

Dell EMC Ready Bundle for Red Hat OpenStack Platform

**PowerEdge FX Hardware Deployment Guide
Version 10.0.1**



Dell EMC Converged Platforms and Solutions

Contents

List of Figures.....	iv
List of Tables.....	v
Trademarks.....	6
Notes, Cautions, and Warnings.....	7
Chapter 1: Overview.....	8
Deployment Methodology.....	9
Intended Audience.....	9
Dependencies.....	9
Chapter 2: Hardware Setup.....	10
Unpacking and Installing the Equipment.....	11
Dell EMC PowerEdge FX2 Layout Overview.....	11
Nodes Overview.....	11
Server Node Network Connections.....	12
Storage Sled Drive Configuration.....	14
Powering Up the Equipment.....	14
Verifying the Equipment.....	15
Tested BIOS and Firmware.....	15
Chapter 3: Configuring Your Network.....	17
Network Configuration Overview.....	18
Using the Workbook.....	18
Dell Networking Switches Default Solution Values.....	19
Optional: S6000-ON Switches.....	19
Splitting Ports on S6000-ON.....	20
Third-Party Network Hardware.....	20
Chapter 4: Configuring PowerEdge Hardware.....	22
IPMI Configuration.....	23
Configuring the CMC on Dell EMC PowerEdge FX.....	23
Configuring Server User Information.....	23
Configuring Server Network Settings.....	23
Validating Server IPMI Configuration.....	24
Infrastructure and Virtualization Node Settings.....	24
Open Source Hardware Configuration Toolkit.....	24
Creating the Open Source Hardware Configuration Toolkit ISO.....	25
Customizing the ISO.....	25
iDRAC Default Settings.....	25
SAH BIOS Specification.....	26

OpenStack Controller and Storage Specification.....	26
OpenStack SAH and Compute Specification.....	27
Running the Open Source Hardware Configuration Toolkit ISO.....	27
Chapter 5: Dell Storage PS Series Storage Group.....	28
Dell Storage PS Series Configuration Information.....	29
Chapter 6: Dell Storage SC Series Storage Arrays.....	31
Dell Storage SC Series Configuration Information.....	32
Chapter 7: Bills of Materials.....	33
Bill of Materials for PowerEdge FX Solution.....	34
Dell EMC PowerEdge FX2 Chassis 1 - SAH Controller/2 Compute Nodes.....	34
Dell EMC PowerEdge FX2 Chassis 2 - Controller/Compute/Storage Node.....	39
Dell EMC PowerEdge FX2 Chassis 3 - Controller/Compute/Storage Node.....	44
Dell EMC PowerEdge FX2 Chassis 4 - 2 Compute/Storage Node.....	50
Server Racks and Power.....	54
Bill of Materials - 2 Dell Networking S4048-ON Switches.....	54
Bill of Materials - Cables for PowerEdge FX Solution.....	54
Software Subscriptions for All Solutions.....	55
Appendix A: References.....	56
To Learn More.....	57

List of Figures

Figure 1: Dell EMC PowerEdge FX2 Chassis Layout.....	11
Figure 2: Dell EMC PowerEdge FX Four Node Chassis Network Ports.....	12
Figure 3: Dell EMC PowerEdge FX Three Node Chassis Network Ports.....	13
Figure 4: Dell EMC PowerEdge FX Two StorageNode Chassis Network Ports.....	13
Figure 5: Storage Sled Dell EMC PowerEdge FD332 Drive Layout.....	14

List of Tables

Table 1: Bond / Interface Cross Reference.....	13
Table 2: Dell EMC PowerEdge FC630/Dell EMC PowerEdge FD332 Tested BIOS and Firmware Versions.....	15
Table 3: Dell Storage Tested Software and Firmware Versions.....	15
Table 4: Dell Networking Tested Firmware Versions.....	16
Table 5: Example VLAN Assignments.....	18
Table 6: Switch Port Defaults.....	19
Table 7: iDRAC Specification for SAH Nodes.....	25
Table 8: SAH BIOS Specification.....	26
Table 9: OpenStack Controller and Storage Node Specification.....	27
Table 10: OpenStack SAH and Compute Specification.....	27
Table 11: PS Series Information Needed from Configuration.....	29
Table 12: SC Series Information Needed from Configuration.....	32
Table 13: Chassis 1 – Dell EMC PowerEdge FX2 SAH/Controller/Compute Nodes.....	34
Table 14: Chassis 2 – Dell EMC PowerEdge FX2 Controller/Compute/Storage Nodes.....	39
Table 15: Chassis 3 – Dell EMC PowerEdge FX2 Controller/Compute/Storage Nodes.....	44
Table 16: Chassis 4 – Dell EMC PowerEdge FX2 Compute/Storage Nodes.....	50

Trademarks

Copyright © 2014-2017 Dell Inc. or its subsidiaries. All rights reserved.

Microsoft® and Windows® are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Red Hat®, Red Hat Enterprise Linux®, and Ceph are trademarks or registered trademarks of Red Hat, Inc., registered in the U.S. and other countries. Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries. Oracle® and Java® are registered trademarks of Oracle Corporation and/or its affiliates.

DISCLAIMER: The OpenStack® Word Mark and OpenStack Logo are either registered trademarks/service marks or trademarks/service marks of the OpenStack Foundation, in the United States and other countries, and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation or the OpenStack community.

Notes, Cautions, and Warnings

-  A **Note** indicates important information that helps you make better use of your system.
-  A **Caution** indicates potential damage to hardware or loss of data if instructions are not followed.
-  A **Warning** indicates a potential for property damage, personal injury, or death.

This document is for informational purposes only and may contain typographical errors and technical inaccuracies. The content is provided as is, without express or implied warranties of any kind.

Chapter

1

Overview

Topics:

- [Deployment Methodology](#)
- [Intended Audience](#)
- [Dependencies](#)

This guide provides information necessary to deploy the Dell EMC Ready Bundle for Red Hat OpenStack Platform, on Dell EMC PowerEdge FX with Dell EMC PowerEdge FC630 and Dell EMC PowerEdge FD332; and the network with Dell Networking S3048-ON and S4048-ON switches.

Deployment Methodology

To perform a deployment of the Dell EMC Ready Bundle for Red Hat OpenStack Platform:

1. Use the [Dell EMC Ready Bundle for Red Hat OpenStack Platform Hardware Deployment Guide](#).
2. Then, depending on the methodology that you prefer, use the [Dell EMC Ready Bundle for Red Hat OpenStack Platform Software Deployment Guide](#) to perform either:
 - a. An automated deployment using scripts and methods developed and validated by Dell EMC
 - b. A manual deployment using methods developed and validated by Dell EMC

Intended Audience

This guide assumes the reader is familiar with:

- OpenStack
- Dell EMC PowerEdge FX with the Dell EMC PowerEdge FC630 and Dell EMC PowerEdge FD332 RAID configuration
- Red Hat Enterprise Linux (RHEL)
- Red Hat OpenStack Platform (RHOSP) documentation
- Network Configuration
- The concepts and procedures in [Red Hat's Red Hat OpenStack Platform update/upgrade documentation](#)

Dependencies

For customers performing a self-installation, these files are available on request from Dell EMC. Please contact your account representative, or email openstack@dell.com for instructions.

[Dell EMC Ready Bundle for Red Hat OpenStack Platform Hardware Deployment Guide](#) dependencies and prerequisites include:

- IPMI Utilities - used for validating server IPMI configuration
 - For Linux® - <http://sourceforge.net/projects/ipmitool/>
 - For Windows® - <http://ipmiutil.sourceforge.net/>
- The Dell EMC Open Source Hardware Configuration Toolkit (OS-HCTK)
 - A copy of the archive: JetPack-manual-10.0.1.tgz, which contains:
 - The OS-HCTK ISO
 - Sample switch configs
 - Solution Workbook
 - Creating the OS-HCTK ISO requires a Linux® environment that has the following programs installed:
 - `cpio`
 - `rpm`
 - `rpm2cpio`

Chapter 2

Hardware Setup

Topics:

- [*Unpacking and Installing the Equipment*](#)
- [*Dell EMC PowerEdge FX2 Layout Overview*](#)
- [*Nodes Overview*](#)
- [*Server Node Network Connections*](#)
- [*Storage Sled Drive Configuration*](#)
- [*Powering Up the Equipment*](#)
- [*Verifying the Equipment*](#)
- [*Tested BIOS and Firmware*](#)

These procedures ensure that your hardware is installed correctly prior to installing the Dell EMC Ready Bundle for Red Hat OpenStack Platform.

Unpacking and Installing the Equipment

Before you proceed you must perform the following procedures following all standard industry safety procedures:

1. Unpack and install the racks.
2. Unpack and install the server hardware.
3. Unpack and install the switch hardware.
4. Unpack and install the network cabling.
5. Connect each individual machine to both power bus installations.
6. Apply power to the racks.

 **Note:** This is usually performed by the Dell EMC EDT Team.

Dell EMC PowerEdge FX2 Layout Overview

4 FX2 chassis OpenStack – 3 x CEPH, 3 x Controller, 1 x SAH, 6 x Compute servers in 8 rack units

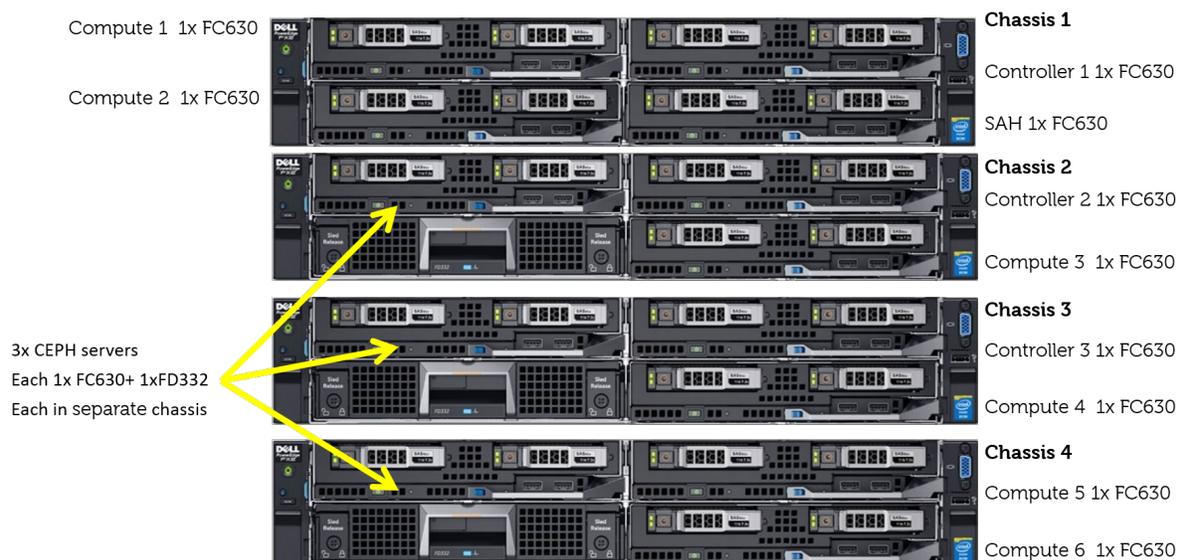


Figure 1: Dell EMC PowerEdge FX2 Chassis Layout

Nodes Overview

The solution is based on the following servers used:

- 1 Solution Admin Host (SAH)
- 3 Controller nodes
- 6 Compute nodes

- 3 Storage servers

The hardware includes:

- Dell EMC PowerEdge FX2 chassis with the FC630 servers and FD332 storage modules.
- Dell Networking S4048-ON network switches
- All Build of Materials for Computes and Storage are written for the minimum needed for the Validated Solution, additional nodes of these can be in a quantity of one (1) or more.
- Optional hardware: there are optional hardware available for the Compute and Storage nodes. When designing a solution all nodes of a class (Compute or Storage) must be the same.

Please consult with your Dell EMC sales representative to ensure proper preparation and submission of your hardware and software orders.

Server Node Network Connections

Server connections to the network switches for the data network are bonded, and use an Active-Active LAN aggregation group (LAG) in a load-balance configuration using IEEE 802.3 Link Aggregation Control Protocol (LACP). (Under Linux®, this is referred to as 802.3ad or mode 4 bonding).

The connections are made to a pair of ToR switches, to provide redundancy in the case of port, cable, or switch failure. The switch ports are configured as a LAG, and the switches are configured as a high availability pair using VLT.

Connections to the BMC network use a single connection from the iDRAC port to a S3048-ON management switch in each rack.

The mapping of bonds to individual interfaces is shown in [Table 1: Bond / Interface Cross Reference](#) on page 13.

The Dell EMC PowerEdge FX architecture uses a converged iDRAC or CMC connection on the back of the chassis. All of the units in a Dell EMC PowerEdge FX chassis use the same physical connector on the back of the unit for the physical network connection, and have separate IP addresses for each sub-unit. [Figure 2: Dell EMC PowerEdge FX Four Node Chassis Network Ports](#) on page 12 displays the connection for a single chassis iDRAC connection. The port next to it can be used to daisy chain the CMCs.

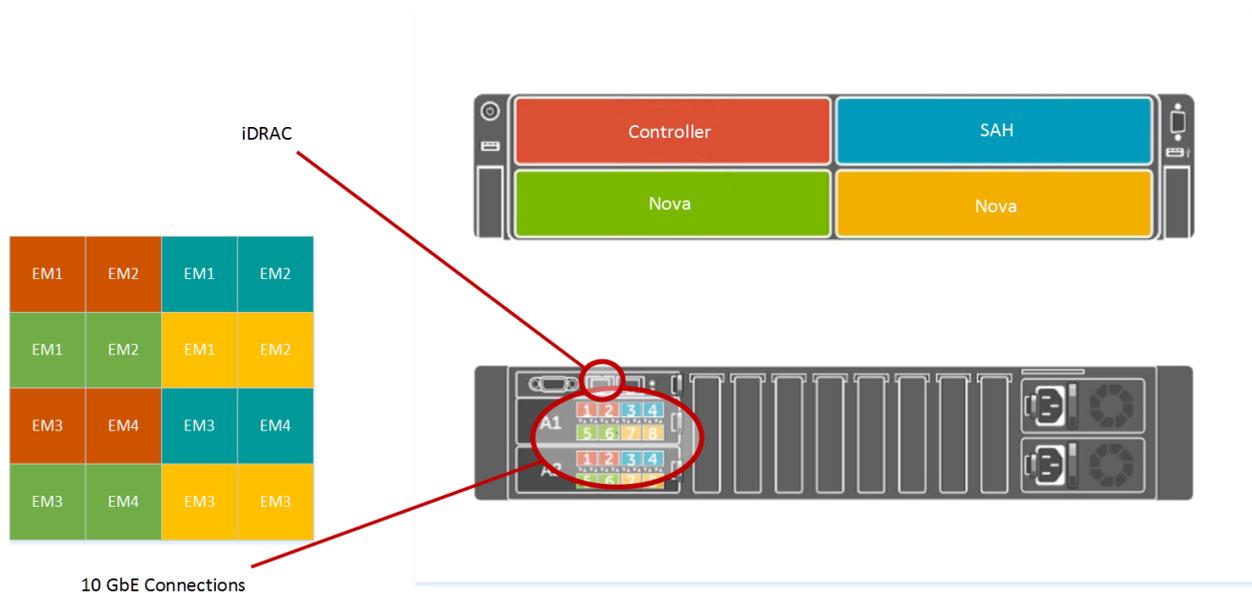


Figure 2: Dell EMC PowerEdge FX Four Node Chassis Network Ports

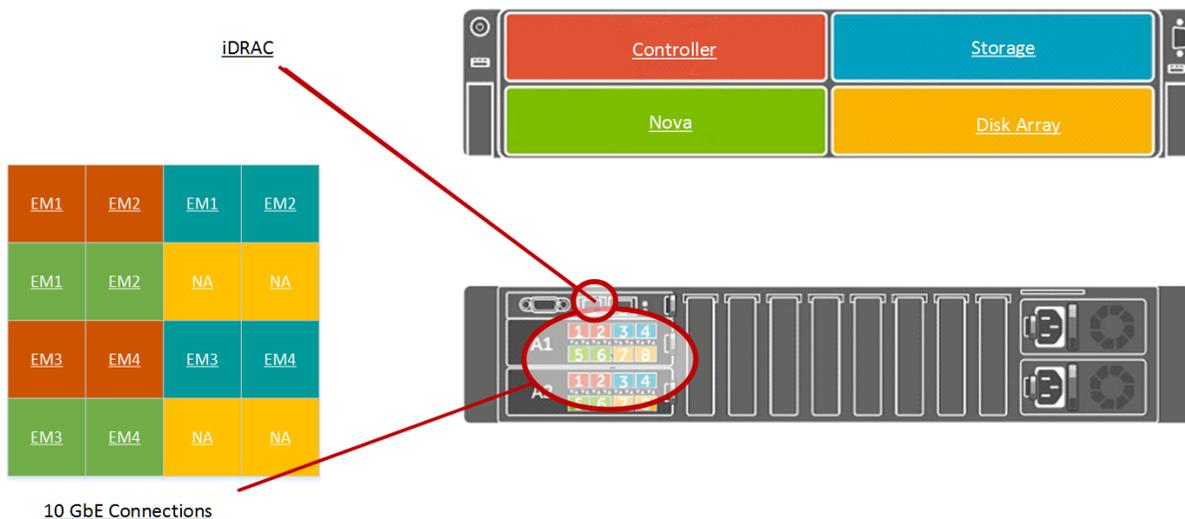


Figure 3: Dell EMC PowerEdge FX Three Node Chassis Network Ports

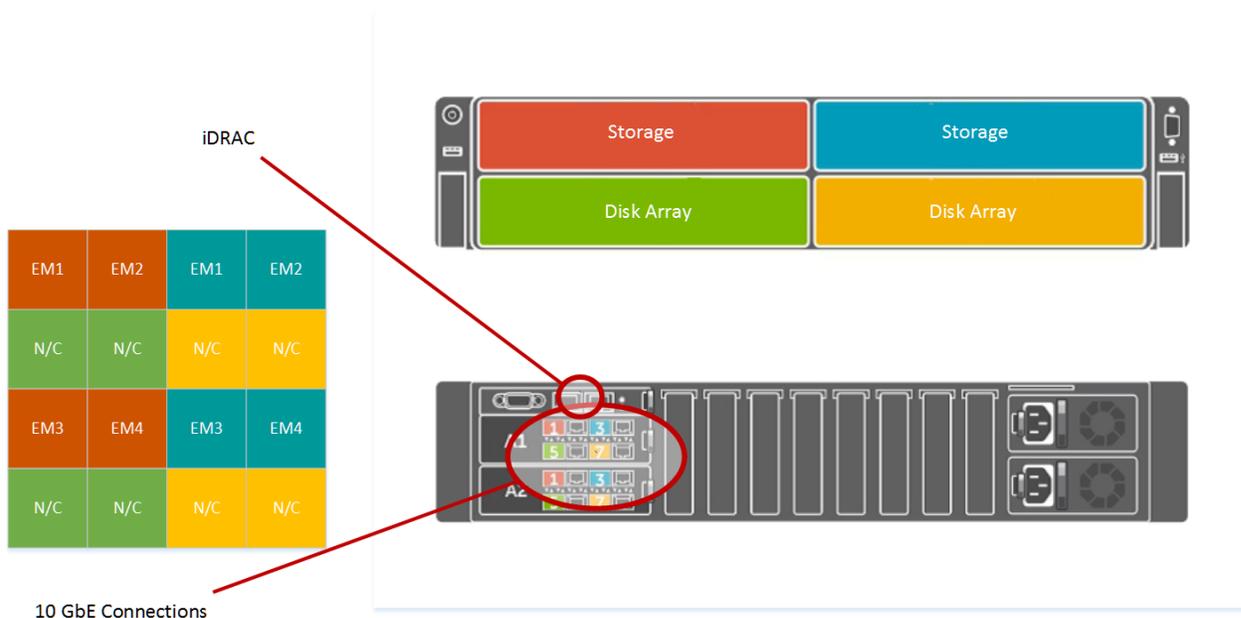


Figure 4: Dell EMC PowerEdge FX Two StorageNode Chassis Network Ports

Table 1: Bond / Interface Cross Reference

Server Platform	Interface	Bond
Dell EMC PowerEdge FX	em1	bond0
Dell EMC PowerEdge FX	em2	bond0
Dell EMC PowerEdge FX	em3	bond1
Dell EMC PowerEdge FX	em4	bond1

 **Note:** Interface names may be different depending on the Server and NIC BIOS.

Storage Sled Drive Configuration

The storage sled, Dell EMC PowerEdge FD332, may be ordered with up to 4 SSD drives for Ceph Storage journaling. To ensure optimum performance it is best to check the layout of the drives and ensure they are in optimum sled drive-bays, for when the controller is in split mode. The proper drive bays for journaling drives are 0,1,8, and 9.



Figure 5: Storage Sled Dell EMC PowerEdge FD332 Drive Layout

The drive positioning will be used in creating the Ceph Storage OSD Configuration for the *dell-environment.yaml* file, which is discussed in the [Dell EMC Ready Bundle for Red Hat OpenStack Platform Software Deployment Guide, version 10.0.1](#).



Note: For further information about controller split mode, drive positioning, and the proper way to handle the equipment see the [Dell EMC PowerEdge FD332 Owner's Manual](#).

Powering Up the Equipment

To perform the power on test:



Note: This is usually performed by the Dell EMC EDT Team.

1. Power on each server node, individually.
2. Wait for internal system diagnostic procedures to complete.
3. Power on the network switches.
4. Wait for the switches' internal system diagnostic procedures to complete.

Verifying the Equipment

The cluster hardware should be verified before physical installation begins. After installation, the final functional tests should be run.

Recommended validation steps:

1. All power on tests complete successfully.
2. All drives should be powered on, verify that the hardware diagnostic LEDs and system console does not report any errors.
3. All nodes should be checked for correct memory size.
4. All network ports and cables should be checked for connections.

Tested BIOS and Firmware

Table 3: Dell Storage Tested Software and Firmware Versions on page 15 lists the Dell Storage Center, PS Series, and SC Series software and firmware versions that were tested for the Dell EMC Ready Bundle for Red Hat OpenStack Platform.

Table 4: Dell Networking Tested Firmware Versions on page 16 lists the S3048-ON, S4048-ON, and S6000-ON switch firmware versions that were tested for the Dell EMC Ready Bundle for Red Hat OpenStack Platform.

 **Caution:** You must ensure that the firmware on all servers, storage devices, and switches is up to date. Otherwise, unexpected results may occur.

Table 2: Dell EMC PowerEdge FC630/Dell EMC PowerEdge FD332 Tested BIOS and Firmware Versions

Product	Version
BIOS	2.0.1
iDRAC Firmware	2.30.30.30(50)
CPLD Version	1.05
Lifecycle Controller	2.30.30.30
Intel® X710 10G NIC	17.0.12
PERC H330 RAID Controller	4.250.01-4405
Chassis Management Controller (CMC)	1.30

Table 3: Dell Storage Tested Software and Firmware Versions

Product	Version
Dell Storage Center Software	2016 R2 Build 16.2.1.228
PS Series Firmware	9.0.5
SC Series Firmware	6.5.20.17

Table 4: Dell Networking Tested Firmware Versions

Product	Version
S3048-ON Firmware	9.11(0.0)
S4048-ON Firmware	9.11(0.0P2)
S6000-ON Firmware	9.11(0.0P2)

Chapter

3

Configuring Your Network

Topics:

- [Network Configuration Overview](#)
- [Using the Workbook](#)
- [Dell Networking Switches Default Solution Values](#)
- [Optional: S6000-ON Switches](#)
- [Splitting Ports on S6000-ON](#)
- [Third-Party Network Hardware](#)

This topic describes the procedures required to configure the Dell EMC Ready Bundle for Red Hat OpenStack Platform network.

Network Configuration Overview

Complete the following steps to set up your network:

1. Determine the VLANs to be used and how they are used.
2. Determine the IP ranges and associate them to a VLAN.
3. Fill in the Solution Workbook. See [Using the Workbook](#) on page 18.
4. Ensure that the cabling matches your Workbook.
5. Configure your switches per the Workbook:
 - [Dell Networking Switches Default Solution Values](#) on page 19

Using the Workbook

 **Note:** The Solution Workbook was designed for Dell EMC and Red Hat deployment services to use as a general worksheet for planning a deployment. It is available upon request, as explained in [Dependencies](#) on page 9, for customers performing a self-deployment. For the Network Configuration portion of the deployment procedure, only the worksheets on Dell Networking are required. The rest of the worksheets are optional.

The *Solution Workbook* is set up to enable the installers to use the same information to:

- Program the switches
- Build the configuration for each node

Using the worksheet you must complete the following tasks for each connection from Server to Switch.

On Any Page:

- If the information is indicated as *required*, then it is needed in order to ensure a successful install.
- We provide a table for you to complete, similar to [Table 5: Example VLAN Assignments](#) on page 18.

 **Note:** When configuring your networks they must be aligned so that the tenant networks can be expanded by adding a VLAN for each OpenStack virtual network. This is accomplished by assigning all the other networks to lower VLAN numbers than that of the internal tenant network. The solution, as tested, uses a single external network for tenants. A service motion can be arranged to allow dedicated external tenant networks.

Table 5: Example VLAN Assignments

VLAN Name	Recommended VLAN
Management/Out of Band (OOB) Network	110
Provisioning Network VLAN	120
Tenant Tunneling Network VLAN	130
Private API Network VLAN	140
Storage Network VLAN	170
Storage Clustering Network VLAN	180
Public API Network VLAN (API, GUI)	190
External Network VLAN for Tenants (tenants' floating IP addresses)	191

VLAN Name	Recommended VLAN
Internal Networks VLAN for Tenants	200+

 **Note:** Management/Out of Band network ports Management 1/1 is used by the VLT for the heartbeat, and must terminate on the same VLAN in the same IP address range.

On the General Configuration Page:

- Fill in the information needed as required by the site.

On the Switch Configuration Pages:

- **Name** - The Port name on the switch.
- **Connector** - The type of connector used.
- **Device Name** - The name of the server/device connected to the switch. It is helpful to use a name that describes the server usage and associated bond.
- **Port** - The Network Interface Card (NIC) name and port number as the OS would generate.
- **Untagged** and **Tagged** - Used to indicate what VLAN(s) the port should be used, and how.
- **Port-channel number** - The unique number on the switch that represents the port-channel. Each pair in a server bond must have their own unique port-channel number, which is the same on both switches.
- **Mode** - The mode the port-channel will use [802.3ad](#) for all nodes.

Working switch configurations based on the validated solution are included within the Open Source Hardware Configuration Toolkit (OS-HCTK) tgz file.

Dell Networking Switches Default Solution Values

 **Note:** The VLT ports differ, and are defined in the example.

Table 6: Switch Port Defaults

CLI Command	Reccomended Default	Example
ip address	No IP address assigned	no ip address
portmode	Hybrid mode	portmode hybrid
switchport	Enabled - after portmode hybrid executed	switchport
mtu	9216 on S3048-ON; 9216 on S4048-ON	mtu 9216 or mtu 9216
flowcontrol	Flow control receive on, transmit off	flowcontrol rx on tx off
spanning-tree	Rapid Spanning Tree set to Edge-Port going to servers.	spanning-tree rstp edge-port

Optional: S6000-ON Switches

The *Dell EMC Ready Bundle for Red Hat OpenStack Platform Reference Architecture* is prescriptive in its hardware, software, networking, and installation definitions. This ensures a consistent experience when you create your OpenStack environment.

The Reference Architecture uses Dell Networking™ S4048-ON switches. However, when the solution is expanded, or initially built beyond ten (10) systems, it can benefit from using Dell EMC's newest aggregation and Top-of-Rack (TOR) switches - the Dell Networking S6000-ON switches. The S6000-ON provides the following benefits:

- Leverages a non-blocking switching architecture
- Delivers line-rate L2 and L3 forwarding capacity
- Provides up to 96 ports of 10Gbe, and eight (8) additional ports of 40Gbe

To utilize the S6000-ON in the solution:

1. Replace up to four S4048-ONs with two S6000-ONs.
2. Mount the two switches in separate racks, so that they draw power from different Power Distribution Units (PDUs).
3. Using the 40G to 10G splitter cables, wire the servers so that each of the two 10Gb ports is connected to a port on a separate switch (e.g., no single NIC has both ports connected to the same switch).

Splitting Ports on S6000-ON

There are several considerations you must take into account when splitting ports on Dell Networking S6000-ON switches:

- Splitting a single 40G port into four 10G ports is supported only on a standalone unit.
- Split ports cannot be used as stack-link to stack an S6000-ON.
- Split ports cannot be a part of any stacked system.
- Some of the ports on an S6000-ON are fixed 40G ports. Therefore, splitting those ports is not allowed.
 - Fixed ports include ports 4, 12, 20, 28, 100, 108, 116, and 124.
- Reload is mandatory when:
 - QSFP ports are converted into 4x 10G SFP+ ports using the `portmode quad` CLI command
 - Converting quad ports back to a QSFP port

To split a port:

1. Log onto the switch.
2. Execute the following command:

```
stack-unit 0 port 48 portmode quad
```

Third-Party Network Hardware

If you are not using Dell Networking S3048-ON and/or S4048-ON switches, you must program the switches to support your cloud instantiation. Your switches are expected to support the following:

- Support for IEEE 802.1Q VLAN traffic and port tagging
- Support for using one untagged and multiple tagged VLANs on the same port
- The ability to provide a minimum of 170 Gigabit Ethernet ports, in a non-blocking configuration, within the Provisioning VLAN
 - Configuration can be a single switch or a combination of stacked switches, to meet the additional requirements
- The ability to create link aggregation groups (LAGs) with a minimum of two physical links in each LAG
- If multiple switches are stacked:

- The ability to create a LAG across stacked switches
- Full-bisection bandwidth
- Support for VLANs to be available across all switches in the stack
- 250,000 packets-per-second capability per switch
- A managed switch that supports both SSH and serial line configuration
- SNMP v3 support

Chapter

4

Configuring PowerEdge Hardware

Topics:

- [IPMI Configuration](#)
- [Configuring the CMC on Dell EMC PowerEdge FX](#)
- [Configuring Server User Information](#)
- [Configuring Server Network Settings](#)
- [Validating Server IPMI Configuration](#)
- [Infrastructure and Virtualization Node Settings](#)
- [Open Source Hardware Configuration Toolkit](#)

This section describes manually configuring PowerEdge server hardware for the Dell EMC Ready Bundle for Red Hat OpenStack Platform with Red Hat OpenStack Platform:

- IPMI Configuration
- BIOS Configuration
- RAID Configuration

IPMI Configuration

The servers' iDRACs must be configured correctly for Dell EMC Ready Bundle for Red Hat OpenStack Platform deployment. Dell EMC recommends that you use the OS-HCTK to configure the iDRAC on the SAH node. See [iDRAC Default Settings](#) on page 25 for further details. Overcloud nodes' iDRACs should be configured correctly by the factory, with the possible exception of network settings. See [Configuring Server Network Settings](#) on page 23 for details on configuring iDRAC network settings.

Configuring the CMC on Dell EMC PowerEdge FX

To configure the CMC Network, perform the following steps. Instructions for cabling are listed after these steps if you select a redundant configuration.

1. Configure an Ethernet port on a workstation to have a static IP address of 192.168.0.110, with a netmask of 255.255.255.0 and gateway of 192.168.0.1.
2. Connect the Ethernet port directly to the GB1 port of the CMC.
3. Open a browser window (for supported browsers see the CMC release notes) and type the default static IP address of the CMC: 192.168.0.120.
4. Log in to the CMC Web Interface as root (password *calvin*).
5. Go to the Network Configuration page at Chassis Overview # Network # Network.
6. Record the MAC address.
7. Select the settings that are appropriate for your network environment and select Apply Changes. Your current connection to the CMC may get disconnected and may have to reconnect based on the settings you just changed.
8. Use the CMC to program the network address for each Server iDRAC in the Chassis.

 **Note:** If you have chosen DHCP, the CMC must now be connected to a network with an active DHCP server, and you must either find the assigned address on the DHCP server (using the MAC address recorded in step 6) or log in to the CMC serial port (115200,8,n,1) and examine the output of the command `getniccfg -m chassis`. The CMC network settings can also be accessible from any server console in the KVM through the iDRAC pre-boot environment HII menu under “CMC Network Settings link”

Configuring Server User Information

1. Set credentials for the root user, including changing the password based upon good password standards.
2. Set privileges for the user to the Admin level, including over LAN.
3. Enable the user, if disabled.

Configuring Server Network Settings

1. Set the iDRAC IP address source:
 - a. If the Overcloud nodes were ordered with the iDRACs configured for DHCP, or are currently configured for DHCP, then no further configuration is necessary.
 - b. If you wish to use static IP addresses, then configure the Overcloud nodes' DRAC IP address, subnet mask, default gateway IP, and default VLAN (ID = 110, if required) using the iDRAC GUI.

Validating Server IPMI Configuration

Validating that remote commands can be executed is an essential part of the IPMI setup.

1. Install the IPMI Utilities to your workstation from SourceForge:
 - a. For Linux® - <http://sourceforge.net/projects/ipmitool/>
 - b. For Windows® - <http://ipmiutil.sourceforge.net/>
 - c. Validate that you have all the requirements, and that it will run.
2. Plug your Ethernet port into a switch port that is on the same VLAN as your iDRACs.
3. Configure your NIC to use an IP address in the iDRAC network range.
4. Execute the following IPMI command, replacing "username" and "password" with the credentials for the iDRACs:

```
for i in $(seq 162 170); do ipmitool -P "password" -U "username" -I
lanplus -H 192.168.200.$i power status; done
```

This will perform a simple, non-destructive poll of the power status of the iDRAC from *192.168.200.162* to *192.168.200.170*.

 **Note:** You will need to replace the IP address range and subnet with correct information for the deployed iDRAC subnet.

- a. You can replace the keyword status with *reset*, *off*, or *on*.

 **Note:** These may change the power state of the nodes.

5. Ensure that all machines return responses to the command.

Infrastructure and Virtualization Node Settings

The following settings should be preset from the factory on the Dell EMC PowerEdge FC630; be sure to double-check them:

- [SAH BIOS Specification](#) on page 26

This section describes the settings for nodes that will be used on the Solution Admin Host (SAH), OpenStack controllers, and Compute nodes:

- [OpenStack Controller and Storage Specification](#) on page 26
- [OpenStack SAH and Compute Specification](#) on page 27

Open Source Hardware Configuration Toolkit

The Open Source Hardware Configuration Toolkit (OS-HCTK) is a configuration utility with sample scripts and configuration files that is used to automate the setup and configuration of BIOS and RAID settings for Dell EMC servers used for OpenStack and Hadoop open source software solutions.

The OS-HCTK enables you to create a USB key from which you can boot a Dell EMC PowerEdge FC630 or Dell EMC PowerEdge FD332, and apply the BIOS and RAID settings.

Topics discussed include:

- [Creating the Open Source Hardware Configuration Toolkit ISO](#) on page 25
- [Customizing the ISO](#) on page 25

- [iDRAC Default Settings](#) on page 25
- [SAH BIOS Specification](#) on page 26
- [OpenStack Controller and Storage Specification](#) on page 26
- [OpenStack SAH and Compute Specification](#) on page 27
- [Running the Open Source Hardware Configuration Toolkit ISO](#) on page 27

Creating the Open Source Hardware Configuration Toolkit ISO

To create the OS-HCTK ISO:

1. Ensure you are running in a Linux[®] environment that has the following programs installed:
 - `cpio`
 - `rpm`
 - `rpm2cpio`
2. Ensure the user you are logged in as has passwordless `sudo` rights.
3. Copy the `bootimg.iso` included in the OS-HCTK `tgz` file to your home directory.
4. Run the following command to ensure that the loop module is loaded, so that the script has access to loopback devices:

```
$ sudo modprobe loop
```

5. Copy the ISO onto a USB key using the following command:

```
$ sudo dd if=~/.bootimg.iso of=/dev/sdx bs=2048
```

Where: `/dev/sdx` is the device that was created when the USB key was inserted into the system. The USB key must be at least 512MB in size.

Customizing the ISO

This utility creates a CentOS 6.6 Live CD ISO that has the Dell EMC OS-HCTK installed. It uses `syscfg`, `raidcfg` and `racadm` to configure the system. The main customization point is `bootimg/node-config.sh`, which automatically runs when the ISO finishes booting.

iDRAC Default Settings

[Table 7: iDRAC Specification for SAH Nodes](#) on page 25 lists and describes iDRAC default `racadm` settings that will be set by the OS-HCTK.

Table 7: iDRAC Specification for SAH Nodes

Menu Choice	iDRAC Setting
iDRAC.IPMILan.Enable	Enabled
iDRAC.IPMILan.PrivLimit	4
iDRAC.IPv4.Enable	Enabled
iDRAC.Users.2.Enable	Enabled
iDRAC.Users.2.IpmiLanPrivilege	4
iDRAC.Users.2.Privilege	0x1ff
iDRAC.WebServer.Enable	Enabled

SAH BIOS Specification

Table 8: SAH BIOS Specification on page 26 lists and describes the default BIOS settings for the OpenStack servers that will be set by the OS-HCTK.

Table 8: SAH BIOS Specification

Display Name	Attribute	Settings
Boot Mode	BootMode	BIOS
Boot Sequence Retry	BootSeqRetry	Enabled
DCU IP Prefetcher	DculpPrefetcher	Enabled
DCU Streamer Prefetcher	DcuStreamerPrefetcher	Enable
Logical Processor Idling	DynamicCoreAllocation	Disabled
Integrated RAID Controller	IntegratedRaid	Enabled
Internal SD Card	InternalSdCard	Off
I/OAT DMA Engine	loatEngine	Enabled
Logical Processor	LogicalProc	Enabled
Memory Operating Mode	MemOpMode	OptimizerMode
System Memory Testing	MemTest	Disabled
Node Interleaving	NodeInterleave	Disabled
OS Watchdog Timer	OsWatchdogTimer	Disabled
Adjacent Cache Line Prefetch	ProcAdjCacheLine	Enabled
Number of Cores per Processor	ProcCores	all
Execute Disable	ProcExecuteDisable	Enabled
Hardware Prefetcher	ProcHwPrefetcher	Enabled
CPU Power Management	ProcPwrPerf	MaxPerf
Turbo Mode	ProcTurboMode	Enabled
Virtualization Technology	ProcVirtualization	Enabled
QPI Speed	QpiSpeed	MaxDataRate
Alternate RTID (Requestor Transaction ID) Setting	RtidSetting	Disabled
SR-IOV Global Enable	SriovGlobalEnable	Enabled
System Profile	SysProfile	PerfOptimized

OpenStack Controller and Storage Specification

Table 9: OpenStack Controller and Storage Node Specification on page 27 lists and describes OpenStack Controller and Storage Node parameters that differ from *SAH BIOS Specification* on page 26. Controller nodes are sometimes referred to as Infrastructure nodes.

Table 9: OpenStack Controller and Storage Node Specification

Display Name	Attribute	Settings
SR-IOV Global Enable	SriovGlobalEnable	Disabled

OpenStack SAH and Compute Specification

Table 10: OpenStack SAH and Compute Specification on page 27 lists and describes SAH and the Compute parameters that differ from *SAH BIOS Specification* on page 26.

Table 10: OpenStack SAH and Compute Specification

Display Name	Attributes	Settings
Virtualization Technology	ProcVirtualization	Enabled

Running the Open Source Hardware Configuration Toolkit ISO

To run the OS-HCTK ISO:

1. Boot each system to be configured from the USB key.
2. Once the system finishes booting, it displays the detected RAID controllers along with their current configuration; and offers you a choice of system configurations.
 - a. Select a system configuration based upon the role that the node will play:
 - OpenStack Infrastructure (Controller)
 - OpenStack Compute
 - OpenStack Storage
 - OpenStack SAH
3. The OS-HCTK automatically configures the RAID and BIOS settings. Once finished, it will ask you to provide basic iDRAC connectivity information, including:
 - a. Whether the iDRAC should use DHCP
 - b. Or, basic IPv4 settings if not using DHCP
4. The system configures the iDRAC with some default settings plus the network settings from Step 3 above. Once it finishes applying those settings, it prompts you to reboot the system.
5. Assuming there were no errors, remove the USB key and then reboot the system.

The changes are applied, and the system is configured for its role.

Chapter 5

Dell Storage PS Series Storage Group

Topics:

- [Dell Storage PS Series Configuration Information](#)

The PS Series Storage Group can consist of one or more storage arrays with one or more storage groups.



Note: The configuration of the arrays is beyond the scope of this document. Please refer to the Dell Storage PS Series Support Website (<https://eqsupport.dell.com/secure/login.aspx>) for the latest guides, whitepapers, and best practices on how to setup your Storage Group for your application.

Dell Storage PS Series Configuration Information

Once the Storage Group(s) are setup, the information contained in [Table 11: PS Series Information Needed from Configuration](#) on page 29 must be collected to configure your storage backend.

 **Note:** To reduce volume initialization time, Dell EMC recommends that `san_thin_provision` be set to `true`.

More information can be found at <https://access.redhat.com/documentation/en/red-hat-openstack-platform/8/dell-equallogic-back-end-guide/dell-equallogic-back-end-guide>.

Table 11: PS Series Information Needed from Configuration

[DEFAULT]	Description
<code>volume_driver = cinder.volume.drivers.eqlx.DellEQLSanISCSIDriver</code>	Dell Storage PS Series volume driver
<code>san_ip = <IP_address_of_EQLX></code>	IP address used to reach the PS Series Group through SSH
<code>san_login = <user_name></code>	User name to login to the Group manager via SSH at the <code>san_ip</code>
<code>san_password = <password></code>	Password to login to the Group manager via SSH at the <code>san_ip</code> (not used when <code>san_private_key</code> is set)
<code>san_thin_provision = <true false></code>	Enable/disable creation of thin-provisioned volumes
<code>san_ssh_port = 22</code>	Port used for SSH
<code>ssh_conn_timeout = 30</code>	Timeout value, in seconds, used by CLI commands over SSH
<code>san_private_key = <filename></code>	Filename of the private key used for SSH authentication
<code>ssh_min_pool_conn = 1</code>	Minimum number of SSH connections in the pool
<code>ssh_max_pool_conn = 5</code>	Maximum number of SSH connections in the pool
<code>eqlx_chap_login = admin</code>	Existing CHAP account name
<code>eqlx_chap_password = password</code>	Password for specified CHAP account name
<code>eqlx_cli_max_retries = 5</code>	Maximum retry count for reconnection
<code>eqlx_cli_timeout = 30</code>	Timeout for the Group Manager CLI command execution
<code>eqlx_group_name = group-0</code>	Group name to use for creating volumes

[DEFAULT]	Description
eqlx_pool = default	Pool in which volumes will be created
eqlx_use_chap = False	Use CHAP authentication for targets?

Chapter 6

Dell Storage SC Series Storage Arrays

Topics:

- [Dell Storage SC Series Configuration Information](#)

The SC Series can consist of one or more Dell Storage Centers with Dell Storage Enterprise Manager platform.



Note: The configuration of the cluster is beyond the scope of this document. Please refer to the Dell Storage SC Series support website, <http://www.dell.com/support/contents/us/en/19/article/Product-Support/Dell-Subsidiaries/compellent>, for the latest guides, white papers, and best practices on how to setup your storage cluster.

Dell Storage SC Series Configuration Information

Once the Dell Storage SC Series with the Dell Storage Enterprise Manager platform is setup according to the [Dell EMC Ready Bundle for Red Hat OpenStack Platform Reference Architecture](#), the information contained in [Table 12: SC Series Information Needed from Configuration](#) on page 32 must be collected to configure your storage backend.

More information can be found at <https://access.redhat.com/documentation/en/red-hat-openstack-platform/version-8/dell-storage-center-back-end-guide/>

Table 12: SC Series Information Needed from Configuration

[DEFAULT]	Description
Required Values	
<code>volume_backend_name = delliscsi</code>	Name given to the storage backend
<code>volume_driver = cinder.volume.drivers.dell.dell_storagecenter_iscsi.DellStorageCenterISCSIDriver</code>	Dell Storage SC Series iSCSI volume driver
<code>san_ip = <IP_address></code>	IP address of Enterprise Manager
<code>san_login = <user_name></code>	User name to log into Enterprise Manager at the <code>san_ip</code>
<code>san_password = <password></code>	Password to log into the Enterprise Manager at the <code>san_ip</code>
<code>iscsi_ip_address = <IP_address></code>	The Storage Center iSCSI IP address
<code>dell_sc_ssn = <serial_number></code>	The Storage Center serial number to use
Optional Vaules	
<code>dell_sc_api_port = <port_to_use></code>	Configured Enterprise Manager API port, default is 3033
<code>dell_sc_server_folder = <folder_name></code>	Server folder in which to place new server definitions
<code>dell_sc_volume_folder = <folder_name></code>	Volume folder in which to place created volumes
<code>iscsi_port = <port_number></code>	iSCSI port to use, if you do not wish to use the default port number 3260

Chapter 7

Bills of Materials

Topics:

- [Bill of Materials for PowerEdge FX Solution](#)

This guide provides Bill of Material information necessary to purchase the proper hardware to deploy the Dell EMC Ready Bundle for Red Hat OpenStack Platform.



Note: SKUs in these Bills of Materials are valid as of the publication date. If any SKUs are subsequently superseded please contact your Dell EMC sales representative for replacement SKUs.

Bill of Materials for PowerEdge FX Solution

The Dell EMC Ready Bundle for Red Hat OpenStack Platform PowerEdge FX Solution is comprised of 4 chassis and 2 Dell Networking S4048-ON switches.

Topics discussed include:

- [Dell EMC PowerEdge FX2 Chassis 1 - SAH Controller/2 Compute Nodes](#) on page 34
- [Dell EMC PowerEdge FX2 Chassis 2 - Controller/Compute/Storage Node](#) on page 39
- [Dell EMC PowerEdge FX2 Chassis 3 - Controller/Compute/Storage Node](#) on page 44
- [Dell EMC PowerEdge FX2 Chassis 4 - 2 Compute/Storage Node](#) on page 50
- [Server Racks and Power](#) on page 54
- [Bill of Materials - 2 Dell Networking S4048-ON Switches](#) on page 54
- [Bill of Materials - Cables for PowerEdge FX Solution](#) on page 54
 - [Switch and Cable Notes](#) on page 55
- [Software Subscriptions for All Solutions](#) on page 55
 - [Bill of Materials - FX2- Software Licenses](#)

Dell EMC PowerEdge FX2 Chassis 1 - SAH Controller/2 Compute Nodes

Table 13: Chassis 1 – Dell EMC PowerEdge FX2 SAH/Controller/Compute Nodes

SKU	Description	Quantity
Dell EMC PowerEdge FX2 Chassis		
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
210-ABUX	PowerEdge FX2	1
321-BBFM	PowerEdge FX2 Chassis for upto 4 Half-Width Nodes	1
321-BBFZ	FX2S Chassis Configuration Label	1
321-BBGH	PowerEdge FX2S Chassis Configuration with Flexible IO (up to 8 PCIe Slots)	1
340-AGKB	PowerEdge FX2 Shipping	1
403-BBEQ	SD Storage for Chassis Management Controller	1
634-0287	CMC Enterprise for FX2	1
542-BBBS	PowerEdge FX2 10Gbe Pass Through Module, Internal 8 ports to External 8 ports	2
770-BBER	FX2 ReadyRails Sliding Rails	1
450-ADTZ	Power Supply, Redundancy Alerting Enabled Configuration	1
450-AENU	Dual, Hot-plug, Redundant Power Supply, 2000W, C19/C20 Power Cord Required for Use	1
492-BBEI	Power Cord, C20 to C19, PDU Style, 16A, 250V, 2ft (0.6m)	2

SKU	Description	Quantity
343-BBBW	USER Guide, FX2 Chassis	1
421-5736	No Media Required	1
332-1286	US Order	1
973-9918	Mission Critical Package: 4-Hour 7x24 On-Site Service withEmergency Dispatch, Initial Year	1
973-9938	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
973-9919	Mission Critical Package: 4-Hour 7x24 On-Site Service withEmergency Dispatch, 2 Year Extended	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
973-9947	MISSION CRITICAL PACKAGE: Enhanced Services, 3 Year	1
973-9867	Dell Hardware Limited Warranty Plus On Site Service Extended Year	1
973-9866	Dell Hardware Limited Warranty Plus On Site Service Initial Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
804-6779	ProDeploy Dell Server FX2 Converged - Deployment Verification	1
804-6778	ProDeploy Dell Server FX2 Converged - Deployment	1
973-2426	Declined Remote Consulting Service	1
qty 2 Computes -		
331-6781	ACES QUALITY REVIEW	2
379-BCVO	OpenStack Cloud Compute NOD	2
469-3879	ESO ORDER ONLY Send PO to ACES	2
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	6
210-ACWK	PowerEdge FC630 Server Node	2
329-BCZL	PowerEdge FC630 Motherboard MLK	2
389-BESB	PowerEdge FC630 Regulatory Label, DAO	2
461-AADM	PowerEdge Server FIPS TPM 2.0	2
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	2
750-AADI	System ordered as part of Multipack order	2
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	2
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	2
374-BBHL	DIMM Blanks for System with 2 Processors	2
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	2
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	2
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	2

SKU	Description	Quantity
384-BBDS	Standard Cooling,FC630	2
370-ACPH	2400MT/s RDIMMs	2
370-AAIP	Performance Optimized	2
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	16
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	2
405-AAED	H330 Controller	2
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	4
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	2
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	2
634-BBWU	OpenManage Essentials, Server Configuration Management	2
330-BBCY	No Internal SD Module	2
384-BBBL	Performance BIOS Settings	2
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	2
420-6320	No Operating System	2
421-5736	No Media Required	2
332-1286	US Order	2
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	2
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	2
997-0181	Dell Hardware Limited Warranty Plus On Site Service	2
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	2
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	2
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	2
900-9997	On-Site Installation Declined	2
Dell EMC PowerEdge FC630 qty 1 - SAH		
331-6781	ACES QUALITY REVIEW	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
379-BCVO	OpenStack Cloud Compute NOD	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1

SKU	Description	Quantity
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
Dell EMC PowerEdge FC630 qty 1 - Controller		
331-6781	ACES QUALITY REVIEW	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3

SKU	Description	Quantity
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1

SKU	Description	Quantity
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
460-0864	SOC QUALITY REVIEW	3

Dell EMC PowerEdge FX2 Chassis 2 - Controller/Compute/Storage Node

Table 14: Chassis 2 – Dell EMC PowerEdge FX2 Controller/Compute/Storage Nodes

SKU	Description	Quantity
Dell EMC PowerEdge FX2 Chassis		
379-BCVO	OpenStack Cloud Compute NOD	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
331-6781	ACES QUALITY REVIEW	1
210-ABUX	PowerEdge FX2	1
321-BBFM	PowerEdge FX2 Chassis for upto 4 Half-Width Nodes	1
321-BBGH	PowerEdge FX2S Chassis Configuration with Flexible IO (up to 8 PCIe Slots)	1
321-BBFZ	FX2S Chassis Configuration Label	1
340-AGKB	PowerEdge FX2 Shipping	1
403-BBEQ	SD Storage for Chassis Management Controller	1
634-0287	CMC Enterprise for FX2	1
542-BBBS	PowerEdge FX2 10Gbe Pass Through Module, Internal 8 ports to External 8 ports	2
770-BBER	FX2 ReadyRails Sliding Rails	1
450-ADTZ	Power Supply, Redundancy Alerting Enabled Configuration	1
450-AENU	Dual, Hot-plug, Redundant Power Supply, 2000W, C19/C20 Power Cord Required for Use	1
492-BBEI	Power Cord, C20 to C19, PDU Style, 16A, 250V, 2ft (0.6m)	2
343-BBBW	USER Guide, FX2 Chassis	1
421-5736	No Media Required	1
332-1286	US Order	1
973-9867	Dell Hardware Limited Warranty Plus On Site Service Extended Year	1
973-9885	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, 2 Year Extended	1

SKU	Description	Quantity
973-9906	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
973-9884	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, Initial Year	1
973-9866	Dell Hardware Limited Warranty Plus On Site Service Initial Year	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
804-6778	ProDeploy Dell Server FX2 Converged - Deployment	1
804-6779	ProDeploy Dell Server FX2 Converged - Deployment Verification	1
973-2426	Declined Remote Consulting Service	1
Dell EMC PowerEdge FC630 Quantity 1 - Controller		
331-6781	ACES QUALITY REVIEW	1
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2

SKU	Description	Quantity
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
Dell EMC PowerEdge FC630 Quantity 1 - Compute		
331-6781	ACES QUALITY REVIEW	1
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADZ	No Trusted Platform Module	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1

SKU	Description	Quantity
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAEU	H730 Controller	1
400-AJRB	300GB 15K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
Dell EMC PowerEdge FC630 Quantity 1 - Storage Node		
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1

SKU	Description	Quantity
750-AAID	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1

SKU	Description	Quantity
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
Dell EMC PowerEdge FD332 Quantity 1		
389-BGYB	PowerEdge FD332 Regulatory Label, DAO	1
210-AECJ	PowerEdge FD332 Storage Node	1
461-AADI	PowerEdge FD332 Enclosure with up to 16 2.5" Hard Drives	1
750-AADI	System ordered as part of Multipack order	1
405-AAHJ	FD33xD Dual PERC Controller in HBA Mode	1
400-AMUE	2TB 7.2K RPM NLSAS 12Gbps 512n 2.5in Hot-plug Hard Drive	16
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
973-2426	Declined Remote Consulting Service	1
332-1286	US Order	1
803-0910	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
803-0842	Dell Hardware Limited Warranty Plus On Site Service	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
803-0909	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, 3 Year	1
460-0864	ACES QUALITY REVIEW	1
460-0864	SOC QUALITY REVIEW	3

Dell EMC PowerEdge FX2 Chassis 3 - Controller/Compute/Storage Node

Table 15: Chassis 3 – Dell EMC PowerEdge FX2 Controller/Compute/Storage Nodes

SKU	Description	Quantity
Dell EMC PowerEdge FX2 Chassis		
379-BCVO	OpenStack Cloud Compute NOD	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
331-6781	ACES QUALITY REVIEW	1
210-ABUX	PowerEdge FX2	1
321-BBFM	PowerEdge FX2 Chassis for upto 4 Half-Width Nodes	1
321-BBGH	PowerEdge FX2S Chassis Configuration with Flexible IO (up to 8 PCIe Slots)	1
321-BBFZ	FX2S Chassis Configuration Label	1
340-AGKB	PowerEdge FX2 Shipping	1

SKU	Description	Quantity
403-BBEQ	SD Storage for Chassis Management Controller	1
634-0287	CMC Enterprise for FX2	1
542-BBBS	PowerEdge FX2 10Gbe Pass Through Module, Internal 8 ports to External 8 ports	2
770-BBER	FX2 ReadyRails Sliding Rails	1
450-ADTZ	Power Supply, Redundancy Alerting Enabled Configuration	1
450-AENU	Dual, Hot-plug, Redundant Power Supply, 2000W, C19/C20 Power Cord Required for Use	1
492-BBEI	Power Cord, C20 to C19, PDU Style, 16A, 250V, 2ft (0.6m)	2
343-BBBW	USER Guide, FX2 Chassis	1
421-5736	No Media Required	1
332-1286	US Order	1
973-9867	Dell Hardware Limited Warranty Plus On Site Service Extended Year	1
973-9885	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, 2 Year Extended	1
973-9906	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
973-9884	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, Initial Year	1
973-9866	Dell Hardware Limited Warranty Plus On Site Service Initial Year	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
804-6778	ProDeploy Dell Server FX2 Converged - Deployment	1
804-6779	ProDeploy Dell Server FX2 Converged - Deployment Verification	1
973-2426	Declined Remote Consulting Service	1
Dell EMC PowerEdge FC630 Quantity 1 - Controller		
331-6781	ACES QUALITY REVIEW	1
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1

SKU	Description	Quantity
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
Dell EMC PowerEdge FC630 Quantity 1 - Compute		
331-6781	ACES QUALITY REVIEW	1

SKU	Description	Quantity
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADZ	No Trusted Platform Module	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAEU	H730 Controller	1
400-AJRB	300GB 15K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1

SKU	Description	Quantity
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
Dell EMC PowerEdge FC630 Quantity 1 - Storage Node		
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
330-BBCY	No Internal SD Module	1

SKU	Description	Quantity
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
Dell EMC PowerEdge FD332 Quantity 1		
389-BGYB	PowerEdge FD332 Regulatory Label, DAO	1
210-AECJ	PowerEdge FD332 Storage Node	1
461-AADI	PowerEdge FD332 Enclosure with up to 16 2.5" Hard Drives	1
750-AADI	System ordered as part of Multipack order	1
405-AAHJ	FD33xD Dual PERC Controller in HBA Mode	1
400-AMUE	2TB 7.2K RPM NLSAS 12Gbps 512n 2.5in Hot-plug Hard Drive	16
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
973-2426	Declined Remote Consulting Service	1
332-1286	US Order	1
803-0910	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
803-0842	Dell Hardware Limited Warranty Plus On Site Service	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
803-0909	ProSupport: Next Business Day Onsite Service After ProblemDiagnosis, 3 Year	1
460-0864	ACES QUALITY REVIEW	1
460-0864	SOC QUALITY REVIEW	3

Dell EMC PowerEdge FX2 Chassis 4 - 2 Compute/Storage Node

Table 16: Chassis 4 – Dell EMC PowerEdge FX2 Compute/Storage Nodes

SKU	Description	Quantity
Dell EMC PowerEdge FX2 Chassis		
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
379-BCVO	OpenStack Cloud Compute NOD	1
331-6781	ACES QUALITY REVIEW	1
210-ABUX	PowerEdge FX2	1
321-BBFM	PowerEdge FX2 Chassis for upto 4 Half-Width Nodes	1
321-BBFZ	FX2S Chassis Configuration Label	1
321-BBGH	PowerEdge FX2S Chassis Configuration with Flexible IO (up to 8 PCIe Slots)	1
340-AGKB	PowerEdge FX2 Shipping	1
403-BBEQ	SD Storage for Chassis Management Controller	1
634-0287	CMC Enterprise for FX2	1
542-BBBS	PowerEdge FX2 10Gbe Pass Through Module, Internal 8 ports to External 8 ports	2
770-BBER	FX2 ReadyRails Sliding Rails	1
450-ADTZ	Power Supply, Redundancy Alerting Enabled Configuration	1
450-AENU	Dual, Hot-plug, Redundant Power Supply, 2000W, C19/C20 Power Cord Required for Use	1
492-BBEI	Power Cord, C20 to C19, PDU Style, 16A, 250V, 2ft (0.6m)	2
343-BBBW	USER Guide, FX2 Chassis	1
421-5736	No Media Required	1
332-1286	US Order	1
973-9918	Mission Critical Package: 4-Hour 7x24 On-Site Service withEmergency Dispatch, Initial Year	1
973-9938	ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	1
973-9919	Mission Critical Package: 4-Hour 7x24 On-Site Service withEmergency Dispatch, 2 Year Extended	1
989-3439	Thank you choosing Dell ProSupport. For tech support, visit http://www.dell.com/support or call 1-800- 945-3355	1
973-9947	MISSION CRITICAL PACKAGE: Enhanced Services, 3 Year	1
973-9867	Dell Hardware Limited Warranty Plus On Site Service Extended Year	1
973-9866	Dell Hardware Limited Warranty Plus On Site Service Initial Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1

SKU	Description	Quantity
804-6779	ProDeploy Dell Server FX2 Converged - Deployment Verification	1
804-6778	ProDeploy Dell Server FX2 Converged - Deployment	1
973-2426	Declined Remote Consulting Service	1
469-3879	ESO ORDER ONLY Send PO to ACES	2
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	6
Dell EMC PowerEdge FC630 Quantity: 2 - Computes		
331-6781	ACES QUALITY REVIEW	2
379-BCVO	OpenStack Cloud Compute NOD	2
329-BCZL	PowerEdge FC630 Motherboard MLK	2
210-ACWK	PowerEdge FC630 Server Node	2
389-BESB	PowerEdge FC630 Regulatory Label, DAO	2
461-AADM	PowerEdge Server FIPS TPM 2.0	2
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	2
750-AADI	System ordered as part of Multipack order	2
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	2
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	2
374-BBHL	DIMM Blanks for System with 2 Processors	2
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	2
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	2
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	2
384-BBDS	Standard Cooling,FC630	2
370-ACPH	2400MT/s RDIMMs	2
370-AAIP	Performance Optimized	2
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	16
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	2
405-AAED	H330 Controller	2
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	4
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	2
634-BBWU	OpenManage Essentials, Server Configuration Management	2
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	2
330-BBCY	No Internal SD Module	2
384-BBBL	Performance BIOS Settings	2
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	2

SKU	Description	Quantity
420-6320	No Operating System	2
421-5736	No Media Required	2
332-1286	US Order	2
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	2
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	2
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	2
997-0181	Dell Hardware Limited Warranty Plus On Site Service	2
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	2
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	2
900-9997	On-Site Installation Declined	2
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
379-BCVO	OpenStack Cloud Compute NOD	1
469-3879	ESO ORDER ONLY Send PO to ACES	1
Dell EMC PowerEdge FC630Quantity 1 - Storage		
331-6781	ACES QUALITY REVIEW	1
329-BCZL	PowerEdge FC630 Motherboard MLK	1
210-ACWK	PowerEdge FC630 Server Node	1
389-BESB	PowerEdge FC630 Regulatory Label, DAO	1
461-AADM	PowerEdge Server FIPS TPM 2.0	1
406-BBFE	2.5" Backplane with up to 2 Hard Drives and PERC RAID Controller	1
750-AADI	System ordered as part of Multipack order	1
338-BJDV	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
338-BJDW	Intel Xeon E5-2650 v4 2.2GHz,30M Cache,9.60GT/s QPI,Turbo,HT,12C/24T (105W) Max Mem 2400MHz	1
374-BBHL	DIMM Blanks for System with 2 Processors	1
412-AAEJ	68MM Heatsink for PowerEdge FC630 Processor 1	1
750-AAFG	68MM Processor Heatsink Shroud for PowerEdge FC630	1
412-AAEK	68MM Heatsink for PowerEdge FC630 Processor 2	1
384-BBDS	Standard Cooling,FC630	1
370-ACPH	2400MT/s RDIMMs	1
370-AAIP	Performance Optimized	1
370-ACNX	16GB RDIMM, 2400MT/s, Dual Rank, x8 Data Width	8
780-BBKM	RAID 1 for H330/H730/H730P (2 HDDs, SAS/SATA/SSD)	1

SKU	Description	Quantity
405-AAED	H330 Controller	1
400-AJQC	300GB 10K RPM SAS 12Gbps 2.5in Hot-plug Hard Drive	2
542-BBCF	Intel X710 Quad Port, 10Gb KR Blade Network Daughter Card	1
385-BBHO	iDRAC8 Enterprise, integrated Dell Remote Access Controller, Enterprise	1
634-BBWU	OpenManage Essentials, Server Configuration Management	1
330-BBCY	No Internal SD Module	1
384-BBBL	Performance BIOS Settings	1
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
420-6320	No Operating System	1
421-5736	No Media Required	1
332-1286	US Order	1
492-BBQT	PowerEdge FC PCIE Mezzanine Adapter	1
997-0218	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance,3 Year	1
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
997-0181	Dell Hardware Limited Warranty Plus On Site Service	1
997-0209	ProSupport Plus: 7x24 Next Business Day Onsite Service, 3 Year	1
909-0259	Dell Proactive Systems Management - Declined - www.dell.com/Proactive	1
900-9997	On-Site Installation Declined	1
973-0922	Commercial Sales Operations - ACES AMER Custom Support Services	3
469-3879	ESO ORDER ONLY Send PO to ACES	1
Dell EMC PowerEdge FD332 Quantity 1		
331-6781	ACES QUALITY REVIEW	1
379-BCVO	OpenStack Cloud Compute NOD	1
389-BGYB	PowerEdge FD332 Regulatory Label, DAO	1
210-AECJ	PowerEdge FD332 Storage Node	1
461-AADI	PowerEdge FD332 Enclosure with up to 16 2.5" Hard Drives	1
750-AADI	System ordered as part of Multipack order	1
405-AAHJ	FD33xD Dual PERC Controller in HBA Mode	1
400-AMUE	2TB 7.2K RPM NLSAS 12Gbps 512n 2.5in Hot-plug Hard Drive	16
631-AACK	No Systems Documentation, NoOpenManage DVD Kit	1
973-2426	Declined Remote Consulting Service	1
332-1286	US Order	1
803-0850	ProSupport Plus: Mission Critical 4-Hour 7x24 On-Site Service with Emergency Dispatch, 3Year	1

SKU	Description	Quantity
951-2015	Thank you for choosing Dell ProSupport Plus. For tech support, visit http://www.dell.com/contactdell	1
803-0842	Dell Hardware Limited Warranty Plus On Site Service	1
803-0849	ProSupport Plus: 7x24 HW/SW Tech Support and Assistance, 3Year	1
460-0864	SOC QUALITY REVIEW	3

Server Racks and Power

Both I/O to PSU SKU numbers and PSU to I/O side options are available for reverse air flow. Redundant fans (other than the minimum supplied with chassis) should also be same direction as the base switch. The airflow cannot be reversed in the field at this time

 **Note:** The networking SKUs lists show the AC power supplies only. All switch models are available in DC as well.

All Bill of Materials do not include racks or power distribution units, as they are usually site-specific. The physical dimensions and power requirements need to be reviewed.

Bill of Materials - 2 Dell Networking S4048-ON Switches

SKU	Description	Quantity
634-BCWZ	Dell NW OS9, S4048-ON	2
634-BCWX	Doc Kit, S4000	2
332-1286	US Order	2
210-ADUZ	S4048,48P,PSU-IO,AC	2
450-AAQC	PSU, PSU/IO Air, S4048	2
450-AASX	250V,12A,2MTR,C13/C14	4
900-9997	ONSITE INSTL DECLINED	2
951-2015	INFO,PSP TECH SPT CONTACT,ENTERPRISE	2
997-6304	HW WRTY,NW S4000,EXT	2
997-6305	HW WRTY,NW S4000,INIT	2
997-6306	Info 3rd Party O/S Warranted by Vendor	2
997-6351	PSP NBD OS,NW S4000,UNY,2YR EXT	2
997-6356	PSP NBD OS,NW S4000,UNY,INIT	2
997-6363	PSP TECH SPT,NW S4000,3YR	2

Bill of Materials - Cables for PowerEdge FX Solution

SKU	Description	Quantity
470-AAFF	DELL NTWK,CBL,QSFP-QSFP DAC,5M	2
470-AAIB	Dell, QSFP+ Direct Attach Cable, .5m	2
470-AAGP	Dell, 3m SFP+ DAC Cable	28
470-AAGR	Dell, 5m SFP+ DAC Cable	4

SKU	Description	Quantity
470-AAGN	Dell, 1m SFP+ DAC Cable	24
407-BBTT	Transceiver SFP, 1000BASE-T	8

Switch and Cable Notes

Bill of Materials - Cables for PowerEdge FX Solution on page 54 includes the cables required for connecting the individual servers into the cluster, since the exact cables required depend on the final chosen rack layout, and choice of cable is often based on customer preference, quantities and specific cables will have to be updated.

Software Subscriptions for All Solutions

A Dell sales representative will determine the correct software subscriptions needed for the Dell EMC Ready Bundle for Red Hat OpenStack Platform.

Appendix

A

References

Topics:

- [To Learn More](#)

Additional information can be obtained at <http://www.dell.com/en-us/work/learn/openstack-cloud> or by e-mailing openstack@dell.com.

If you need additional services or implementation help, please contact your Dell EMC sales representative.

To Learn More

For more information on the Dell EMC Ready Bundle for Red Hat OpenStack Platform visit <http://www.dell.com/learn/us/en/04/solutions/red-hat-openstack>.

Copyright © 2014-2017 Dell Inc. or its subsidiaries. All rights reserved. Trademarks and trade names may be used in this document to refer to either the entities claiming the marks and names or their products. Specifications are correct at date of publication but are subject to availability or change without notice at any time. Dell EMC and its affiliates cannot be responsible for errors or omissions in typography or photography. Dell EMC's Terms and Conditions of Sales and Service apply and are available on request. Dell EMC service offerings do not affect consumer's statutory rights.

Dell EMC, the DELL EMC logo, the DELL EMC badge, and PowerEdge are trademarks of Dell Inc.