

Dell Cloud Solution for  
OpenStack™ Solutions  
**Crowbar Deployment Guide**

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## Notes, Cautions, and Warnings



**NOTE:** A NOTE indicates important information that helps you make better use of your system.



**CAUTION:** A CAUTION indicates potential damage to hardware or loss of data if instructions are not followed.



**WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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## 1 Simple environment setup

This section describes the required steps to achieve the default setup.

### 1.1 Hardware setup

This guide assumes the minimal hardware footprint described below. Please see the Reference Architecture for more details.

Role	Count	Usage	Notes
Bootstrap system	1	Runs the VMPlayer image needed to bootstrap	- Has VMPlayer and the proper VMPlayer image
Admin node	1	Runs Crowbar and infrastructure services	- Console access (KVM)* - 2 NICs
Compute node	3-5	Runs cloud components	- For Swift storage, should have at least 2 disks - Ideally, 2 NICs

\*In the current release, console access to the admin node is required. In future versions, all configuration tasks will be performed without the need for console access.

The hardware on the admin node should be configured as follows:

- **Boot sequence:** BIOS is set to boot from local disk. Note that this is the “normal” operating setting, but for its initial setup boot, the admin node will need to boot from network in order to bootstrap the installation from the VMPlayer image.
- **RAID controller:** All disks should be in a RAID 10 configuration.

BMC and networking settings are configured using Crowbar, and manual steps are not required.

#### 1.1.1 Recommended setup

The minimum configuration for the recommended Starter Solution is 6 nodes (3 two sled C6100s). This configuration can be easily expanded to 10 nodes without any changes to the networking infrastructure. Expansion beyond 10 nodes is accomplished by simply adding blocks of servers and networking them.

In this release of the solution, you can deploy the hardware platform and software on:

- PowerEdge C6100 (two sled configuration)
- Dell PC6248

The PowerEdge C6100 is a multi-node shared infrastructure platform delivered in a 2U chassis. There are two or four compute nodes (servers) that install in the chassis. The PowerEdge C6100 configuration for this release is the 2-node configuration. The PowerEdge C6100 compute node is a dual socket Intel XEONTM server. The only difference is the form factor and number of PCIe slots. Each compute node in the PowerEdge C6100 chassis has access to 12 hot-swappable 2.5” drives.

Compute Node	C6100 (2-node)
Platform	C6100
	12 2.5" Drive, 2-node BP per node
CPU	X5620
RAM	96GB (1333 MHz) per node
Additional Network Controller	None
RAID Controller	LSI 2008
DISK	12 x 600GB 2.5" SAS 10K per node
Cluster Switch	PC 6248

### 1.1.2 Site preparation needed for the deployment

Solution deployment needs some preliminary preparation. This solution does not supply any firewalls or load-balancers. You may want to use firewalls or load-balancing to access and use portions of the solution. Indirectly, a bastion host, installed behind appropriate site specific security systems, can be used to access the Starter Solution and the VMs remotely. This means that direct access to local/internal/external networks should not be done.

For the setup of the admin node, connect a keyboard and monitor. In addition, all that is required is a laptop or another machine that can run VMware Player and connect to the admin node via a crossover network cable.

Estimate the electrical power and cooling usage using the Dell Energy Smart Solution Advisor ([http://www.dell.com/content/topics/topic.aspx/global/products/pedge/topics/en/config\\_calculator?c=us&cs=555&l=en&s=biz](http://www.dell.com/content/topics/topic.aspx/global/products/pedge/topics/en/config_calculator?c=us&cs=555&l=en&s=biz)). Using this tool to plan the appropriate PDU and make sure the cooling is adequate.

## 1.2 Network setup

The network configuration assumes a flat L2 wiring – all network connections should be accessible at that layer. Where isolation between different logical networks is required, VLANs are used.

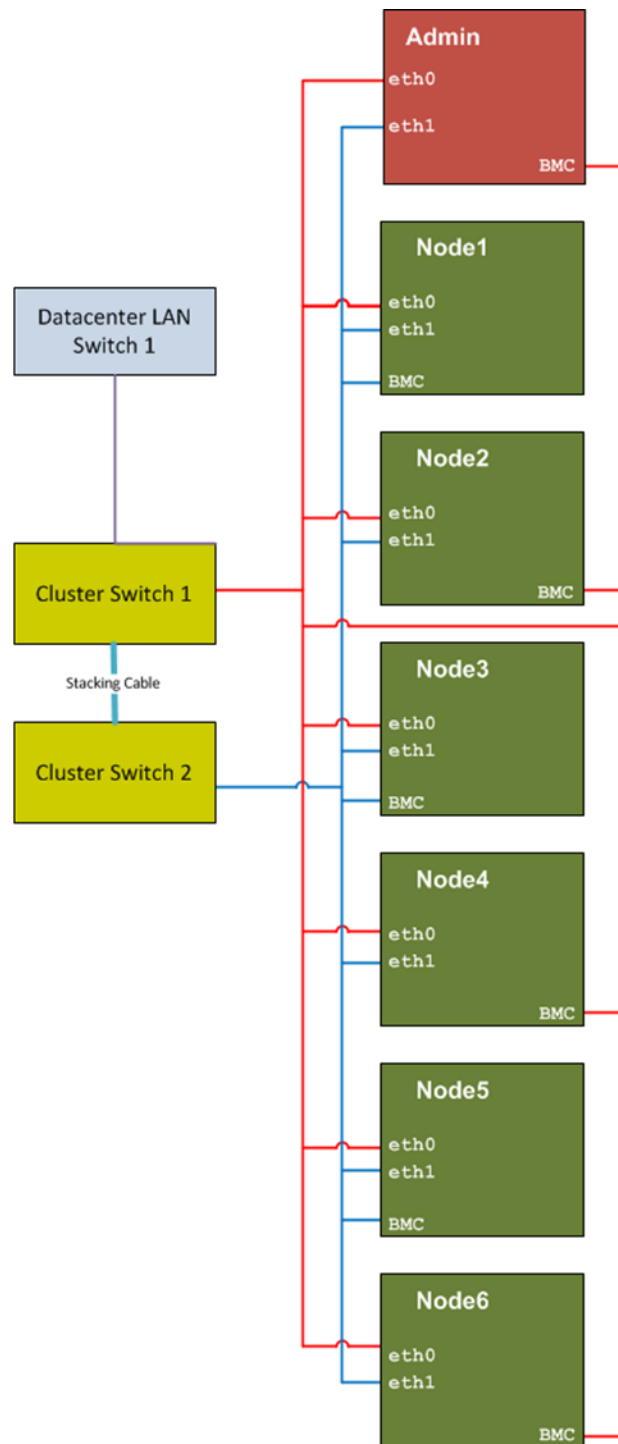
The default networks are presented in the following table.

Usage	Description	Default reserved vLAN tag	Tagged 802.1q
Admin/Internal vLAN	Used for administrative functions such as Crowbar node installation, TFTP booting, DHCP assignments, KVM, system logs, backups, and other monitoring. There is only one vLAN set up for this function and it is spanned across the entire network.	100	Not tagged
BMC vLAN	Used for connecting to the BMC of each node.	100	Not tagged
Storage vLAN	Used by the Swift storage system for replication of data between machines, monitoring of data integrity, and other storage specific functions. (802.1q Tagged)	200	Tagged

External vLANs	Used for connections to devices external to the OpenStack Cloud infrastructure; these include externally visible services such as load balancers and web servers. Use one or many of these networks, dependent on the need to segregate traffic among groups of servers. (802.1q Tagged)	300	Tagged
Nova Floating	Assigned to Nova VMs by the Nova manager. (802.1q Tagged)	400	Tagged
Nova Fixed	Assigned to Nova VMs by the Nova manager. (802.1q Tagged)	500	Tagged

Note: The admin and BMC networks are expected to be in the same L2 network.

The figure below shows example cabling of network connectivity inside the cluster. The network in this solution is not configured for redundancy.



## Node Starter Solution Cabling:

Component	LOM0	LOM1	BMC
CH1SL1	SW1-1	SW2-1	SW1-31
CH1SL2	SW1-2	SW2-2	SW2-31

CH2SL1	SW1-3	SW2-3	SW1-32
CH2SL2	SW1-4	SW2-4	SW2-32
CH3SL1	SW1-5	SW2-5	SW1-33
CH3SL2	SW1-6	SW2-6	SW2-33

(Note: CH = chassis, SL = sled, SW = switch)

All nodes have two (2) 1 Gb NICs. The admin node configures the BMC and the OS is configured to bond the two LOMs. Each NIC and BMC is cabled to the Dell PowerConnect PC6248 per the cabling setup outlined above.

### 1.2.1 Switch Configuration

When deploying the switches the following configuration should be used to appropriately setup the VLANs. The following commands are to be used with a Dell PowerConnect 6248 switch. Modifications will be required depending on the network configuration of the environment.

```

1  #
2  #
3  vlan database
4  vlan 100,200,300,400,500
5  exit
6  interface vlan 100
7  name Admin_Net
8  exit
9  interface vlan 200
10 name Storage_Net
11 exit
12 interface vlan 300
13 name External_Net
14 exit
15 interface vlan 400
16 name Nova_Floating
17 exit
18 interface vlan 500
19 name Nova_Fixed
20 exit
21 #
22 #
23 interface range ethernet 1/g1-1/g48
24 shutdown
25 spanning-tree portfast
26 switchport mode general
27 switchport general pvid 100
28 switchport general allowed vlan add 100
29 switchport general allowed vlan add 200,300,400,500 tagged
30 switchport general allowed vlan remove 1
31 no switchport general acceptable-frame-type tagged-only
32 lldp transmit-tlv port-desc sys-name sys-desc sys-cap
33 lldp transmit-mgmt
34 lldp notification
35 no shutdown
36 exit
37 #
38 #
39 ip address xxx.xxx.xxx.xxx
40 ip address vlan ???
41 ip ssh server
42 #
43 #
44 UPLINK Port
45 interface ethernet 1/gxxx
46 switchport general pvid XXXX
47 no switchport general acceptable-frame-type tagged-only

```



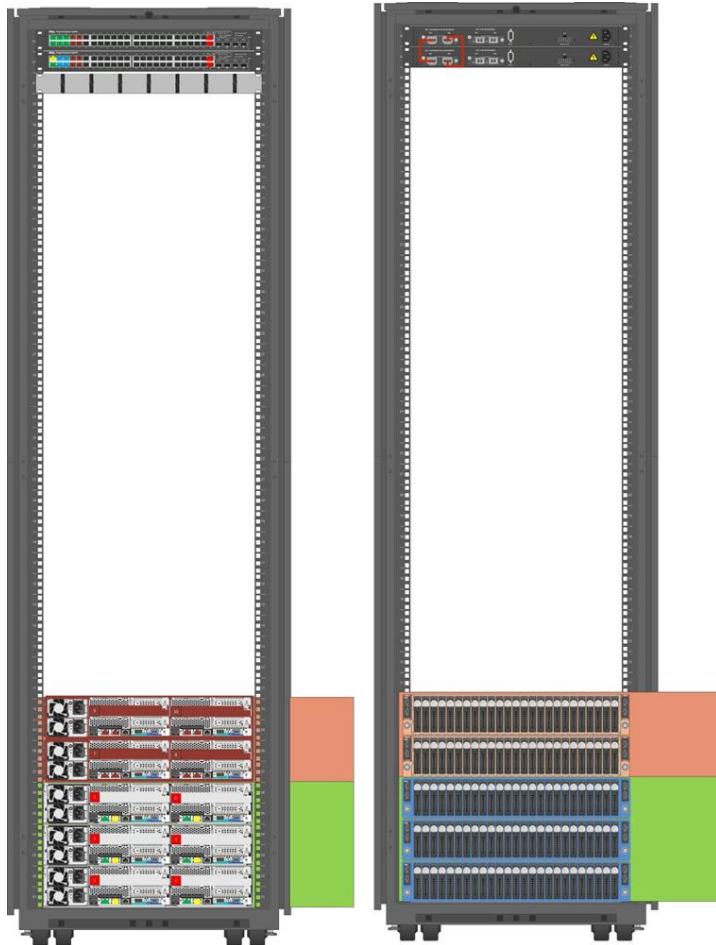
```
48 switchport general allowed vlan add xxxx
49 switchport general allowed vlan add 300 tagged
50 switchport general allowed vlan remove 1
51 lldp transmit-tlv port-desc sys-name sys-desc sys-cap
52 lldp transmit-mgmt
53 lldp notification
54 exit
```

### 1.2.2 Physical configuration

This setup will give the user 1 admin node and 5 compute/storage nodes. There will be 30TB (10 TB usable with a replication factor of 3) of storage and 40 CPU cores. This is done by:

- One 42U rack
- Dell Power Connect 6248
- 1U horizontal cable management
- C6100C 2 sled nodes
- 2 PDUs

Typical Install Solution (rear):

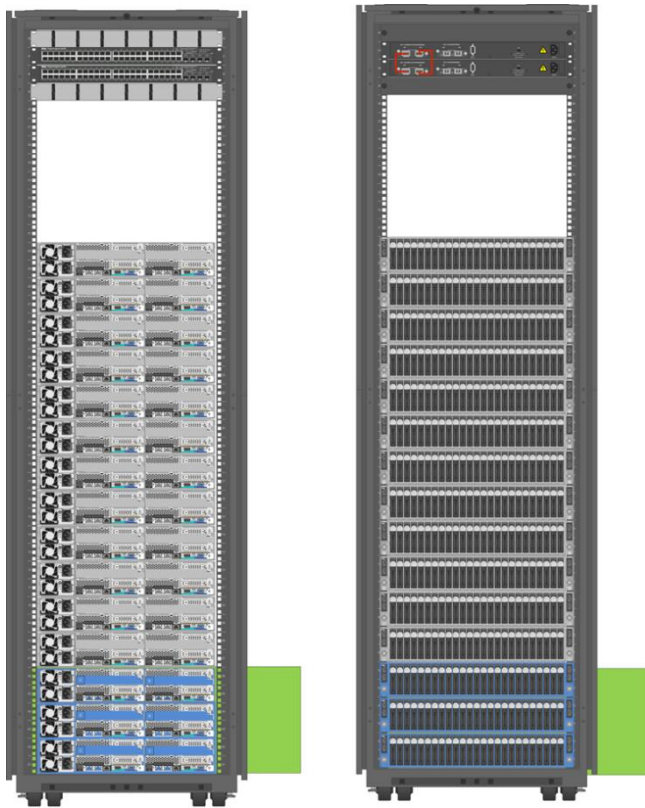


### 1.2.3 Single rack expansion from Starter Solution

You can build the solution to a full rack of nodes to give a total storage of 180 TB (90 TB usable with a replication factor of 3) across 360 Spindles and 240 CPU cores. This configuration gives you 29 Nova and/or Swift nodes and one (1) admin node. You would add:

- 12 C6100C 2 Sled Nodes (7.2TB /Sled)
- 2 PDUs
- Additional cable management

This would appear as in the following diagram (original sleds shaded):



#### 1.2.4 Multi Rack Expansion

Expand the solution further by adding EOR 10 GbE switches and additional racks or equipment. The networking would need to use one of the various hyperscale networking deployments using multiple 10GB LAGs between each of the racks. This will not be covered in the Deployment Guide.

### 1.3 Installing admin node OS

To use Crowbar, you must first install an admin node. Installing the admin node involves installing the base operating system, optionally customizing the Crowbar configuration, and installing Crowbar itself.

The first step is to bootstrap the admin node by PXE booting:

1. The user is expected to make the physical arrangements to connect this VM to the network such that the machine to be used as the admin node can PXE boot from it. A network crossover cable might be required.
2. A VM image with an initial TFTP/DHCP/boot-server is provided. VMware Player is required to execute it. VMware Player may be freely downloaded from VMware's website.

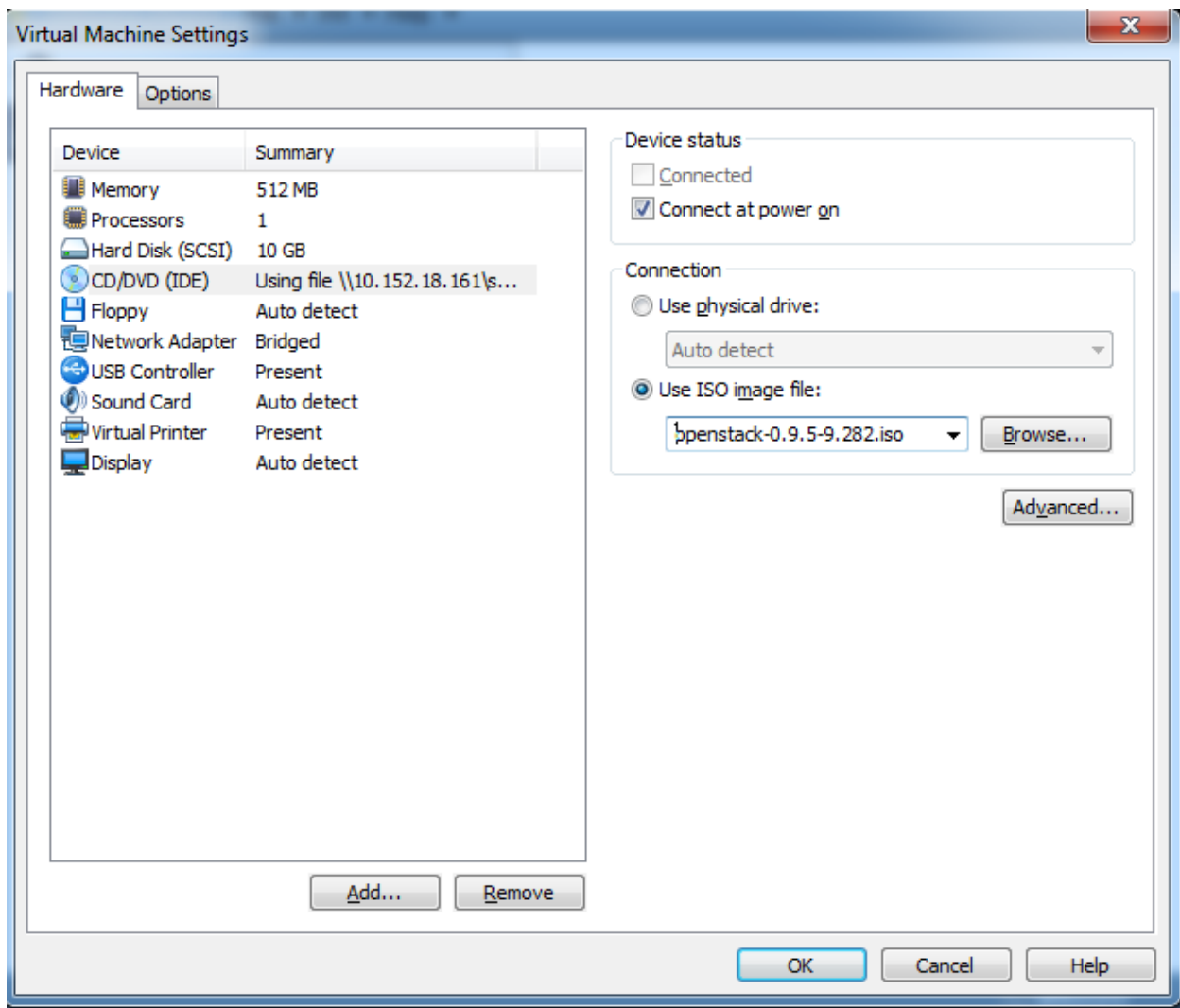
When prepared, install the admin node. (The following steps assume use of a laptop to run VMware Player.)

1. Make sure you have VMware Player installed on the laptop.

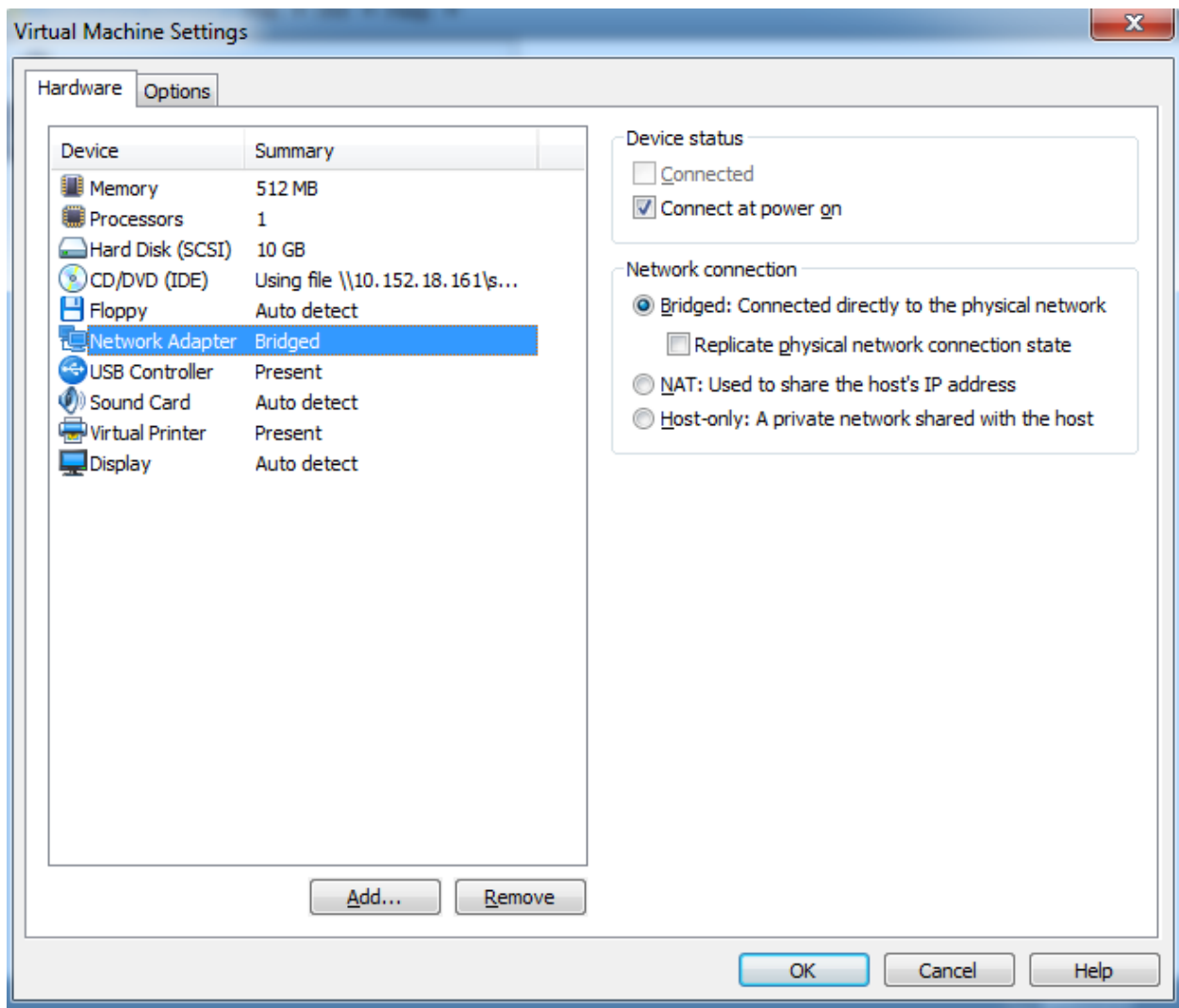
2. Open the VMware machine configuration distributed with Crowbar (this will be a .vmx file).
3. Edit the machine settings within Player and ensure that the network adapter is configured to use Bridged Networking (see images below).
4. Obtain the ISO distribution of Crowbar and configure Player to mount it as a DVD in the VM.
5. Plug the Crossover Cable into eth0 of the server and connect it to the network port of the laptop.
6. Start the VM – it should present a login prompt in under a minute.
7. Power on the admin node, and ensure that:
  - a. It is set up to boot from the hard disk for subsequent boots
  - b. This first boot (and only this first boot) is a network boot
8. Once the installation is complete power down the installer VM.

The machine should obtain its image from the VM and start the installation process.

VMware Player configuration for DVD:



VMware Player configuration for network adapter:



## 1.4 Installing Crowbar

The image installed in the previous steps includes all the required Crowbar components. Before actually installing Crowbar, the user may customize the installation to fit their deployment environment (see accompanying documentation). The steps below assume use of the default configuration.

1. Log onto the admin node. The default username is **openstack**, password: **openstack**.

- If necessary edit the file `/opt/dell/chef/data_bags/crowbar/bc-template-network.json` to customize the network information for the deployment. The networks cannot be reconfigured once the system is installed.

Network configuration options are:

Name	Default	Description
<b>mode</b>	single	A string value of either single, dual, or team. This specifies the default network interface construction model.
<b>teaming</b>	map	A map of values specific to teaming
<b>networks</b>	map	A map of networks that this barclamp should manage

The teaming sub-parameters are:

Name	Default	Description
<b>mode</b>	6	The default teaming algorithm to use for the bonding driver in Linux

The system provides the following default networks.

Name	Usage	Notes
<b>admin</b>	Private network for node to node communication	A router, if wanted, is external to the system. This network must be owned by the crowbar system to run DHCP on.
<b>bmc</b>	Private network for bmc communication	This can be the same as the admin network by using the ranges to limit what IP goes where. A router, if wanted, is external to the system.
<b>bmc_vlan</b>	Private network for admin nodes on the bmc network	This must be the same as the bmc network and have the same vlan. This will be used to generate a vlan tagged interface on the admin nodes that can access the bmc lan.
<b>storage</b>	Private network for storage traffic	A router, if wanted, is external to the system
<b>public</b>	Public network for crowbar and other components	A router, if wanted, is external to the system.
<b>nova_fixed</b>	Public network for nova Virtual Machines	The nova-network node acts as a router. This must be completely owned by the nova system.
<b>nova_floating</b>	Broken	deprecated - most likely to be replaced by nova config.

Each network has the following parameters:

Name	Default	Description
<b>vlan</b>	Integer	The vlan to use on the switch and interfaces for this network
<b>use_vlan</b>	true	A value of true indicates that the vlan should applied to the interface. A value of false assumes that the node will receive untagged traffic for this network.
<b>add_bridge</b>	false	indicates if the network should have a bridge built on top of it. The bridge will be br. This is mostly for Nova compute.

<b>subnet</b>	IP Address	The subnet for this network
<b>netmask</b>	Netmask	The netmask for this network
<b>router</b>	IP Address	The default router for this network
<b>broadcast</b>	IP Address	The default broadcast address for this network
<b>ranges</b>	map	This contains a map of strings to start and stop values for network. This allows for sub-ranges with the network for specific uses. e.g. dhcp, admin, bmc, hosts.

The range map has a string key that is the name and map defining the range.

Name	Type	Description
<b>start</b>	IP Address	First address in the range, inclusive
<b>end</b>	IP Address	Last address in the range, inclusive

3. `cd /tftpboot/ubuntu_dvd/extra`
4. `sudo ./install systemname.yourdomain.com`

The rest of the installation is automated and will take a little while to complete.

## 1.5 Enabling the Public Network Port on the Admin Server

It may be desirable to enable an interface in order to allow external access to the to the admin server. On possible requirement for this would be that the user requires external DNS or NTP servers to interact with the environment. In order to accomplish this please run the following commands from the cmd line on the Admin server after performing the install. The variable <machine name> is the name of the admin server.

1. Log onto the admin node. The default username is `openstack`, password: `openstack`.
2. `sudo su -`
3. `crowbar network allocate_ip default "<machine name>" public host`
4. `knife ssh "name:<machine name>" chef-client`

## 1.6 Verifying admin node state

When the admin node finishes installation, it will remain at a shell prompt. At this point, all Crowbar services have started. Consult the table below to access these services.

Service	URL	Credentials
SSH	<a href="ssh://openstack@192.168.124.10">openstack@192.168.124.10</a>	openstack
Crowbar UI	<a href="http://192.168.124.10:3000/">http://192.168.124.10:3000/</a>	crowbar / crowbar
Nagios	<a href="http://192.168.124.10/nagios3">http://192.168.124.10/nagios3</a>	nagiosadmin / password
Ganglia	<a href="http://192.168.124.10/ganglia">http://192.168.124.10/ganglia</a>	nagiosadmin / password
Chef UI	<a href="http://192.168.124.10:4040/">http://192.168.124.10:4040/</a>	admin / password

Logging into the UI requires acceptance of the EULA. It can be found on the Dashboard under EULA, in Appendix A of this document or at this web page:

<http://www.dell.com/content/topics/global.aspx/policy/en/policy?c=us&l=en&s=gen&~section=015#ds1a>

## 1.7 Installing nodes

Nodes are installed automatically when they are first powered up. The machine will be PXE booted by the admin node. It will then proceed to go through several installation phases (involving several automatic reboots) culminating in the deployment of a minimal OS image installed on its local drive. Part of the basic installation includes “hooking” the nodes into the infrastructure services: NTP, DNS, Nagios, and Ganglia.

After the installation process, the node should be listed in the Crowbar UI. From the UI, a node can be powered on and off, rebooted, and reconfigured (see accompanying documentation for details).

Functional components are installed on nodes by including them in one or more proposals. For example, when a node is listed as a storage node in a proposal for Swift, the relevant packages, services and settings are deployed to that node upon committing the proposal within Crowbar.

## 2 Installing components

The general workflow to install any component (e.g. Nova, Swift) is the same:

- a. Obtain a default proposal which includes the parameters for the component and a mapping of nodes to the roles they are assigned
- b. If desired, edit the proposal for a custom configuration
- c. Save the proposal to Crowbar
- d. Commit the proposal

This may be done through the use of the Crowbar command line tool or the web based UI. The sections that follow use the command line tool: `/opt/dell/bin/crowbar` (for details on using the UI, see the Crowbar Users Guide).



---

When using the crowbar tool on the admin node, the user may first have to set the following environment variable:

```
export CROWBAR_KEY=`cat /etc/crowbar.install.key`
```

If on a non-admin node, one may also use:

```
export CROWBAR_KEY=crowbar:crowbar (the default username/password)
```

---

### 2.1 Example: Implementing a Proposal via Cmd. Line



---

You must be root in order to run the crowbar command

---



### 2.1.1 Obtain a proposal

Crowbar will inspect the current known nodes and provide a proposal that it believes will best utilize available systems for the component being installed. To obtain and inspect this proposed configuration:

```
/opt/dell/bin/crowbar <component> proposal create <name>
```

```
/opt/dell/bin/crowbar <component> proposal show <name> > <local_file_name>
```

Where:

- `<component>` - is the component for which the proposal is made; e.g. swift, nova, glance
- `<name>` - is the name assigned to this proposal. This name should be unique for the component; i.e. if 2 swift clusters are being installed, the proposals for each should have unique names. They need not be unique between components of different types
- `<local_file_name>` - is a file into which the proposal will be written

### 2.1.2 Update a proposal

The local file created above can be inspected and modified. Common changes include:

- Changing default passwords and other Barclamp parameters (e.g. Swift replica count)
- Changing the assignment of machines to roles

Once edits are completed, crowbar must be updated. To update Crowbar with a modified proposal:

```
/opt/dell/bin/crowbar <component> proposal --file=<local_file_name> edit <name>
```

where the parameters in this command are the same as mentioned above. Crowbar will validate the proposal for syntax and make some basic sanity checks as part of this process.

### 2.1.3 Committing proposal

Once the proposal content is satisfactory, the Barclamp instance can be activated:

```
/opt/dell/bin/crowbar <component> proposal commit <name>
```

This might take a few moments, as Crowbar is deploying the required software to the machines mentioned in the proposal.

### 2.1.4 Modifying an active configuration

When committing a proposal which was previously committed, Crowbar compares the new configuration to the currently active state and applies the deltas.

To force crowbar to reapply a proposal, the active state needs to be deleted via:

```
/opt/dell/bin/crowbar <component> delete <name>
```

Then commit the proposal again as described above.

### 3 Appendix A: End User License Agreement

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## **SUPPLEMENTAL TERMS FOR EMC SOFTWARE**

You may use one copy of the Software on only one computer or device at a time for your own internal business purposes. You shall not, without Dell's prior written consent copy, provide, disclose or otherwise make available Software in any form to anyone other than your employees, consultants or independent contractors who shall use the Software in a manner that is consistent with this Agreement.

Notwithstanding anything to the contrary in the Agreement, licenses to Software are non-exclusive, non-transferable and non-sub licensable and subject to the restriction that the Software be used solely in conjunction with the equipment (storage system or switch/hub) or related central processing unit for which it was licensed.

Rev. 110109

## DELL EQUALLOGIC PS SERIES ARRAY END USER LICENSE AGREEMENT

This License Agreement ("Agreement") is made as of the date of shipment of the Products to the Customer (the "Effective Date") by and between Dell, Inc, its subsidiaries and affiliates, with offices at 300 Innovative Way, Suite 301, Nashua, NH 03062 ("collectively "the Company"), and the Customer. In consideration of the mutual obligations set forth below the parties, intending to be legally bound, agree as follows:

### 1. Definitions

**"Customer"** means the end user of the Products.

**"Hardware"** means the Dell EqualLogic PS Series branded array hardware along with any end user manuals supplied by the Company.

**"Maintenance Releases"** means any update, upgrade, revision, patch, bug fix or an improved, upgraded or enhanced version of the Products released by the Company to which Customer is rightfully entitled by way of a valid maintenance agreement, warranty, or other Company offering. Third Party Products are excluded and subject to their own terms and conditions.

**"Object Code"** means computer programs assembled, compiled, or converted to magnetic or electronic binary form on software or hardware media, which are readable and usable by computer equipment, but not generally readable by humans without reverse assembly, reverse compiling, reverse conversion, reverse engineering and/or any other disassembly or decompilation.

**"Product(s)"** means, collectively, the Hardware and Software which may be supplied to Customer.

**"Software"** means all components of the Company's storage management software and related documentation made generally available by the Company from time to time not accompanied by its own license agreement. The term "Software" shall include any and all software, scripts, firmware, and microcode running on Hardware or any computer system, including all Maintenance Releases supplied in accordance with this Agreement. The Software shall be provided in Object Code form only. No source code will be provided.

**"Third Party Products"** means any hardware or software licensed or distributed by the Company to Customer that is not owned by the Company.

### 2. Grant of License

The Company hereby grants to Customer a nonexclusive, nontransferable license to install and use the Software solely for Customer's ordinary internal business purposes and solely for Software's intended use in conjunction with Product. The Software is in use if it is loaded on the Product or any computer's permanent or temporary memory. Customer may make one copy of the Software for archive and security backup purposes only. You must include on any backup copy all copyright and other notices included on the Software as supplied by the Company. Installation on a network server for the sole purpose of your internal distribution of the Software is permitted so long as all arrays are properly licensed Products to which the Software is distributed. All rights not expressly granted to Customer in this Agreement are reserved by the Company. There are no implied rights. Unless otherwise indicated on the sales quotation, this License is perpetual (subject to termination pursuant to Section 6 below).

### 3. Payments

If Customer has purchased the Product through a value added reseller ("VAR") of the Company, the payment obligations of the customer are agreed upon between the VAR and the customer. If the Customer is buying the product directly from the Company, the Customer's payment obligations are set forth on the sales quotation. Customer agrees to pay all fees due pursuant to this Agreement in U.S. dollars, and unless the sales quotation expressly provides otherwise all fees are due net thirty (30) days from the date of invoice. Any amount not paid when due shall bear a late payment charge, until paid, in an amount equal to 1.5% per month or, if lower, the maximum rate allowed by law. In addition, Customer shall reimburse the Company for all reasonable costs (including court costs and attorneys' fees and expenses) incurred in collecting amounts owed under this Agreement. Customer shall be responsible for all sales, use, property, excise, and other similar taxes resulting from the transactions contemplated by this Agreement, excluding taxes on the net income of the Company.

#### **4. Term of Agreement; Termination.**

This Agreement shall commence upon the Effective Date and, unless terminated in accordance with this Section 4, or terminated by transfer with written approval by the Company according to Section 15, shall be perpetual. Either party may terminate this Agreement in the event of a material breach of this Agreement by the other party that is not cured within thirty (30) days of written notice thereof from the other party; provided, however, that this Agreement shall immediately terminate upon breach by Customer of Section 6.

#### **5. Effect of Termination.**

Upon termination of this Agreement, all licenses granted hereunder shall automatically terminate except as expressly stated in this Agreement. Each party shall promptly pay to the other any amounts due and owing hereunder. No termination of this Agreement shall release Customer from any obligation to pay the Company any amount that has accrued or will accrue or become payable prior to, at, or after the date of termination of this Agreement. Each party shall immediately cease using and return all property in its possession belonging to the other party, including without limitation all Products and tangible embodiments of Confidential Information (as defined below). Customer shall not be entitled to a refund, in whole or in part, of any amounts paid hereunder, other than in accordance with Section 8(a). Sections 3, 5-10 and 12- 15 hereof will survive termination of this Agreement.

#### **6. Representations, and Covenants of Customer.**

(a) Except as expressly permitted in this Agreement, Customer shall not, and shall not permit others to, (i) use, modify, copy (except for one copy of the Software for archive and security back-up purposes), or otherwise reproduce the Product in whole or in part, (ii) reverse engineer, decompile, disassemble, or otherwise attempt to derive the source code form, algorithms, processes, state machines or structure of the Software or the proprietary network protocols implemented by the Software, higher algorithms or state machines, (iii) transmit the Software over a network by telephone or electronically using any means (iv) distribute, sublicense, assign, share, timeshare, sell, grant a security interest in, use for service bureau purposes, or otherwise transfer the Software or Customer's right to use the Products without the prior written consent of the Company and then only upon a permanent transfer of the Products purchased and provided all Software is included in such transfer and Customer does not retain a copy of the Software, (v) remove any proprietary notices or labels on the Products. Without limiting the foregoing, copying or reproduction of the software to any other server or location for further reproduction or redistribution is expressly prohibited.

(b) Customer hereby covenants and agrees to (i) limit access to the Products to its employees and consultants who require access in connection with Customer's use of the Products and who are bound by a duty of confidentiality no less protective than this Agreement, (ii) take all reasonable precautions to prevent unauthorized or improper use or disclosure of the Products, (iii) ensure that its use of the Products is in compliance with all foreign, federal, state, and local laws and regulations, including without limitation all laws and regulations relating to export and import control, privacy rights, and data protection and (iv) for any utilization of the Products for or on behalf of the United States of America, its agencies and/or instrumentalities ("U.S. Government"), ensure use, duplication, or disclosure of the Software by the U.S. government is subject to the restrictions set forth in FAR 12.212 for civilian agencies and DFAR 227.7202 for military agencies. If the licensee hereunder is the U.S. Government, the Software is licensed hereunder (i) only as a commercial item and (ii) only with those rights as are granted to all other end users pursuant to the terms and conditions of this Agreement.

Customer agrees to indemnify the Company for all claims or alleged claims for a breach of any of the foregoing covenants. Customer will obtain any export and/or re-export authorization required under the Export Administration

Regulations of the United States Department of Commerce and other relevant regulations controlling the export of Product or related technical data.

## **7. Proprietary Rights and Confidentiality.**

(a) Customer acknowledges and agrees that (i) as between the Company and Customer, all rights, title and interest in and to the Product and all derivatives thereof (including any and all patents, copyrights, trade secret rights, trademarks, trade names and other proprietary rights embodied therein or associated therewith) are and shall remain with the Company, their suppliers or licensors', and this Agreement in no way conveys any right or interest in the Product other than a limited license to use them in accordance herewith, and (ii) the Products are works protected by copyright, trade secret, and other proprietary rights and laws.

(b) Each party acknowledges that by reason of its relationship to the other party under this Agreement it may have access to Confidential Information. Each party agrees to maintain in confidence and use only as expressly permitted in this Agreement all Confidential Information received from the other, both orally and in writing. For the purposes of this Agreement, the term "Confidential Information" means the Products, the terms of this Agreement, and any other non-public information or materials; provided, that Confidential Information shall not include information the receiving party can demonstrate (i) is or becomes a matter of public knowledge through no fault of the receiving party, (ii) was rightfully in the receiving party's possession prior to disclosure by the disclosing party, as evidenced by written records of the receiving party, (iii) subsequent to disclosure, is rightfully obtained by the receiving party from a third party in lawful possession of such Confidential Information, as evidenced by written records of the receiving party, (iv) is independently developed by the receiving party without reference to Confidential Information, or (v) is required to be disclosed by law.

(c) The above limitations include but are not limited to the disclosure of information relating to the performance, functionality, reliability or any benchmarking tests or results of the Products. Under no circumstances are the above listed items to be placed into the public domain by the Customer without the prior written consent of the Company.

## **8. Indemnification Obligations.**

(a) the Company shall defend and indemnify Customer against any action or proceeding brought against Customer which alleges that the Products infringe any United States patent, copyright, or trademark, and the Company shall pay damages finally awarded or agreed in settlement against Customer (including, without limitation, court costs and reasonable attorneys' fees and expenses); provided, that (i) Customer notifies the Company promptly in writing of the claim in question, (ii) the Company has sole control of the defense and all related settlement negotiations, and (iii) Customer provides the Company with all commercially reasonable assistance, information and authority to perform the above at the Company's expense. In the event that Customer's use of the Products are enjoined by a court of competent authority, the Company shall, at its sole option and at its expense, (I) procure for Customer the right to continue to use the Products in question, (II) modify the Products to avoid infringement without material impairment of its functionality or (III) replace the Products with functionally equivalent non-infringing products. If none of the foregoing remedies can be obtained upon commercially reasonable terms, Customer shall remove and return to the Company the Products in question and the Company shall refund to Customer the unamortized portion, if any, of the fees paid by Customer to the Company for the Products in question (based on a three (3) year amortization of such fees commencing on the Effective Date). The foregoing indemnity shall not apply if the alleged infringement is attributable to the combination of the Products with products not provided by the Company, or if the Product is modified or altered by any person or entity other than the Company (or an authorized agent of the Company), or if the Products are used outside the scope of this Agreement (each a "Customer Modification"). THIS SECTION STATES THE COMPANY'S SOLE LIABILITY HEREUNDER WITH RESPECT TO INFRINGEMENT OF ANY INTELLECTUAL PROPERTY AND PROPRIETARY RIGHTS.

(b) Customer, at its expense, shall defend and indemnify the Company and any of its subsidiaries or affiliates against any action or proceeding brought against the Company or any of its subsidiaries or affiliates and Customer shall pay damages finally awarded or agreed in settlement which arises from or in any manner is connected with a Customer Modification or any of Customer's actions or omissions in using the Products (excluding claims for which the Company is obligated to defend Customer under Section 8(a) hereof); provided, that (i) the Company notifies Customer promptly in writing of the claim in question, (ii) Customer has sole control of the defense and all related settlement negotiations, and (iii) the Company provides Customer with all commercially reasonable assistance, information and authority to perform the above at Customer's expense.

## **9. Limitation of the Company's Liability.**



CUSTOMER'S SOLE REMEDY AND THE COMPANY'S SOLE OBLIGATION WITH RESPECT TO ANY CLAIMS, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING OUT OF, CONNECTED WITH, OR RESULTING FROM THIS AGREEMENT SHALL BE GOVERNED BY THIS AGREEMENT, AND IN ALL CASES CUSTOMER'S REMEDY SHALL BE EXPRESSLY LIMITED TO MONETARY DAMAGES NOT TO EXCEED THE LESSER OF THE FEES PAID FOR THE SPECIFIC PRODUCT WHICH CAUSED THE DAMAGE OR THE COST OF REPAIR OR REPLACEMENT OF ANY HARDWARE COMPONENTS THAT MALFUNCTION IN CONDITIONS OF NORMAL USE. WITHOUT LIMITING THE FOREGOING, IT IS EXPRESSLY AGREED THAT IN NO EVENT SHALL THE COMPANY OR THEIR SUPPLIERS OR ANYONE ELSE WHO HAS BEEN INVOLVED IN THE PERFORMANCE OF THIS AGREEMENT ON BEHALF OF THE COMPANY, INCLUDING ITS EMPLOYEES, SUBCONTRACTORS OR AGENTS, BE LIABLE FOR ANY DAMAGES CAUSED BY THE PRODUCT OR THE FAILURE OF THE PRODUCT TO PERFORM, INCLUDING ANY LOST PROFITS OR SAVINGS OR SPECIAL, INDIRECT, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES. THE COMPANY IS NOT LIABLE FOR ANY CLAIM MADE BY A THIRD PARTY OR MADE BY YOU FOR A THIRD PARTY. THIS LIMITATION OF LIABILITY CANNOT BE WAIVED OR AMENDED BY ANY PERSON. THIS LIMITATION OF LIABILITY WILL BE EFFECTIVE EVEN IF YOU HAVE ADVISED THE COMPANY OR AN AUTHORIZED REPRESENTATIVE OF THE COMPANY OF THE POSSIBILITY OF ANY SUCH DAMAGES. THIS LIMITATION OF LIABILITY, HOWEVER, WILL NOT APPLY TO CLAIMS FOR PERSONAL INJURY. NOTWITHSTANDING THE FOREGOING, THE COMPANY SPECIFICALLY DISCLAIMS, TO THE EXTENT PERMITTED BY APPLICABLE LAW, LIABILITY FOR ANY PERSONAL INJURY RESULTING FROM FAILURE TO READ AND FOLLOW INSTRUCTIONS AND SAFETY PRECAUTIONS CONTAINED IN THE DOCUMENTATION SUPPLIED WITH THE PRODUCT.

#### **10. Use of Customer's Name.**

Customer consents to being listed as a customer of the Company in any standard customer listing (or partial customer listing) published by the Company and in press releases or other publications, provided that such release or publication relates to new customers or to customers generally and does not supply detail regarding Customer or this Agreement beyond the name of the Products licensed without the prior consent of Customer.

#### **11. Third Party Products.**

Any third party products are provided solely as a convenience to Customer, and are provided and/or licensed under the terms of said products' manufacturer. The Company assumes no responsibility for said products including but not limited to any warranties or indemnification rights contained in Sections 9 and 10 hereof.

#### **12. Injunctive Relief; Cumulative Remedies.**

The parties hereto agree that money damages would be an inadequate remedy for the Company in the event of a breach or threatened breach by Customer of the provisions set forth in Sections 7, 8 or 15 hereof; therefore, in the event of a breach or threatened breach by Customer of any such provisions, the Company may, either with or without pursuing any other remedies afforded to it by law, immediately obtain and enforce an injunction from any court of law or equity prohibiting the Customer from breaching such provisions. All rights and remedies afforded the Company by law shall be cumulative and not exclusive.

#### **13. General.**

Customer may not sublicense, assign (by operation of law or otherwise) or transfer this Agreement or any license or any right, duty or obligation under this Agreement without the Company's prior written consent, and any attempt to do so shall be null and void. Any transfer approved by the Company shall immediately terminate this agreement. Subject to the foregoing limitations, this Agreement will mutually benefit and be binding upon the parties, their successors and assigns. Nothing in this Agreement shall be construed to imply a joint venture, partnership or agency relationship between the parties and the Company shall be considered an independent contractor when performing any services in connection with this Agreement.

Any notice required to be provided pursuant to this Agreement shall be in writing and shall be deemed given if sent to the addresses stated on the sales quotation and such notices shall be effective upon receipt. A failure or delay by either party to enforce any right under this Agreement shall not at any time constitute a waiver of such right or any other right, and shall not modify the rights or obligations of either party under this Agreement. To the extent that any provision of this Agreement is found to be void or unenforceable, such provision shall be without effect and the remainder of the Agreement shall be enforced to the full extent of the law.

In no event shall either party be liable for any delay or failure to perform under this Agreement which is due to causes beyond the reasonable control of such part including but not limited to any act of God, act of any government or other authority or statutory undertaking, industrial dispute, fire, explosion, accident, power failure, flood, riot or war (declared or undeclared).

This Agreement shall be governed by and construed under the laws of the State of New Hampshire, without regard to principles of conflicts of laws. Application of the U.N. Convention on Contracts for the International Sale of Goods is expressly excluded. Any action brought pursuant to or in connection with this Agreement shall be brought only in the state or federal courts within the State of New Hampshire without regard to its conflict of law's provisions. In any such action, the parties shall submit to the personal jurisdiction of the courts of the State of New Hampshire and waive any objections to venue in such courts.

Pre-printed terms and conditions set forth on any purchase order submitted by Customer, or on any quotation, purchase order acceptance or invoice submitted by Customer, shall have no force and effect and are expressly superseded by the terms of this Agreement. In the event of a conflict between the terms of this Agreement and the terms of the Warranty and Support Information documentation supplied with the Product, the terms of the Warranty and Support Information shall control. The Company may make Product updates and enhancements available to Customer from time to time accompanied by a revision or amendment to this Agreement. Installation or use by Customer of the Products or any such updates or enhancements shall constitute acceptance by Customer of this Agreement and/or any such revised agreement. Except as expressly provided herein, no amendment or modification of this Agreement shall be effective unless made in writing and signed by the Company and Customer.

This Agreement is the entire agreement of the parties, and supersedes all prior agreements and communications, whether oral or in writing, between the parties with respect to the subject matter of this Agreement.

**(Rev. 030109)**

#### **DELL KACE SOFTWARE END USER LICENSE AGREEMENT**

This is a legal agreement ("Agreement") between you, the user, and Dell Inc. and its subsidiaries and affiliates ("Dell"). This Agreement covers all software and associated documentation that is distributed with or for the Dell product (and upgrades and updates thereto), known as a "KACE Appliance," whether such software is delivered independently or preloaded on Dell hardware, whether branded KACE or Dell KACE or otherwise (collectively the "Software"). This Agreement is not for the sale of Software or any other intellectual property. All title and intellectual property rights in and to Software is owned by the manufacturer or owner of the Software. All rights not expressly granted under this Agreement are reserved by the manufacturer or owner of the Software. By opening or breaking the seal on the Software packet(s), installing or downloading the Software, or using the Software that has been preloaded or is embedded in your product, you agree to be bound by the terms of this Agreement. If you do not agree to these terms, promptly return all Software items (media, written materials, and packaging) and any hardware containing preloaded Software.

PLEASE NOTE: THIS AGREEMENT MAY DIFFER FROM THE LICENSE AGREEMENT INCLUDED IN THE PRINTED MATERIALS ENCLOSED IN THE BOX WITH YOUR KACE APPLIANCE. IF SO, THIS AGREEMENT SHALL CONTROL OVER THE PRINTED DOCUMENT.

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If you purchased Software preloaded onto Dell hardware, whether branded KACE or Dell KACE or otherwise, (such hardware and Software together, an "Appliance"), you may use the Software only together with the Appliance on which it was loaded by Dell. If you purchased Software independent of hardware (such Software, a "Virtual Appliance"), you may install the Virtual Appliance and run the number of instances of the Virtual Appliance as you have purchased licenses. So long as you do not exceed the scope of your license, you may move a Virtual Appliance



to a different server. You may distribute Software to computers or other physical or virtual devices configured for management by your Appliance or Virtual Appliance (each such device, a "Managed Computer"), provided that the number of Managed Computers does not exceed the scope of the Software license (including the number of licensed nodes) that you have purchased from Dell. In determining the number of Managed Computers, each individual physical device and each virtual device (e.g., each instance of an operating environment running concurrently with another operating environment on a single physical device) shall constitute a separate Managed Computer.

If you are a commercial customer of Dell or a Dell affiliate, you hereby grant Dell, or an agent selected by Dell, the right to perform an audit of your use of the Software during normal business hours, you agree to cooperate with Dell in such audit, and you agree to provide Dell with all records reasonably related to your use of the Software. The audit will be limited to verification of your compliance with the terms of this Agreement.

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The Software regularly communicates with Dell during the normal course of operation to obtain and provide updated data feeds. You agree that Dell may collect, store, aggregate, and analyze information about your usage of the Software, including, without limitation, information about applications, processes, services, and characteristics of your user environment associated with using the Software, database, application server, and Licensee's error logs (collectively, the "Data"), for internal use in order to provide product support and conduct product research. If at any time during the Term you opt to activate the AppDeploy Live feature, you agree that Dell may collect, store, aggregate, analyze, and disclose to other Software users and to the general public the Data collected by Dell in anonymous, aggregate form. You further understand and agree that any information you choose to manually disclose through the AppDeploy Live feature may be used and disclosed in accordance with the foregoing sentence. In such cases, you grant Dell a non-exclusive, worldwide, royalty-free, perpetual, non-revocable license to use, compile, distribute, display, store, process, reproduce, or create derivative works of the Data. You represent and warrant that you have obtained all rights, permissions, and consents necessary to use and transfer the Data within and outside of the country in which you are located in conjunction with your use of the Software (including providing adequate disclosures and obtaining legally sufficient consent from your employees, agents, and contractors).

## LIMITED WARRANTY

Dell warrants that the Software media will be free from defects in materials and workmanship under normal use for 90 days from the date you receive them. This warranty is limited to you and is not transferable. Any implied warranties are limited to 90 days from the date you receive the Software. Some jurisdictions do not allow limits on the duration of an implied warranty, so this limitation may not apply to you. The entire liability of Dell and its suppliers, and your exclusive remedy, shall be, at Dell's option, either (a) termination of this Agreement and return of the price paid for the Software or (b) replacement of any media not meeting this warranty that is sent with a return authorization number to Dell, within the 90 day warranty period, at your cost and risk. This limited warranty is void if any media damage has resulted from accident, abuse, misapplication, or service or modification by someone other than Dell. Any replacement media is warranted for the remaining original warranty period or 30 days, whichever is longer.

Dell and its suppliers do NOT warrant that the functions of the Software will meet your requirements or that operation of the Software will be uninterrupted or error free. You assume responsibility for selecting the Software to achieve your intended results and for the use and results obtained from the Software.

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IN NO EVENT SHALL DELL OR ITS SUPPLIERS BE LIABLE FOR ANY DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR OTHER PECUNIARY LOSS) ARISING OUT OF USE OR INABILITY TO USE THE SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. BECAUSE SOME JURISDICTIONS DO NOT ALLOW AN EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

This Agreement does not entitle you to receive Software support, patches, upgrades or updates. In order to receive Software support and any patches, upgrades and updates that are released to licensed users of the Software with current support contracts, you must purchase Dell Kace technical support services, which are described at [www.kace.com/support](http://www.kace.com/support). In addition, first time purchasers of a KACE Appliance are required to purchase training services referred to as the KACE JumpStart Program at the time of purchase of their initial KACE Appliance. In connection with the KACE JumpStart Program, KACE or a KACE authorized third party will deliver online training to assist you in the installation and basic configuration of the KACE Appliance. This training will also include exercises that enable deployment of KACE Agent Software on up to 150 managed machines as well as instructions on how to successfully deploy KACE Agent Software on the remaining managed machines (if any). The KACE JumpStart Program consists of a fixed number of two hour sessions depending on the specific model and modules purchased.

Standard Appliance JumpStart	2 sessions
Standard Bundle JumpStart	4 sessions
Enterprise Appliance JumpStart	6 sessions
Enterprise Bundle JumpStart	12 sessions

These sessions must be completed within 60 days of the initial KACE Appliance shipment. Sessions not completed within that time period can be purchased separately at the then current price levels. All services delivered by or on behalf of Dell, including technical support services for Software and training including the KACE JumpStart Programs are provided pursuant to the Dell Customer Master Services Agreement posted at: [www.dell.com/servicecontracts](http://www.dell.com/servicecontracts) and by accepting the terms of this EULA you agree that such terms shall govern any Software support or other services provided by or on behalf of Dell.

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## U.S. GOVERNMENT RESTRICTED RIGHTS

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## CONFIDENTIALITY

You agree to: (a) refrain from using Confidential Information (defined below) except as necessary to exercise the rights herein and (b) to use best efforts to preserve and protect the confidentiality of the Confidential Information. "Confidential Information" means any oral, written, graphic or machine-readable information disclosed by Dell that is (i) identified herein as confidential; (ii) designated in writing to be confidential or proprietary; or (iii) should be reasonably understood to be confidential. Notwithstanding the foregoing, Confidential Information shall not include information: (i) already publicly known through no fault of you; (ii) otherwise known to you by no wrongful conduct; or (iii) to the extent required to be disclosed by law or court order. You acknowledge that the Software and Dell products embody and contain valuable trade secrets and Confidential Information owned by Dell, including but not limited to source code, the development status of Software and Dell products, the appearance, content and flow of the user interface of the Software and Dell product, and the content and documentation of the Software or Dell product.

## GENERAL

This license is effective until terminated. It will terminate upon the conditions set forth above or if you fail to comply with any of its terms. Upon termination, you agree that the Software and accompanying materials, and all copies thereof, will be destroyed. This Agreement is governed by the laws of the State of Texas, without regard to principles of conflicts of laws. Each provision of this Agreement is severable. If a provision is found to be unenforceable, this finding does not affect the enforceability of the remaining provisions of this Agreement. This Agreement is binding on successors and assigns. Dell agrees and you agree to waive, to the maximum extent permitted by law, any right to a jury trial with respect to the Software or this Agreement. Because this waiver may not be effective in some jurisdictions, this waiver may not apply to you. You acknowledge that you have read this Agreement, that you understand it, that you agree to be bound by its terms, and that this is the complete and exclusive statement of the Agreement between you and Dell regarding the Software.

## SUPPLEMENTAL TERMS FOR MICROSOFT SOFTWARE

You acknowledge that the Software may include certain software and materials licensed to Dell by Microsoft Corporation and/or its affiliates (collectively, "Microsoft")(such software or materials licensed by Microsoft, "Microsoft Software"). You agree that (i) this license is limited to use of Software containing Microsoft Software as a boot, diagnostic, disaster recovery, setup, restoration, emergency services, installation, test and/or configuration utilities program, and not for use as a general purpose operating system or as a substitute for a fully functional version of any operating system product; (ii) the Software containing the Microsoft Software contains a security feature that will cause the computer system to reboot without prior notification to the end user after 24 hours of continuous use; and (iii) all computer support issues will be handled solely by Dell.

## SUPPLEMENTAL TERMS FOR MYSQL SOFTWARE

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