration of a new physical volume.

Cancel

Create Physical Volume

The Create Physical Volume dialog box appears, with the **Local Volume Group** automatically set to **nova-local**.

b) Using the **Disks** drop-down menu, select a non-root disk to provide storage.

You can add any number of non-root disks to the **nova-local** group, limited only by the number of disks available.



CAUTION: Always use non-root disks for **nova-local** storage. Use of the root disk for this purpose is not a supported configuration.

- c) Click **Create Physical Volume**.

The disk assignment is added to the **Physical Volumes** list.

6. Allocate resources on the physical volume for the local volume group.

- a) In the **Local Volume Groups** list, click **nova-local** to open the Local Volume Group Detail page.

OverviewParameters

nova-local

Info

UUID

bb204b7a-d897-4f17-8497-6a3cebf124d2

State

adding

Access

None

Size

0 bytes

Max Local Volumes

0

Current Local Volumes

0

Max Physical Volumes

0

Current Physical Volumes

0

Volume Group Total Physical Extents

0

Volume Group Free Physical Extents

0

Created At

2016-10-14T17:57:37.177110+00:00

Updated At

None

- b) Select the **Parameters** tab.

OverviewParameters

Name	Key	Value	Actions
Concurrent Disk Operations	concurrent_disk_operations	2	Edit
Instance Backing	instance_backing	image	Edit

Displaying 2 Items

- c) Select the **Instance Backing** type.

Click **Edit** for the **Instance Backing** setting.

LVM backed

Local storage for instances is provided using LVM RAW disks to optimize run-time I/O performance.

CoW Image backed

Local storage for instances is provided using copy-on-write (CoW) image files to optimize launch and delete performance. This is the default.

For more information about the **Instance Backing** type, see *Titanium Server System Administration:Storage on Compute Hosts*.

After making your selection, click **Save** to return to the Parameters tab.

The Parameters list is updated to show the corresponding value (**lvm** or **image**).

If the **Instance Backing** parameter is set to **image**, the **Instances LV Size** parameter is no longer shown.

- d) If you are using LVM-backed storage, specify the **Instances LV Size**.



NOTE: The **Instances LV Size** parameter is available only if the **Instance Backing** is set to **lvm**.

Click **Edit**, and then set the **Instances Logical Volume Size**.

If the total space in the volume group is less than 80GB (81920 MiB), then you must allocate at least 2048 MiB. If it is greater or equal than 80GB (81920 MiB), then you must allocate at

least 5120 MiB. The actual size is limited to ensure at least 50% free space in the volume group for creating disks for launched instances. The dialog box provides an acceptable parameter range for convenience.

For more information, see *Titanium Server System Administration:Storage on Compute Hosts*.

Provisioning Storage on Controller-1 Using the CLI

You can use the command-line interface to configure storage resources on a host.

Procedure

Configure the Cinder storage on **controller-1**.

Obtain the uuid of the physical disk to use for Cinder storage:

```
~(keystone_admin)$ system host-disk-list controller-1
+-----+-----+-----+...
| uuid                                | device_node | device_num | ...
+-----+-----+-----+...
| e0bf6865-1080-4bb5-8f0c-9167a620da25 | /dev/sda    | 2048       | ...
| 12da99c4-8a33-4b5c-8ae6-8ab88504a1ac | /dev/sdb    | 2064       | ...
+-----+-----+-----+...
```

Assign Cinder storage to the physical disk using a command of the following form:

```
~(keystone_admin)$ system host-stor-add controller-1 cinder uuid
```

For example, to assign Cinder storage on **/dev/sdb** in the example above:

```
~(keystone_admin)$ system host-stor-add controller-1 cinder
12da99c4-8a33-4b5c-8ae6-8ab88504a1ac
+-----+-----+
| Property | Value |
+-----+-----+
| osdid    | None  |
| state    | None  |
| function  | cinder |
| uuid     | 2d362546-1be5-4c6f-95d3-d0731250986a |
| ihost_uuid | e1c47086-3230-4b92-91d0-208c55130a52 |
| idisk_uuid | 12da99c4-8a33-4b5c-8ae6-8ab88504a1ac |
| created_at | 2015-12-10T15:58:27.713557+00:00 |
| updated_at | None  |
+-----+-----+
```



NOTE: You cannot assign Cinder storage on the **rootfs** disk (**/dev/sda**).

Unlocking Controller-1

You must unlock both controller nodes to provide redundancy.

The OAM interface, data interfaces and storage for the compute function must be configured before **controller-1** can be unlocked.

Procedure

Unlock the host to make it available for use.

On the **Hosts** tab of the Host Inventory page, open the drop-down list for the host, and then select **Unlock Host**.

The host is rebooted, and its **Availability State** is reported as **In-Test**. After a few minutes, it is reported as **Unlocked, Enabled, and Available**.

Both controllers are now available, with one active and one redundant.



NOTE: Controller-0 and controller-1 use IP multicast messaging for synchronization. If loss of synchronization occurs a few minutes after controller-1 becomes available, ensure that the switches and other devices on the management, infrastructure, and OAM networks are configured with appropriate settings. For example, consider that IGMP snooping may interfere with IP multicast messaging in some scenarios.

Unlocking Controller-1 Using the CLI

You must initialize and configure a redundant controller (**controller-1**) using the **controller-0** command-line interface.

The OAM interface, data interfaces and storage for the compute function must be configured before **controller-1** can be unlocked.

Procedure

On the **controller-0** console, unlock **controller-1**.

```
~(keystone_admin)$ system host-unlock controller-1
```

Property	Value
administrative	unlocked
availability	offline
created_at	2014-01-06T15:54:40.313688+00:00
hostname	controller-1
id	2
invProvision	provisioned
location	{}
mgmt_ip	192.168.204.4
mgmt_mac	08:00:27:1f:5e:e4
operational	disabled
personality	controller
serialId	None
updated_at	2014-01-06T17:07:10.987257+00:00
uuid	4e83bc2f-57d4-4508-9550-564d74dc32d4

controller-1 moves into the **intest** availability state, and then into the **available** state. This may take several minutes.

a) On the **controller-0** console, verify that **controller-1** is in the **intest** availability state.

```
~(keystone_admin)$ system host-list
```

id	hostname	personality	administrative	operational	availability
1	controller-0	controller	unlocked	enabled	available
2	controller-1	controller	unlocked	disabled	intest

Controller-1 moves into the **intest** availability state within 30 seconds following the unlocking command.

- b) On the **controller-0** console, verify that **controller-1** moves to the **available** state.

```
~(keystone_admin)$ system host-list
+-----+-----+-----+-----+-----+-----+
| id | hostname      | personality | administrative | operational | availability |
+-----+-----+-----+-----+-----+-----+
| 1  | controller-0  | controller  | unlocked       | enabled     | available    |
| 2  | controller-1  | controller  | unlocked       | enabled     | available    |
+-----+-----+-----+-----+-----+-----+
```

Controller-1 moves into the **available** state within two to three minutes following the unlock command.

Controller-1 is enabled. It works with **controller-0** to form a single high-availability cluster.



NOTE: Controller-0 and controller-1 use IP multicast messaging for synchronization. If loss of synchronization occurs a few minutes after controller-1 becomes available, ensure that the switches and other devices on the management, infrastructure, and OAM networks are configured with appropriate settings. For example, consider that IGMP snooping may interfere with IP multicast messaging in some scenarios.

A

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Boot Sequence Considerations

During Titanium Server software installation, each host must boot from different devices at different times. In some cases, you may need to adjust the boot order.

The first controller node must be booted initially from a removable storage device to install an operating system. The host then reboots from the hard drive.

Each remaining host must be booted initially from the network using PXE to install an operating system. The host then reboots from the hard drive.

To facilitate this process, ensure that the hard drive does not already contain a bootable operating system, and set the following boot order in the BIOS.

1. removable storage device (USB flash drive or DVD drive)
2. hard drive
3. network (PXE), over an interface connected to the internal management network

For BIOS configuration details, refer to the OEM documentation supplied with the computing node.



NOTE: If a host contains a bootable hard drive, either erase the drive beforehand, or ensure that the host is set to boot from the correct source for initial configuration. If necessary, you can change the boot device at boot time by pressing a dedicated key. For more information, refer to the OEM documentation for the compute node.

Using a Controller Configuration Input File

For automated installation, you can create a configuration file to use with the controller configuration script.

The controller configuration script accepts a path to a configuration file as an optional parameter:

```
$ config_controller --config-file filename
```

where *filename* is the path and name of the file.



NOTE: The **config_controller** controller configuration script will verify the installed software as either Titanium Server CPE or Titanium Server standard product against the provided license file. It will be rejected if the license file and the installed software do not match.

The configuration file contains all the settings required by the script, expressed using INI format. You can create one manually, or you can use the configuration file generator utility provided with the Titanium Server Guest Software Development Kit (SDK). For more about the format, see [Configuration Input File Format](#) on page 58. For information about the configuration file generator utility, see the documentation included with the SDK.

You can validate a configuration file before applying it, using the **config_validator** utility provided with the SDK. The same validation is also performed automatically when the configuration controller script is executed. For information about the configuration file validator utility, see the documentation included with the SDK.

For general information about the SDK, see the *Titanium Server Software Development Kit*.

Postrequisites



CAUTION: The configuration file contains clear-text authentication data. For improved security, delete this file from the system after use.

Configuration Input File Format

The configuration file uses key-value pairs in standard INI format.

Valid sections, keys, and values are as follows.

Table 1 **Configuration Input File INI Specification**

[Section] / Key	Value	Remarks
[STORAGE]		
DATABASE_STORAGE	(size in GB)	Postgres database size
IMAGE_STORAGE	(size in GB)	Storage for nova instances launched from glance images
BACKUP_STORAGE	(size in GB)	
CINDER_BACKEND	lvm or ceph	
CINDER_DEVICE	(string)	
CINDER_STORAGE	(size in GB)	
[DNS]		(optional)
NAMESERVER_1	(IP address)	
NAMESERVER_2	(IP address)	
NAMESERVER_3	(IP address)	
[NTP]		(optional)
NTP_SERVER_1	(IP address or FQDN)	
NTP_SERVER_2	(IP address or FQDN)	
NTP_SERVER_3	(IP address or FQDN)	
[LOGICAL_INTERFACE_n]		(where <i>n</i> is an interface number, beginning with 1)
LAG_INTERFACE	Y or N	
LAG_MODE	802.3ad (LACP) policy or Balanced XOR policy or Active-backup policy	
INTERFACE_MTU	(MTU size)	
INTERFACE_PORTS	(a comma-separated list of ethernet interfaces)	for example: eth0,eth1
[MGMT_NETWORK]		
VLAN	(VLAN id)	
IP_START_ADDRESS	(IP address)	
IP_END_ADDRESS	(IP address)	
CIDR	(network/mask)	
MULTICAST_CIDR	(IP address)	

[Section] / Key	Value	Remarks
DYNAMIC_ALLOCATION	Y or N	This setting applies to other network types system-wide, such as the Infra network.
LOGICAL_INTERFACE	LOGICAL_INTERFACE_ <i>n</i>	(where <i>n</i> is an interface number, beginning with 1)
GATEWAY	(IP address)	This key can be specified in the MGMT_NETWORK section or OAM_NETWORK section, but not both
[INFRA_NETWORK]		
VLAN	(VLAN id)	
IP_START_ADDRESS	(IP address)	
IP_END_ADDRESS	(IP address)	
CIDR	(network/mask)	
LOGICAL_INTERFACE	LOGICAL_INTERFACE_ <i>n</i>	(where <i>n</i> is an interface number, beginning with 1)
[OAM_NETWORK]		
VLAN	(VLAN id)	
IP_START_ADDRESS	(IP address)	You can use these to define contiguous addresses for the IP floating address and unit addresses; for example, 10.10.10.2 (the IP floating address) through 10.10.10.4 (for two contiguous unit addresses). As an alternative, you can specify the addresses separately (and non-contiguously) using the keys IP_FLOATING_ADDRESS, IP_UNIT_0_ADDRESS, and IP_UNIT_1_ADDRESS.
IP_END_ADDRESS	(IP address)	
CIDR	(network/mask)	
MULTICAST_CIDR	(IP address)	
LOGICAL_INTERFACE	LOGICAL_INTERFACE_ <i>n</i>	(where <i>n</i> is an interface number, beginning with 1)
GATEWAY	(IP address)	This key can be specified in the MGMT_NETWORK section or OAM_NETWORK section, but not both

[Section] / Key	Value	Remarks
[PXEBOOT_NETWORK]		
PXEBOOT_CIDR	(network/mask)	
[LICENSING]		
LICENSE_FILE_NAME	(filename or full path to license file)	
[SECURITY]		
CONFIG_WRSROOT_PW_AGE	(number of days)	
SSL_REST_API	Y or N	
SELF_SIGNED	Y or N	
CERTIFICATE_FILE_NAME	(filename or full path to license file)	Required only if SELF_SIGNED=N
CERTIFICATE_PASSWORD	(string)	Required if CERTIFICATE_FILE_NAME is password-protected
FIREWALL_RULES_FILE	(full path to a rules file)	Optional if changes to the default firewall are required
[BOARD_MANAGEMENT_NETWORK]		
VLAN	(VLAN id)	
MTU	(MTU size)	
SUBNET	(network/mask)	
[CEILOMETER]		
TIME_TO_LIVE	(seconds)	
[AUTHENTICATION]		
ADMIN_PASSWORD	(string)	
[VERSION]		
RELEASE	16.10	Checked by config_validator

The following example is provided for reference.

```
[STORAGE]
; Storage Configuration
CINDER_BACKEND=lvm
DATABASE_STORAGE=20
IMAGE_STORAGE=10
BACKUP_STORAGE=42
CINDER_DEVICE=/dev/sdb
CINDER_STORAGE=110

; LOGICAL_INTERFACE <number>
; LAG_INTERFACE <Y/N>
; LAG_MODE      One of 1) Active-backup policy
;              2) Balanced XOR policy
```

```
;                                     4) 802.3ad (LACP) policy
;                                     Interface for pxebooting can only be LACP
;   INTERFACE_MTU   <mtu size>
;   INTERFACE_PORTS <comma separated list of ethernet interfaces>

[LOGICAL_INTERFACE_1]
LAG_INTERFACE=N
;LAG_MODE=
INTERFACE_MTU=1500
INTERFACE_PORTS=eth1

[LOGICAL_INTERFACE_2]
LAG_INTERFACE=N
;LAG_MODE=
INTERFACE_MTU=1500
INTERFACE_PORTS=eth0

[MGMT_NETWORK]
; Management Network Configuration
CIDR=192.168.204.0/24
MULTICAST_CIDR=239.1.1.0/28
DYNAMIC_ALLOCATION=Y
IP_START_ADDRESS=192.168.204.2
IP_END_ADDRESS=192.168.204.99
LOGICAL_INTERFACE=LOGICAL_INTERFACE_1

;[INFRA_NETWORK]
; Infrastructure Network Configuration

[OAM_NETWORK]
; External OAM Network Configuration
CIDR=128.224.150.0/23
MULTICAST_CIDR=239.1.1.0/28
GATEWAY=128.224.150.1
IP_FLOATING_ADDRESS=128.224.151.212
IP_UNIT_0_ADDRESS=128.224.151.192
IP_UNIT_1_ADDRESS=128.224.151.193
LOGICAL_INTERFACE=LOGICAL_INTERFACE_2

[DNS]
; DNS Configuration
NAMESERVER_1=128.224.144.130
NAMESERVER_2=8.8.8.8
NAMESERVER_3=8.8.4.4

[NTP]
; NTP Configuration
NTP_SERVER_1=0.pool.ntp.org
NTP_SERVER_2=1.pool.ntp.org
NTP_SERVER_3=2.pool.ntp.org

[LICENSING]
LICENSE_FILE_NAME=license.lic

[SECURITY]
ENABLE_HTTPS=N
FIREWALL_RULES_FILE=/home/wrsroot/iptables3.rules
CONFIG_WRSROOT_PW_AGE=45

[AUTHENTICATION]
ADMIN_PASSWORD=admin

[VERSION]
RELEASE=16.10
```

Adding Hosts Using the host-add Command

You can add hosts to the system inventory using the command line.

There are several ways to add hosts to Titanium Server; for an overview, see [Methods for Adding and Configuring Hosts](#) on page 33. Instead of powering up each host and then defining its personality and other characteristics interactively, you can use the **system host-add** command to define hosts before you power them up. This can be useful for scripting an initial setup.



NOTE: On systems that use static IP address assignment on the management network, new hosts must be added to the inventory manually and assigned an IP address using the **system host-add** command. If a host is not added successfully, the host console displays the following message at power-on:

```
This system has been configured with static management
and infrastructure IP address allocation. This requires
that the node be manually provisioned in System
Inventory using the 'system host-add' CLI, GUI, or
sysinv-api equivalent.
```

Procedure

1. Add the host to the system inventory.



NOTE: The host must be added to the system inventory before it is powered on.

On **controller-0**, acquire Keystone administrative privileges:

```
$ source /etc/nova/openrc
```

Use the **system host-add** command to add a host and specify its personality. You can also specify the device used to display messages during boot.



NOTE: The **hostname** parameter is required for compute hosts. For controller and storage hosts, it is ignored.

```
~(keystone_admin)$ system host-add -p personality -n hostname \
[-l location] [-o install_output[-c console]] [-b boot_device] \
[-r rootfs_device] [-m mgmt_mac] [-i mgmt_ip] [-D ttys_dcd] \
[-T bm_type -M bm_mac -I bm_ip -U bm_username -P bm_password]
```

where

hostname

is a name to assign to the host (used for compute nodes only)

personality

is the host type (**controller**, **storage**, or **compute**)

location

is a string describing the location of the host

console

is the output device to use for message display on the host (for example, **tty0**). The default is **ttys0, 115200**.

install_output

is the format for console output on the host (**text** or **graphical**). The default is **text**.



NOTE: The **graphical** option currently has no effect. Text-based installation is used regardless of this setting.

boot_device

is the host device for boot partition, relative to **/dev**. The default is **sda**.

rootfs_device

is the host device for rootfs partition, relative to **/dev**. The default is **sda**.

mgmt_mac

is the MAC address of the port connected to the internal management or PXE boot network.

mgmt_ip

is the IP address of the port connected to the internal management or PXE boot network, if static IP address allocation is used.

ttys_dcd

is set to **True** to have any active console session automatically logged out when the serial console cable is disconnected, or **False** to disable this behavior. The server must support data carrier detect on the serial console port.

bm_type

is the board management controller type (**iLO3**, **iOL4** or **Quanta**)

bm_mac

is the board management controller MAC address

bm_ip

is the board management controller IP address

bm_username

is the username for board management controller access

bm_password

is the password for board management controller access

For example:

```
~(keystone_admin)$ system host-add -n compute-0 -p compute -m 08:00:27:5C:97:DB
+-----+-----+
| Property          | Value          |
+-----+-----+
| action            | none           |
```

administrative	locked	
availability	offline	
bm_ip	None	
bm_mac	None	
bm_type	None	
bm_username	None	
boot_device	sda	
capabilities	{u'bm_region': u'External'}	
config_applied	None	
config_status	None	
config_target	None	
console	tty0	
created_at	2015-12-24T12:04:56.114817+00:00	
hostname	compute-1	
id	5	
install_output	graphical	
invprovision	None	
location	{}	
mgmt_ip	None	
mgmt_mac	08:00:27:5c:97:db	
operational	disabled	
personality	compute	
reserved	False	
rootfs_device	sda	
serialid	None	
software_load	15.10	
task	None	
ttys_dcd	None	
updated_at	None	
uptime	0	
uuid	61aed626-8301-4f76-a895-ff16ce9f4fe2	
vim_progress_status	None	
+-----+-----+-----+		

2. With **controller-0** running, start the host.

The host is booted and configured with a personality.

Postrequisites

After adding the host, you must provision it according to the requirements of the personality. For more information, see [Software Installation Workflow](#) on page 2.

Adding Hosts in Bulk

You can add an arbitrary number of hosts using a single CLI command.

Procedure

1. Prepare an XML file that describes the hosts to be added.

For more information, see [Bulk Host XML File Format](#) on page 66.

You can create a configuration file using the **config_gui** utility provided with the Titanium Server Guest Software Development Kit. For more information, see the *Titanium Server Software Development Kit: wrs-configutilities—Configuration Utilities*.

You can also create the XML configuration file from an existing, running configuration using the **system host-bulk-export** command. For more information, see [Exporting Host Configurations](#) on page 68.

2. Run the **system host-bulk-add** utility.

The command syntax is:

```
~[keystone_admin]$ system host-bulk-add xml_file
```

where *xml_file* is the name of the prepared XML file.

3. Power on the hosts to be added, if required.



NOTE: Hosts equipped with board management modules can be powered on automatically using settings in the XML file.

The hosts are configured. The utility provides a summary report, as shown in the following example:

```
Success:
compute-0
compute-1
Error:
controller-1: Host-add Rejected: Host with mgmt_mac 08:00:28:A9:54:19 already exists
```

Bulk Host XML File Format

Hosts for bulk addition are described using an XML document.

The document root is **hosts**. Within the root, each host is described using a **host** node. To provide details, child elements are used, corresponding to the parameters for the **host-add** command.

The following elements are accepted. Each element takes a text string. For valid values, refer to the CLI documentation.

Element	Remarks
hostname	A unique name for the host.
personality	The type of host.
mgmt_mac	The MAC address of the management interface.
mgmt_ip	The IP address of the management interface.
bm_mac	The MAC address of the board management module, if present.
bm_ip	The IP address of the board management module, if present.

Element	Remarks
bm_type	The board management module type.
bm_username	The username for board management module authentication.
bm_password	The password for board management module authentication.
power_on	An empty element. If present, powers on the host automatically using the specified board management module.
install_output	The display mode to use during installation (text or graphical). The default is text .
console	If present, this element specifies the port, and if applicable the baud, for displaying messages. If the element is empty or not present, the default setting ttyS0,115200 is used.
rootfs_device	The device to use for the rootfs partition, relative to /dev .
boot_device	The device to use for the boot partition, relative to /dev .
location	A description of the host location.

The following sample describes a controller, three compute nodes, and two storage nodes:

```
<?xml version="1.0" encoding="UTF-8" ?>
<hosts>
  <host>
    <personality>controller</personality>
    <mgmt_mac>08:00:27:19:b0:c5</mgmt_mac>
    <install_output>text</install_output>
    <location>System12/A4</location>
  </host>
  <host>
    <hostname>compute-0</hostname>
    <personality>compute</personality>
    <mgmt_mac>08:00:27:dc:42:46</mgmt_mac>
    <mgmt_ip>192.168.204.50</mgmt_ip>
    <install_output>text</install_output>
    <console></console>
  </host>
  <host>
    <hostname>compute-1</hostname>
    <personality>compute</personality>
    <mgmt_mac>08:00:27:87:82:3E</mgmt_mac>
    <mgmt_ip>192.168.204.51</mgmt_ip>
    <rootfs_device>sda</rootfs_device>
    <install_output>text</install_output>
  </host>
  <host>
    <hostname>compute-2</hostname>
    <personality>compute</personality>
    <mgmt_mac>08:00:27:b9:16:0d</mgmt_mac>
    <mgmt_ip>192.168.204.52</mgmt_ip>
```

```
<rootfs_device>sda</rootfs_device>
<install_output>graphical</install_output>
<console></console>
<power_on/>
<bm_mac>08:00:27:b9:16:ac</bm_mac>
<bm_ip>192.168.204.60</bm_ip>
<bm_type>ilo4</bm_type>
<bm_username>tsmith1</bm_username>
<bm_password>mypass1</bm_password>

</host>
<host>
  <personality>storage</personality>
  <mgmt_mac>08:00:27:dd:e3:3f</mgmt_mac>
</host>
<host>
  <personality>storage</personality>
  <mgmt_mac>08:00:27:8e:f1:b8</mgmt_mac>
</host>
</hosts>
```

Exporting Host Configurations

You can generate a host configuration file from a running configuration for re-installation, upgrade, and maintenance purposes.

You use the **system host-bulk-export** command to generate the host configuration file. You can then use this file as the basis for re-configuring the system in the case of a system re-installation or upgrade using the **system host-bulk-add** command.

The **host-bulk-export** command copies all settings (management MAC address, BM MAC address, and so on) into the host configuration file. This enables you to leverage the non-interactive and bulk installation and commissioning commands more easily.

- Run the **host-bulk-export** command to create the host configuration file.

The command syntax is shown below.

```
system host-bulk-export [--filename FILENAME]
```

- Where *FILENAME* is the path and name of the output file. If the **--filename** option is not present, the default path **./hosts.xml** is used.

The **host-bulk-export** command is an **admin** command.

It can not be run by a tenant.

It exports all hosts except **controller-0**.

Certain information is not loaded into the host configuration file.

- The power-on element is commented out. This is because we can not know what you will want to do when you run the **host-bulk-add** utility to apply this configuration to another system.
- For a system that does not have BMC configured, the BMC elements will be left empty.

For details on the structure and elements of the XML bulk configuration file, see [Bulk Host XML File Format](#) on page 66.

You can later use the generated host configuration file as the XML file name argument for the **system host-bulk-add** command to reconfigure the system during a system re-installation. For more information, see [Re-installing a System Using an Exported Host Configuration File](#) on page 69 and [Adding Hosts in Bulk](#) on page 65.

Re-installing a System Using an Exported Host Configuration File

You can re-install a system using the host configuration file that is generated using the **host-bulk-export** command.

Prerequisites

For the following procedure, **controller-0** must be the active controller.

Procedure

Procedure

1. Create a host configuration file using the **system host-bulk-export** command, as described in [Exporting Host Configurations](#) on page 68.
2. Copy the host configuration file to a USB drive or somewhere off the controller hard disk.
3. Edit the host configuration file as needed, for example to specify power-on or BMC information.
4. Delete all the hosts except **controller-0** from the inventory.
5. Re-install the Titanium software on **controller-0**, which must be the active controller.
6. Run **config_controller**.
7. Follow the instructions for using the **system host-bulk-add** command, as detailed in [Adding Hosts in Bulk](#) on page 65.

DRBD Sync Settings

DRBD sync settings are set to a default value but can be changed as needed to enhance performance.

The Distributed Replicated Block Device (DRBD) sync rate for the controllers is set initially to a default value of 40% of the link capacity rate reported by the user during controller configuration. This allows bandwidth for other traffic on the network. If the default value causes unwanted interruptions or delays for other processes, you can lower it to provide more bandwidth. Calculations for an optimal bandwidth must consider not only the actual link capacity, but also disk performance, network propagation speeds, and other relevant factors.

Peak utilization occurs as the controller disks are synchronized initially during installation or re-installation. For large media, this can continue for an hour or more. During this time the controllers are functional, but they are reported as **Degraded**, and **lock** and **swact** operations are unavailable.

After initial synchronization, utilization drops to levels required for incremental updates, and bandwidth requirements are not normally significant with respect to other processes.

DRBD file system synchronization uses the infrastructure interface if configured, otherwise, it uses the management interface. It is configured to use a variable resync rate: various parameters are derived from the available link bandwidth, and it assumes that several file systems sync in parallel. The default setting is 40% of available DRBD replication link bandwidth. This utilization setting may be modified using the following command:

```
~(keystone_admin)$ system drbdsync-modify --util percent
```

Tuning DRBD Sync Settings

You may need to adjust the DRBD sync rate for slower drives.

Procedure

1. To view the configuration status of controllers and to see the parameters that govern the Distributed Replicated Block Device (DRBD) sync rate, run the **drbdsync-show** command.

```
system drbdsync-show
+-----+-----+
| Property | Value |
+-----+-----+
| uuid     | 0833c9ba-ecb4-409c-886a-7430ab9d01d3 |
| isystem_uuid | bfc37360-4cae-4c2f-a1e8-ec9548f5e995 |
| created_at | 2015-12-02T15:12:12.532684+00:00 |
| updated_at | 2015-12-02T15:12:25.580281+00:00 |
| link_util | 40 |
| num_parallel | 3 |
| rtt_ms    | 0.2 |
+-----+-----+

+-----+-----+-----+-----+-----+-----+
| id | hostname | personality | administrative | operational | availability |
+-----+-----+-----+-----+-----+-----+
| 1 | controller-0 | controller | unlocked | enabled | available |
None |
| 2 | controller-1 | controller | unlocked | enabled | degraded |
None |
+-----+-----+-----+-----+-----+-----+
+-----+-----+-----+-----+-----+-----+
```

2. Use the **drbdsync-modify** command to modify the DRBD sync rate by setting the link utilization percentage.

Issuing this command pushes the DRBD reconfiguration to controllers, and takes approximately one minute to complete. Upon completion, the new settings have an immediate throttling effect. This command is accepted as long as controller configuration is not already in progress. You can issue the command when the DRBD re-sync operation is underway (for example, when you want to slow the sync down).

Help information for the command is as follows:

```
system help drbdsync-modify
```

```
usage: system drbdsync-modify [--util <percent>]
```

Modify DRBD sync rate parameters.

Optional arguments:

```
--util <percent>    Engineered percentage of link utilization for DRBD sync.
```

The following is an example execution of the **drbdsync-modify** command:

```
system drbdsync-modify --util 40
```

```

+-----+
| Property | Value |
+-----+
| uuid | 0833c9ba-ecb4-409c-886a-7430ab9d01d3 |
| isystem_uuid | bfc37360-4cae-4c2f-a1e8-ec9548f5e995 |
| created_at | 2015-12-02T15:12:12.532684+00:00 |
| updated_at | 2015-12-02T15:12:25.580281+00:00 |
| link_util | 40 |
| num_parallel | 3 |
| rtt_ms | 0.2 |
+-----+
waiting for hosts: controller-0, controller-1 to finish configuring . . . . .
DRBD configuration finished.

```


B

Resources for Host Provisioning

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Network Interface Provisioning

Before you can unlock and use the compute or storage nodes, you must configure the interfaces to attach them to networks.

Some interfaces require manual provisioning before the nodes can be unlocked.

- For the second controller node, you must attach an interface to the OAM network, and to the infrastructure network if used, before you can unlock the node.
- For a storage node, you must attach an interface to the infrastructure network before you can unlock the node.
- For a compute node, you must attach interfaces to provider networks before you can unlock the node. The provider networks must be set up beforehand; for more information, see *Titanium Server System Administration: Configuring Provider Networks*.

If the compute cluster uses an infrastructure network, you must attach an interface to the infrastructure network before you can unlock the node. In addition, if the infrastructure uses

static addressing, you must assign an IP address to the interface using the **system host-addr-add** command.

Titanium Server supports three types of interfaces:

Ethernet interfaces

These are created automatically for each port on the host. You must configure Ethernet interfaces by specifying the network type.

aggregated Ethernet interfaces

For link protection, you can create an aggregated Ethernet interface with two or more ports, and configure it with the network type.

VLAN interfaces

To support multiple interfaces on the same physical Ethernet or aggregated Ethernet interface, you can create VLAN interfaces and configure them with the network type.

The procedure for attaching an interface depends on the interface type.

- To attach an Ethernet interface, see [Configuring Ethernet Interfaces](#) on page 83.
- To attach an aggregated Ethernet interface, see [Configuring Aggregated Ethernet Interfaces](#) on page 86.
- To attach a VLAN interface, see [Configuring VLAN Interfaces](#) on page 91.



NOTE: To attach a data network to an existing management or infrastructure network interface, see [Editing Interface Settings](#) on page 79.

As an alternative, you can use the CLI to attach interfaces. See [Network Interface Provisioning Using the CLI](#) on page 74.

Logical interfaces of network types **oam** and **mgmt** cannot be deleted. They can only be modified to use different physical ports when required.

For more information on interfaces, see *Titanium Server Planning: Ethernet Interfaces*.



NOTE: On compute and storage nodes, the Ethernet interface for the internal management network is attached automatically, to support installation using PXE booting. On controller nodes, the interface for the internal management network is attached according to the settings specified during the controller configuration script. For more information, see *Titanium Server Installation: The Controller Configuration Script* on page 13.

Network Interface Provisioning Using the CLI

You can use CLI commands to create and attach network interfaces.

For more information about interface provisioning, or help using the Web administration interface, see [Network Interface Provisioning](#) on page 73.

To list attached interfaces, use the **system host-if-list** command.

```
~(keystone_admin)$ system host-if-list controller-0
...+-----+-----+-----+-----+-----+-----+-----+
+...
...| name      | netwo...| type      | vlan id | ports      | uses i/f  | used by i/f
|...
...+-----+-----+-----+-----+-----+-----+-----+
```

```
+...
...| infra0 | infra...| vlan      | 22      | []      | [u'mgmt0'] | []
...
...| oam0    | oam   ...| ethernet | None    | [u'enp0s3'] | []      | []
...
...| mgmt0    | mgmt  ...| ethernet | None    | [u'enp0s8'] | []      | [u'infra0']
...
+-----+-----+-----+-----+-----+-----+-----+
+...
```

To see all available interfaces, add the **-a** flag.

```
~(keystone_admin)$ system host-if-list -a controller-0
...+-----+-----+-----+-----+-----+-----+-----+
+...
...| name    | netwo...| type    | vlan id | ports    | uses i/f  | used by i/f
...
+-----+-----+-----+-----+-----+-----+-----+
+...
...| eth3    | None ...| ethernet | None    | [u'enp0s10'] | []      | []
...
...| infra0  | infra...| vlan     | 22      | []      | [u'mgmt0'] | []
...
...| eth2    | None ...| ethernet | None    | [u'enp0s9'] | []      | []
...
...| oam0    | oam   ...| ethernet | None    | [u'enp0s3'] | []      | []
...
...| mgmt0    | mgmt  ...| ethernet | None    | [u'enp0s8'] | []      | [u'infra0']
...
+-----+-----+-----+-----+-----+-----+-----+
+...
```

To assign an IP address to an interface, use the **system host-addr-add** command. This is required for the management and infrastructure networks if static IP address assignment is in use.

```
~(keystone_admin)$ system host-addr-add node ifname ip_address prefix
```

where

node

is the name or UUID of the compute node

ifname

is the name of the interface

ip_address

is an IPv4 or IPv6 address

prefix

is the netmask length for the address

Combined Data and Management or Infrastructure Interfaces

You can add a data interface to a management or infrastructure interface using a command of the following form:

```
~(keystone_admin)$ system host-if-modify -nt "mgmt,data" -p group0-data0 compute-0
mgmt0
```

This example adds a data network to the **mgmt0** interface on **compute-0**, for the provider network **group0-data0**.

Interface Settings

The settings for creating or editing an interface on a node depend on the type of network to which the interface is connected (for example, **infra** or **data**), as well as the type of interface (for example, **aggregated ethernet** or **vlan**).

These settings are available on the **Edit Interface** and **Create Interface** dialog boxes for a host, accessible from the **Interfaces** tab of the Host Inventory page.

For more about creating and editing interfaces, see [Network Interface Provisioning](#) on page 73.

Interface Name

A name used to identify the interface.

Network Type

The type of network to which the interface is attached.



NOTE: This selection supports multiple network types on the same *logical* interface. Titanium Server also supports multiple network types on the same *physical* interface, using VLAN interfaces.

You can select multiple checkboxes, but the only valid multiple selection is **data** in addition to either **mgmt** or **infra** on the interface connected to the management or infrastructure network.

Depending on the interface, the checkbox options can include:

none

Clears the Network Type setting.

infra

Attaches the interface to an infrastructure network.

When a compute or storage node is added to Titanium Server, an interface must be attached to the infrastructure network before the node can be unlocked.

You can edit the infrastructure interface to add a **data** network and provider network. This allows both infrastructure and data traffic to be carried on the interface.

oam

Attaches the interface to the OAM network.

The OAM network is used by controller nodes for administrator remote access. It is not applicable to compute or storage nodes.

mgmt

Attaches the interface to the internal management network.

When a compute or storage node is added to Titanium Server, the interface used for PXE boot is assigned automatically to the internal management network. In the settings for this interface, **mgmt** is already selected. For other interfaces, this selection is not used.

You can edit the management interface to add a **data** network and provider network. This allows both management and data traffic to be carried on the interface.

pci-passthrough

Provides for a direct connection to physical interface hardware and the attached provider network from a virtual machine. A single VM can directly access the physical interface. For more information, see *Titanium Server Cloud Administration: Configuring PCI Passthrough Ethernet Interfaces*.

data

Attaches the interface to a provider network.

You can add a data interface to a management or infrastructure interface by editing the interface and selecting **data** in addition to **mgmt** or **infra**.

pci-sriov

Provides for a direct connection to a virtual unit of physical interface hardware, and the attached provider network, from a virtual machine. Multiple VMs can directly access and share the same physical interface. For more information, see *Titanium Server Cloud Administration: Configuring SR-IOV Ethernet Interfaces*.

Interface Type

(Shown only when the **Network Type** is set to **mgmt**, **oam**, **data**, or **infra**) The type of interface (Ethernet, aggregated Ethernet, or VLAN).

Aggregated Ethernet - Mode

(Shown only when the **Interface Type** is set to **aggregated ethernet**) The operational mode for link aggregation.

Aggregated Ethernet - Tx Policy

(Shown only when the **Aggregated Ethernet - Mode** is set to **balanced** or **802.3ad**) The transmit policy for link aggregation.

Vlan ID

(Shown only when the **Interface Type** is set to **vlan**) A unique VLAN identifier for the network.

Port(s)

The physical port or ports used for the interface.

Provider Networks

(Shown only when the Network Type is set to **data**, **pci-passthrough**, or **pci-sriov**) The available provider networks. To attach the interface to a provider network, select the provider network.



NOTE: You cannot attach to a VLAN provider network using a VLAN data interface.

MTU

The maximum transmission unit for the interface. For more information, see *Titanium Server Planning: The Ethernet MTU*.



NOTE: You cannot change the MTU for an infrastructure interface. The value from the network resource is always used.

IPv4 Addressing Mode

(Shown only when the **Network Type** is set to **data**) The method for assigning an IP address to the interface for use with VXLAN networks. For more information about VXLAN networks, see *Titanium Server System Administration: Using VXLANs*.

Disabled

Do not assign an IPv4 address.

Static

Use a static IPv4 address.

Pool

Use an address from a pool of IPv4 addresses that has been defined and associated with the data interface.

IPv4 Address Pool

(Shown only when the **IPv4 Addressing Mode** is set to **pool**) The pool from which to assign an IPv4 address.

IPv6 Addressing Mode

(Shown only when the **Network Type** is set to **data**) The method for assigning an IP address to the interface for use with VXLAN networks. For more information about VXLAN networks, see *Titanium Server System Administration: Using VXLANs*.

Disabled

Do not assign an IPv6 address.

Static

Use a static IPv6 address.

Pool

Use an address from a pool of IPv6 addresses that has been defined and associated with the data interface.

Automatic Assignment

Use an automatically assigned IPv6 address.

Link Local

Use a link local IPv6 address.

IPv6 Address Pool

(Shown only when the **IPv6 Addressing Mode** is set to **pool**) The pool from which to assign an IPv6 address.

Virtual Functions

(Shown only when the **Network Type** is set to **pci-sriov**) The number of virtual interfaces to use. For more information, see *Titanium Server Cloud Administration: Configuring SR-IOV Ethernet Interfaces*.

Maximum Virtual Functions

(Shown only when the Network Type is set to **pci-sriov**)

the maximum number of virtual interfaces available.

For more information about adding provider networks, see *Titanium Server System Administration: Configuring Provider Networks*.

For more information about link aggregation, see [Link Aggregation Settings](#) on page 90.

For more information about IP address pools, see *Titanium Server System Administration: Using IP Address Pools for Data Interfaces*.

Editing Interface Settings

You can change the settings for a host interface.

The ability to change the interface settings is especially useful for updating the management interface. When a compute node is first created, its internal management interface is automatically set up using the default **Interface Type (ethernet)**. If you are using LAG on the internal management network, you must update this manually to **aggregated ethernet**.

You can also edit an internal management or infrastructure interface to attach to a data network by selecting **data** as an additional Network Type for the interface, or using the CLI. For CLI instructions, see [Network Interface Provisioning Using the CLI](#) on page 74.

To add or edit IP addresses on a data interface, see *Titanium Server System Administration: Adding a Static IP Address to a Data Interface*.

Procedure

1. Lock the host to make changes.
 - a) On the **Admin** menu of the Web administration interface, in the **System** section, select **Inventory**.
 - b) Select the **Hosts** tab.
 - c) In the **Actions** column, open the drop-down list for the host, and then select **Lock Host**.
 - d) Wait for the host to be reported as **Locked**.
2. Open the **Inventory Detail** page for the locked host.

In the **Host Name** column, click the name of the host.
3. Select the **Interfaces** tab to display the existing interfaces.

Overview	Processor	Memory	Storage	Ports	Interfaces	Sensors
----------	-----------	--------	---------	-------	------------	---------

Interfaces

Create Interface Profile

Create Interface

Name	Network Type	Type	Vlan ID	Port(s)	Uses	Used By	Provider Network(s)	Attributes	Actions
eth0	data	ethernet	-	eth0			provider-net-a	MTU=1500, accelerated=True	<div>Edit Interface</div>
eth2	data	ethernet	-	eth2			-	MTU=1500	<div>Edit Interface</div>
eth3	data	ethernet	-	eth3			-	MTU=1500	<div>Edit Interface</div>
mgmt0	mgmt	ethernet	-	eth1			-	MTU=1500	<div>Edit Interface</div>

Displaying 4 items

- Click **Edit Interface** for the interface you want to change.

Edit Interface

Interface Name *

eth0

Network Type *

☒ none
 ☐ infra
 ☐ oam
 ☐ mgmt
 ☐ pci-passthrough
 ☐ data
 ☐ pci-sriov
 ☐ pxeboot

Interface Type

ethernet

MTU

1500

Description:

From here you can update the configuration of the current interface.

Port & LLDP Neighbors

eth0 (08:00:27:47:ec:ea, 0000:00:09:0, eth0)

1. e84d539d-71f4-4665-af7d-592ca56e6524 (vendor=0x1af4, device=0x1000)

Cancel

Save

- Make the required changes, and then click **Save**.

The settings shown depend on the interface type. For information about the available settings, see [Interface Settings](#) on page 76.

6. Unlock the host.

Related Links

[Ports Tab](#)

[Interfaces Tab](#)

Creating Interfaces

You can create new logical interfaces using the **Create Interface** button on the **Interfaces** tab.

This button is available only on nodes in the locked state. When the button is clicked, the Create Interface dialog box is displayed, as illustrated below.

Create Interface

Interface Name *

Network Type *

☒ none

☐ mgmt

☐ oam

☐ data

☐ infra

☐ pxeboot

Interface Type *

<Select interface type>

Interface(s) @

☐ enp0s3 (08:00:27:6d:4a:00, infra)

☐ mgmt0 (08:00:27:19:70:68, mgmt)

☐ eth0 (08:00:27:47:ec:ea, data)

☐ eth1 (08:00:27:91:f9:b6, data)

MTU @

1500

Description:

From here you can define the configuration of a new interface.

Ports & LLDP Neighbors

enp0s3 (08:00:27:6d:4a:00, 0000:00:03.0, enp0s3)

1. 08:00:27:2d:09:ed (enp0s9)

2. 08:00:27:41:e7:1d (enp0s9)

3. 08:00:27:4e:69:96 (enp0s9)

4. 08:00:27:b9:93:8e (enp0s9)

5. 08:00:27:dd:24:03 (enp0s10)

6. 08:00:27:fd:2e:9d (enp0s3)

enp0s8 (08:00:27:19:70:68, 0000:00:06.0, mgmt0) - bootif

1. 08:00:27:20:41:0e (enp0s8)

2. 08:00:27:2d:fc:25 (enp0s8)

3. 08:00:27:3e:04:ae (enp0s8)

4. 08:00:27:7e:28:d1 (enp0s8)

5. 08:00:27:da:8b:59 (enp0s8)

6. 08:00:27:e6:ef:ae (enp0s8)

eth0 (08:00:27:47:ec:ea, 0000:00:09.0, eth0)

1. 763c8370-528a-4374-b928-1c237c14b64c (vendor=0x1af4,device=0x1000)

eth1 (08:00:27:91:f9:b6, 0000:00:0a.0, eth1)

1. ca41ca3a-bbe2-4a36-af27-5b9a6c211ae8 (vendor=0x1af4,device=0x1000)

Cancel

Create Interface

Different fields are displayed depending on the interface type selected. For more information, see [Interface Settings](#) on page 76.

Deleting Interfaces

You can delete an interface using the Web administration interface or the CLI.



NOTE: You cannot delete an interface of type **Ethernet**. You can only designate it as unused by setting its network type to **none**.

From the Web administration interface, you can delete an interface from the **Interface** tab of the Host Inventory page.

Inventory / Host Detail: compute-0

Overview Processor Memory Storage Ports Interfaces LLDP Sensors Devices

Create Interface Profile

Create Interface

Name	Network Type	Type	Vlan ID	Port	Neighbors	Uses	Used By	Provider Network(s)	Attributes	Actions
enp0s3	Infra	ethernet	-	enp0s3	[]			-	MTU=1500	<div>Edit Interface</div>
eth0	data	ethernet	-	eth0	[]			providernet-a	MTU=1500, accelerated=True	<div>Edit Interface</div>
eth1	-	ethernet	-	eth1	[]		eth1a	-	MTU=1500	<div>Edit Interface</div>
eth1a	data	ae	-			eth1		providernet-b	MTU=1500, AE_MODE=active_standby, accelerated=True	<div>Edit Interface</div> <div>Delete Interface</div>
mgmt0	mgmt	ethernet	-	enp0s8	[u'08:00:27:31:a6:a6', u'08:00:27:0f:01:40']			-	MTU=1500	<div>Edit Interface</div>

Displaying 5 items

From the CLI, you can use the **system host-if-delete** command.

```
~(keystone_admin) system host-if-delete host interface
```

where

host

is the hostname or ID of the host

interface

is the name or UUID of the interface

For example, to delete an aggregated Ethernet interface named **eth1a** on **compute-0**:

```
~(keystone_admin)$ system host-if-delete compute-0 eth1a  
Deleted interface: host compute-0 if eth1a
```

Marking an Ethernet Interface as Unused

You cannot delete an Ethernet interface. You can mark an Ethernet interface as unused by setting the interface type to **none** from the Web administration interface, or from the CLI using the **system host-if-modify** command.

For example, to designate the **eth1** Ethernet interface on **compute-0** as unused:

```
~(keystone_admin)$ system host-if-modify -nt none compute-0 eth1
+-----+-----+
| Property | Value |
+-----+-----+
| ifname   | eth1  |
| networktype | None |
| iftype   | ethernet |
| ports    | [u'eth1'] |
| providernetworks | None |
| imac     | 08:00:27:91:f9:b6 |
| imtu     | 1500  |
| aemode   | None  |
| schedpolicy | None |
| txhashpolicy | None |
| uuid     | 87dd1d4b-1e38-4f6c-a692-4c4199a3ef0e |
| ihost_uuid | 3b659824-eac3-4446-af73-f4a519e8ab30 |
| vlan_id  | None  |
| uses     | []    |
| used_by  | []    |
| created_at | 2016-09-22T18:24:08.092296+00:00 |
| updated_at | 2016-09-22T18:36:46.333354+00:00 |
| sriov_numvfs | 0 |
| ipv4_mode | None  |
| ipv6_mode | None  |
| accelerated | [u'True'] |
+-----+-----+
```

Configuring Ethernet Interfaces

You can attach an Ethernet interface to a network by editing the interface.

When a compute or storage node is added to Titanium Server and initialized, Ethernet interfaces are created automatically for each physical port detected. To support installation using PXE booting, one interface is attached automatically to the internal management network. You must attach additional interfaces manually before you can unlock the node. For more about this requirement, see [Network Interface Provisioning](#) on page 73.

For a network that uses Ethernet interfaces, you can edit an existing Ethernet interface on the node to attach it, as described in this topic. You can also do this from the CLI; for more information, see [Network Interface Provisioning Using the CLI](#) on page 74.

For a network that uses aggregated Ethernet or VLAN interfaces, you must create an interface in order to attach it; see [Configuring Aggregated Ethernet Interfaces](#) on page 86 or [Configuring VLAN Interfaces](#) on page 91.

Procedure

1. Open the **Inventory Detail** page for the host.
 - a) Open the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane.
 - b) Select the **Hosts** tab, and then in the **Host Name** column, click the name of the host.
2. Select the **Interfaces** tab.

<div>OverviewProcessorMemoryStoragePortsInterfacesLLDP Sensors Devices</div>										
<div>Create Interface ProfileCreate Interface</div>										
Name	Network Type	Type	Vlan ID	Port	Neighbors	Uses	Used By	Provider Network(s)	Attributes	Actions
enp0s3	-	ethernet	-	enp0s3	[]			-	MTU=1500	Edit Interface
eth0	-	ethernet	-	eth0	[]			-	MTU=1500	Edit Interface
eth1	-	ethernet	-	eth1	[]			-	MTU=1500	Edit Interface
mgmt0	mgmt	ethernet	-	enp0s8	[u'08:00:27:02:ec:c7', u'08:00:27:af:69:4d']			-	MTU=1500	Edit Interface
Displaying 4 Items										

- Click **Edit Interface** for the interface you want to attach to a network.

Edit Interface

Interface Name *

eth0

Network Type *

☒ none

☐ infra

☐ oam

☐ mgmt

☐ pci-passthrough

☐ data

☐ pci-sriov

☐ pxeboot

Interface Type

ethernet

MTU

1500

Description:

From here you can update the configuration of the current interface.

Port & LLDP Neighbors

eth0 (08:00:27:47:ec:ea, 0000:00:09:0, eth0)
1. e84d539d-71f4-4665-af7d-592ca56e6524
(vendor=0x1af4,device=0x1000)

Cancel

Save

For an Ethernet interface, the **Port** is already selected.

- Select the type of network for the interface.
For details, see [Interface Settings](#) on page 76.
- Complete the required information for the type of interface.
For more information, see [Interface Settings](#) on page 76.
- Click **Save** to save your changes and close the dialog box.



NOTE:

If an interface is not supported by AVS using DPDK poll-mode drivers, it will operate in non-accelerated mode leveraging kernel drivers.

The interface is attached to the network.

Configuring Ethernet Interfaces Using the CLI

You can use the CLI to attach Ethernet interfaces to networks.

Ethernet interfaces are created automatically. To attach one to a network, use a command of the following form:

```
~(keystone_admin)$ system host-if-modify -n ifname -m mtu \  
-nt networktype hostname ethname [-p providernetworklist] \  
[--ipv4-mode=ip4_mode [ipv4-pool addr_pool]] [--ipv6-mode=ip6_mode [ipv6-pool  
addr_pool]]
```

where

ifname

is a name for the interface

mtu

is the MTU for the interface

networktype

is the type of network to attach to

hostname

is the name or UUID of the host

ethname

is the name or UUID of the Ethernet interface to use

providernetworklist

is a list of provider networks, delimited by quotes and separated by spaces; for example, "provider-net-a provider-net-b". To specify a single provider network, omit the quotes. This parameter is required only if the *networktype* is set to **data**.

ip4_mode

is the mode for assigning IPv4 addresses to a data interface (**static** or **pool**), for use with VXLANs

ip6_mode

is the mode for assigning IPv6 addresses to a data interface (**static** or **pool**), for use with VXLANs

addr_pool

is the name of an IPv4 or IPv6 address pool, for use with the **pool** mode of IP address assignment for data interfaces used with VXLANs

For valid values, see [Interface Settings](#) on page 76.

For example, to attach an interface named **enp0s3** to the OAM network, using Ethernet interface **enp0s3** on **controller-1**:

```
~(keystone_admin)$ system host-if-modify -n enp0s3 \  
-nt oam controller-1 enp0s3  
+-----+-----+  
| Property          | Value          |  
+-----+-----+  
| ifname            | enp0s3         |
```

networktype	oam
iftype	ethernet
ports	[u'enp0s3']
providernetworks	None
imac	08:00:27:58:0c:e5
mtu	1500
aemode	None
schedpolicy	None
txhashpolicy	None
uuid	14300770-13bf-48fd-b9af-756ec7d8adc1
ihost_uuid	e1c47086-3230-4b92-91d0-208c55130a52
vlan_id	None
uses	[]
used_by	[]
created_at	2015-12-10T14:24:25.967362+00:00
updated_at	2015-12-10T17:01:08.761323+00:00
sriov_numvfs	0
accelerated	[u'True']

To attach an interface named **enp0s9** to a VLAN provider network named **providernet-a**, using Ethernet interface **enp0s9** on **compute-0**:

```
~(keystone_admin)$ system host-if-modify -n enp0s9 \
-nt data compute-0 enp0s9 -p providernet-a
```

Property	Value
ifname	enp0s9
networktype	data
iftype	ethernet
ports	[u'enp0s9']
providernetworks	providernet-a
imac	08:00:27:66:38:c6
mtu	1500
aemode	None
schedpolicy	None
txhashpolicy	None
uuid	4ff97cc5-8e59-4763-9a85-c4be3996ddb6
ihost_uuid	327b2136-ffb6-4cd5-8fed-d2ec545302aa
vlan_id	None
uses	[]
used_by	[]
created_at	2015-12-23T13:04:49.768322+00:00
updated_at	2015-12-23T16:16:19.540661+00:00
sriov_numvfs	0
ipv4_mode	disabled
ipv6_mode	disabled
accelerated	[u'True']

Configuring Aggregated Ethernet Interfaces

You can add and remove interfaces from a LAG group on a host using the Web administration interface or the CLI.

For CLI instructions, see [Network Interface Provisioning Using the CLI](#) on page 74.

Titanium Server supports up to four ports in a LAG group.

Procedure

1. Open the **Inventory Detail** page for the host.

- a) Open the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane.
- b) Select the **Hosts** tab, and then in the **Host Name** column, click the name of the host.

2. Select the **Interfaces** tab.

Overview Processor Memory Storage Ports Interfaces LLDP Sensors Devices										
										Create Interface Profile Create Interface
Name	Network Type	Type	Vlan ID	Port	Neighbors	Uses	Used By	Provider Network(s)	Attributes	Actions
enp0s3	-	ethernet	-	enp0s3	[]			-	MTU=1500	Edit Interface
eth0	-	ethernet	-	eth0	[]			-	MTU=1500	Edit Interface
eth1	-	ethernet	-	eth1	[]			-	MTU=1500	Edit Interface
mgmt0	mgmt	ethernet	-	enp0s8	[u'08:00:27:02:ec:c7', u'08:00:27:af:69:4d']			-	MTU=1500	Edit Interface

Displaying 4 items

3. Click **Create Interface**.

Create Interface

Interface Name *

Network Type *

☒ none
☐ mgmt
☐ oam
☐ data
☐ infra
☐ pxeboot

Interface Type *

<Select interface type>

Interface(s) ⓘ

☐ enp0s3 (08:00:27:6d:4a:00, infra)
☐ mgmt0 (08:00:27:19:70:68, mgmt)
☐ eth0 (08:00:27:47:ec:ea, data)
☐ eth1 (08:00:27:91:f9:b6, data)

MTU ⓘ

1500

Description:

From here you can define the configuration of a new interface.

Ports & LLDP Neighbors

enp0s3 (08:00:27:6d:4a:00, 0000:00:03.0, enp0s3)

1. 08:00:27:2d:09:ed (enp0s9)
2. 08:00:27:41:e7:1d (enp0s9)
3. 08:00:27:4e:69:96 (enp0s9)
4. 08:00:27:b9:93:8e (enp0s9)
5. 08:00:27:dd:24:03 (enp0s10)
6. 08:00:27:1d:2e:9d (enp0s3)

enp0s8 (08:00:27:19:70:68, 0000:00:08.0, mgmt0) - bootif

1. 08:00:27:20:41:0e (enp0s8)
2. 08:00:27:2d:fc:25 (enp0s8)
3. 08:00:27:3e:04:ae (enp0s8)
4. 08:00:27:7e:28:d1 (enp0s8)
5. 08:00:27:da:8b:59 (enp0s8)
6. 08:00:27:e6:ef:ae (enp0s8)

eth0 (08:00:27:47:ec:ea, 0000:00:09.0, eth0)

1. 763c8370-528a-4374-b928-1c237c14b64c (vendor=0x1af4,device=0x1000)

eth1 (08:00:27:91:f9:b6, 0000:00:0a.0, eth1)

1. ca41ca3a-bbe2-4a36-af27-5b9a6c211ae8 (vendor=0x1af4,device=0x1000)

Cancel

Create Interface

4. Select the type of network for the interface.

For details, see [Interface Settings](#) on page 76.

5. If required, open the **Interface Type** drop-down menu, and select **aggregated ethernet**.
The **Interface Type** control appears when the **Network Type** is set to **mgmt**, **oam**, **data**, or **infra**.
6. Set the **Aggregated Ethernet - Mode**. For more information, see [Link Aggregation Settings](#) on page 90.
7. From the **Interfaces** list, select the Ethernet interfaces used to attach this interface to the network.
8. Complete any other settings required for the Network Type. For more information, see [Interface Settings](#) on page 76.
9. To save your changes and close the dialog box, click **Create Interface**.

The interface is created and attached to the network.

Configuring Aggregated Ethernet Interfaces Using the CLI

You can use the CLI to attach aggregated Ethernet interfaces to networks.

Titanium Server supports up to four ports in a LAG group.

To create an aggregated Ethernet interface and attach it to a network, use a command of the following form:

```
~(keystone_admin)$ system host-if-add hostname -m mtu \  
-a aemode -x policy ifname \  
ae "providernetworklist" ethname1 ethname2
```

where

ifname

is a name for the interface

mtu

is the MTU for the interface

aemode

is the link aggregation mode

policy

is the balanced tx distribution hash policy

hostname

is the name or UUID of the host

providernetworklist

is a list of provider networks to attach to, separated by spaces



NOTE: For networks other than data networks, the value **none** is required.

ethname1, ethname2

are the names or UUIDs of the member interfaces

For example, to attach an aggregated Ethernet interface named **ae0** to provider networks **provider-net-a** and **provider-net-b**, using member interfaces **enp0s9** and **enp0s10** on **compute-0**:

```
~(keystone_admin)$ system host-if-add compute-0 -a balanced \  
-x layer2 ae0 ae "provider-net-a provider-net-b" enp0s9 enp0s10
```

For more about link aggregation modes and policies, see [Link Aggregation Settings](#) on page 90.

Changing a Management Interface to Aggregated

When compute and storage nodes are provisioned, the Ethernet interface used for PXE boot is automatically assigned to the internal management network.

To configure a management LAG interface you first need to remove the internal management network type from the existing management Ethernet interface and then add a new AE interface, specifying the **mgmt** network type, **ae** interface type, **802.3ad** AE mode, transmit hash policy and the slave interfaces.

Prerequisites

The node must be locked to edit an interface.

From the command line, you must first delete and then recreate the management interface.

```
~(keystone_admin)$ system host-if-modify -nt none node interface
```

where:

node

is the name of the node from which to delete an interface

interface

is the Ethernet interface to delete

You must then create the new interface.

```
~(keystone_admin)$ system host-if-add -nt mgmt -a 802.3ad -x layer2 node interface ae  
none ports
```

where

node

is the name of the node

interface

is the name to be assigned to the interface

ports

are the Ethernet ports to assign

For example:

```
~(keystone_admin)$ system host-if-add -nt mgmt -a 802.3ad -x layer2 compute-0 bond0 ae  
none enp0s8 enp0s9
```

Link Aggregation Settings

Titanium Server supports several link aggregation (LAG) operational modes.

If you select link aggregation (also known as Aggregate Ethernet) when configuring the management, infrastructure, or OAM networks, you can choose from the following operational modes. For more information, refer to the Linux kernel [Ethernet Bonding Driver](#) documentation available online.



NOTE: Ensure that the LAG mode on the corresponding Top-of-Rack (ToR) switch ports is configured to match your selection.

Table 2 **Supported Link Aggregation Operational Modes**

Mode	Description	Supported Interface Types
Active-backup (default value)	Provides fault tolerance. Only one slave interface at a time is available. The backup slave interface becomes active only when the active slave interface fails.	OAM, infrastructure, and data interfaces (compute nodes)
Balanced XOR	Provides aggregated bandwidth and fault tolerance. The same slave interface is used for each destination MAC address. This mode uses the default transmit policy, where the target slave interface is determined by calculating the source MAC address XOR'd with the destination MAC address, modulo 2. You can modify the transmit policy using the xmit-hash-policy option. For details, see Table 3 on page 91.	OAM, infrastructure, and data interfaces (compute nodes)
802.3ad	Provides aggregated bandwidth and fault tolerance. Implements dynamic link aggregation as per the IEEE 802.3ad (LACP) specification. You can modify the transmit policy using the xmit-hash-policy option. For details, see Table 3 on page 91. In order to support PXE booting over an aggregated management interface, the far-end switch ports must be configured in passive LACP mode. This is required because the BIOS on the host does not support LACP and cannot establish a LAG group, and therefore can use only one of the aggregated interfaces during PXE boot. If the far-end switch is configured to use active LACP, it can establish a LAG group and use either interface, potentially resulting in a communication failure during the boot process.	Management, infrastructure, and data interfaces (compute nodes)

Table 3 **xmit-hash-policy Options**

Option	Description	Supported Interface Types
Layer 2 (default value)	Hashes on source and destination MAC addresses.	OAM, internal management, infrastructure, and data interfaces (compute nodes)
Layer 2 + 3	Hashes on source and destination MAC addresses, and on source and destination IP addresses.	OAM, internal management, and infrastructure
Layer 3 + 4	Hashes on source and destination IP addresses, and on source and destination ports.	OAM, internal management, and infrastructure

Configuring VLAN Interfaces

You can attach an interface to multiple networks using VLAN tagging.

If the cluster is configured with VLAN-tagged networks, you can share an Ethernet interface by attaching it to one or more VLAN-tagged networks. You can do this using the Web administration interface or the CLI. For CLI instructions, see [Network Interface Provisioning Using the CLI](#) on page 74.



NOTE: When attaching to a data network using a VLAN interface, you can select a flat or VXLAN provider network. However, you cannot connect to a VLAN provider network (stacked VLANs are not supported). As an alternative that supports VLAN provider networks, you can edit a management or infrastructure interface to attach to a data network. For more information, see [Editing Interface Settings](#) on page 79.

For more information about shared interfaces, see *Titanium Server Planning: Shared (VLAN) Ethernet Interfaces*.

Procedure

1. Open the **Inventory Detail** page for the host.
 - a) Open the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane.
 - b) Select the **Hosts** tab, and then in the **Host Name** column, click the name of the host.
2. Select the **Interfaces** tab.

Overview Processor Memory Storage Ports Interfaces LLDP Sensors Devices										
										Create Interface Profile Create Interface
Name	Network Type	Type	Vlan ID	Port	Neighbors	Uses	Used By	Provider Network(s)	Attributes	Actions
enp0s3	-	ethernet	-	enp0s3	[]			-	MTU=1500	Edit Interface
eth0	-	ethernet	-	eth0	[]			-	MTU=1500	Edit Interface
eth1	-	ethernet	-	eth1	[]			-	MTU=1500	Edit Interface
mgmt0	mgmt	ethernet	-	enp0s8	[u'08:00:27:02:ec:c7', u'08:00:27:af:69:4d']			-	MTU=1500	Edit Interface

Displaying 4 Items

3. Click **Create Interface**.

Create Interface

Interface Name *

Network Type *

☒ none
 ☐ mgmt
 ☐ oam
 ☐ data
 ☐ infra
 ☐ pxeboot

Interface Type *

<Select interface type>

Interface(s) ?

☐ enp0s3 (08:00:27:6d:4a:00, infra)
 ☐ mgmt0 (08:00:27:19:70:68, mgmt)
 ☐ eth0 (08:00:27:47:ec:ea, data)
 ☐ eth1 (08:00:27:91:f9:b6, data)

MTU ?

1500

Description:

From here you can define the configuration of a new interface.

Ports & LLDP Neighbors

enp0s3 (08:00:27:6d:4a:00, 0000:00:03.0, enp0s3)

1. 08:00:27:2d:09:ed (enp0s9)
 2. 08:00:27:41:e7:1d (enp0s9)
 3. 08:00:27:4e:69:96 (enp0s9)
 4. 08:00:27:b9:93:8e (enp0s9)
 5. 08:00:27:dd:24:03 (enp0s10)
 6. 08:00:27:fd:2e:9d (enp0s3)

enp0s8 (08:00:27:19:70:68, 0000:00:08.0, mgmt0) - bootif

1. 08:00:27:20:41:0e (enp0s8)
 2. 08:00:27:2d:fc:25 (enp0s8)
 3. 08:00:27:3e:04:ae (enp0s8)
 4. 08:00:27:7e:28:d1 (enp0s8)
 5. 08:00:27:da:8b:59 (enp0s8)
 6. 08:00:27:e6:ef:ae (enp0s8)

eth0 (08:00:27:47:ec:ea, 0000:00:09.0, eth0)

1. 763c8370-528a-4374-b928-1c237c14b64c (vendor=0x1af4,device=0x1000)

eth1 (08:00:27:91:f9:b6, 0000:00:0a.0, eth1)

1. ca41ca3a-bbe2-4a36-af27-5b9a6c211ae8 (vendor=0x1af4,device=0x1000)

Cancel

Create Interface

4. Select the type of network for the interface.

For details, see [Interface Settings](#) on page 76.

5. Open the **Interface Type** drop-down menu, and select **vlan**.

The **Interface Type** control appears when the **Network Type** is set to **mgmt**, **oam**, **data**, or **infra**.

6. In the **Vlan ID** field, type a unique VLAN identifier for the network.

7. From the **Interfaces** list, select the Ethernet interfaces used to attach this interface to the network.

The Ethernet interfaces correspond to ports on the node. For more information, see [Network Interface Provisioning](#) on page 73.

8. Complete any other settings required for the Network Type. For more information, see [Interface Settings](#) on page 76.
9. To save your changes and close the dialog box, click **Create Interface**.

The interface is created and attached to the network.

Configuring VLAN Interfaces Using the CLI

You can use the CLI to attach VLAN interfaces to networks.

To create a VLAN interface and attach it to a network, use a command of the following form:

```
~(keystone_admin)$ system host-if-add hostname -V vlan_id \
-nt networktype ifname ethname [-p providernetworklist]
```

where

ifname

is a name for the interface

vlan_id

is the VLAN identifier for the network

hostname

is the name or UUID of the host

networktype

is the type of network to attach to

ethname

is the name or UUID of the Ethernet interface to use

providernetworklist

is a list of provider networks, delimited by quotes and separated by spaces; for example, "provider-net-a provider-net-b". To specify a single provider network, omit the quotes. This parameter is required only if the *networktype* is set to **data**.

For example, to attach a VLAN interface named **infra0** with VLAN ID **22** to the infrastructure network, using Ethernet interface **enp0s8** on **storage-0**:

```
~(keystone_admin)$ system host-if-add storage-0 -V 22 -nt infra infra0 vlan enp0s8
+-----+-----+
| Property      | Value                               |
+-----+-----+
| ifname        | infra0                             |
| networktype   | infra                              |
| iftype        | vlan                               |
| ports         | []                                  |
| providernetworks | None                               |
| imac          | 08:00:27:f2:0d:68                  |
| imtu          | 1500                               |
+-----+-----+
```

aemode	None	
schedpolicy	None	
txhashpolicy	None	
uuid	8ca9854e-a18e-4a3c-8afe-f050da702fdf	
ihost_uuid	3d207384-7d30-4bc0-affe-d68ab6a00a5b	
vlan_id	22	
uses	[u'enp0s8']	
used_by	[]	
created_at	2015-02-04T16:23:28.917084+00:00	
updated_at	None	
+-----+-----+-----+-----+-----+-----+		

where

ifname

is a name for the interface

mtu

is the MTU for the interface

aemode

is the link aggregation mode

policy

is the balanced tx distribution hash policy

hostname

is the name or UUID of the host

ethname1, ethname2

are the names or UUIDs of the member interfaces

Configuring Data Interfaces for VXLANs

For VXLANs, static endpoint IP addresses are required on compute host data interfaces.

For complete information about configuring VXLANs and assigning static IP address to data interfaces, see *Titanium Server System Administration: Using VXLANs*.

Configuring Hosts with Board Management

You can activate board management on a host by provisioning the host with information about the attached board management module.

For some board management modules, you can also configure reporting for hardware sensors. For more information, see *Titanium Server System Administration: Sensors Tab*.

Prerequisites

To use board management on a host, the host must be equipped with a supported HP Integrated Lights Out (iLO) module (iLO3, iLO4, or Quanta). To provision a host with board management, you need the MAC address, user name, and password for the board management module. The module must also be configured to use DHCP for a board management network that uses internal access, or static IP addressing for a network that uses external access. For more information, consult the user documentation for the module.

If the board management is configured for external access, you also need an IP address to assign to the module. For this information, consult your configuration plan.

You can use the Web administration interface or the CLI to provision the host. For CLI instructions, see [Configuring a Host for Board Management Using the CLI](#) on page 96.

Procedure

1. Open the **Hosts** list.

On the Host Inventory page, available from **Admin > Platform > Host Inventory** in the left-hand pane, select **Inventory**.

2. Click **Edit Host** for the host.

3. Select the **Board Management** tab.

Edit Host

Host Info * Installation Parameters * **Board Management**

Board Management Controller Type
HP Integrated Lights Out External

From here you can update the configuration of the board management controller.

Board Management Controller MAC Address
11:22:33:44:55:66

Board Management Controller IP Address
192.168.209.11

Board Management Controller User Name
admin

Board Management Controller Password

Confirm Password

Cancel Save

4. Complete the form as follows.

Field	Comments
Controller Type	Select the type of iLO module attached to the host.
Controller MAC Address	Provide the MAC address of the iLO module.

Field	Comments
Controller IP Address	This field is present if the board management network is configured for external access. Provide the IP address of the iLO module.
User Name	Provide the user name and password configured for the iLO module.
Password	
Confirm Password	

5. Click **Save**.

Configuring a Host for Board Management Using the CLI

To use board management on a host, you must provision the host with information about the attached board management module. If you prefer, you can do this from the command-line interface.

For some board management modules, you can also configure reporting for hardware sensors. For more information, see *Titanium Server System Administration: Sensors Tab*.

Prerequisites

To complete this task, you need the board type (iLO3, iLO4, or Quanta), MAC address, user name, and password of the board management module. The module must also be configured to use DHCP for a board management network that uses internal access, or static IP addressing for a network that uses external access. For more information, consult the user documentation for the module.

If the board management is configured for external access, you also need an IP address to assign to the module. For this information, consult your configuration plan.

Procedure

1. Provision the host with the MAC address and module type of the attached iLO module.

```
~(keystone_admin)$ system host-update hostname bm_mac=MAC_address
bm_type=module_type
```

For example:

```
~(keystone_admin)$ system host-update compute-0 bm_mac=b4:b5:2f:ee:ae:90
bm_type=iLO4
```

2. Provision the host with the user name and password of the iLO module.

```
~(keystone_admin)$ system host-update hostname bm_username=user_name \
bm_password=password
```

3. If the board management network is configured for external access, provision the host with the IP address of the iLO module.

```
~(keystone_admin)$ system host-update hostname bm_ip=ip_address
```