



NETWORKING

GETTING STARTED WITH HC3

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INTRODUCTION

All information provided here is meant as a guideline and recommendation for networking equipment and its use with Scale Computing HC3 systems. This guide covers general concepts rather than specific configuration options. Networking hardware and configuration outside the Scale Computing HC3 nodes is not covered under the support and warranty for the HC3 system; any questions or concerns should be addressed with the manufacturer(s).

NOTE

Scale Computing offers [Professional Service engagements](#) for an additional fee to assist customers with initial networking and switch configuration for the HC3 system. These configuration services are only available when purchasing one of the [recommended hardware products](#) found in this guide, whether purchased directly through Scale Computing or from a third party vendor.

Contact your Scale Computing Sales Representative for the full details on all of our Professional Service offerings.

HC3 SYSTEM NETWORKING OVERVIEW

The HC3 system has two distinct physical networks. A public network—known as the LAN network—provides a path to allow access to the HC3 web interface as well as access to the VMs running on the system. A private network—known as the Backplane network—is used for inter-node data communication. Each network utilizes two NICs in an active/passive bond for failover through the HC3 node software only. Scale Computing does not support any other NIC configuration type at this time (teaming, bridging, etc).

LAN NETWORK

The LAN ports on any Scale Computing node are in an active / passive bond used for failover. This means that only one LAN port is ever active at a time. There is a default primary and secondary port; which physical port this correlates to in the HC3 system is different between 1GbE, 10GBaseT, and 10GbE SFP+ nodes but will always be designated LAN0. For redundancy, both the LAN0 and LAN1 ports on a node should always be cabled in to your switch(es).

LAN IP addresses should be assigned from your primary data network and are used by your system's nodes to communicate data between the system and network. These addresses are used only for data communication and HC3 web interface access. An internal firewall blocks all other traffic outside HC3 system features.

BACKPLANE NETWORK

The backplane ports on any Scale Computing node are in an active / passive bond used for failover. This means that only one backplane port is ever active at a time. There is a default primary and secondary port; which physical port this correlates to in the HC3 system is different between 1GbE, 10GBaseT, and 10GbE SFP+ nodes but will always be designated Backplane0. For redundancy, both the Backplane0 and Backplane1 ports on a node should always be cabled in to your switch(es).

Backplane IP addresses should be assigned from a private network used solely by your system's nodes to communicate with other nodes of the same system and should be non-routable from any other part of the network. It is important that the Backplane network is isolated to a single HC3 system (physically or through VLANs) to ensure system stability and performance. Backplane addresses are used only for critical system operations such as individual node health information and the mirroring of data blocks for redundancy between the nodes. The system backplane is considered the 'backbone' of the system, and it is what makes the separate nodes a single HC3 system once they are initialized. An internal firewall blocks all backplane traffic aside from the HC3 system traffic.

WARNING

Due to their importance, backplane IP addresses are permanent.

Backplane IPs cannot be changed without an entire system factory reset which will wipe all user data and configurations on the system and require a full re-installation.

BEST PRACTICES FOR IP ADDRESS PROVISIONING

Provided are some recommended best practices regarding IP provisioning on the HC3 system.

- Backplane IP addresses should match the last octet of LAN IP addresses when possible.
 - LAN IP 192.168.100.10 would have a matching backplane IP of 1.1.1.10.
- LAN IP addresses should be provisioned in the same block, with room for node additions later.
 - A four node HC3 system with a LAN IP scheme of 10.100.1.11, 10.100.1.12, 10.100.1.13, and 10.100.1.14 would reserve 10.100.1.15-18 for subsequent nodes that may be added in the future.
- Always keep your network environment in mind when assigning IPs; not every recommendation is going to be applicable or possible for every environment.

It is against Scale Computing best practices to use a publicly routable IP address scheme for the LAN IP addresses on your nodes. Choose a non-publicly routable IP addressing scheme for the LAN ports.

If it is necessary to have public access to VMs on the system, utilize individual VM VLAN capabilities to control access to the VMs only, not to the HC3 system nodes.

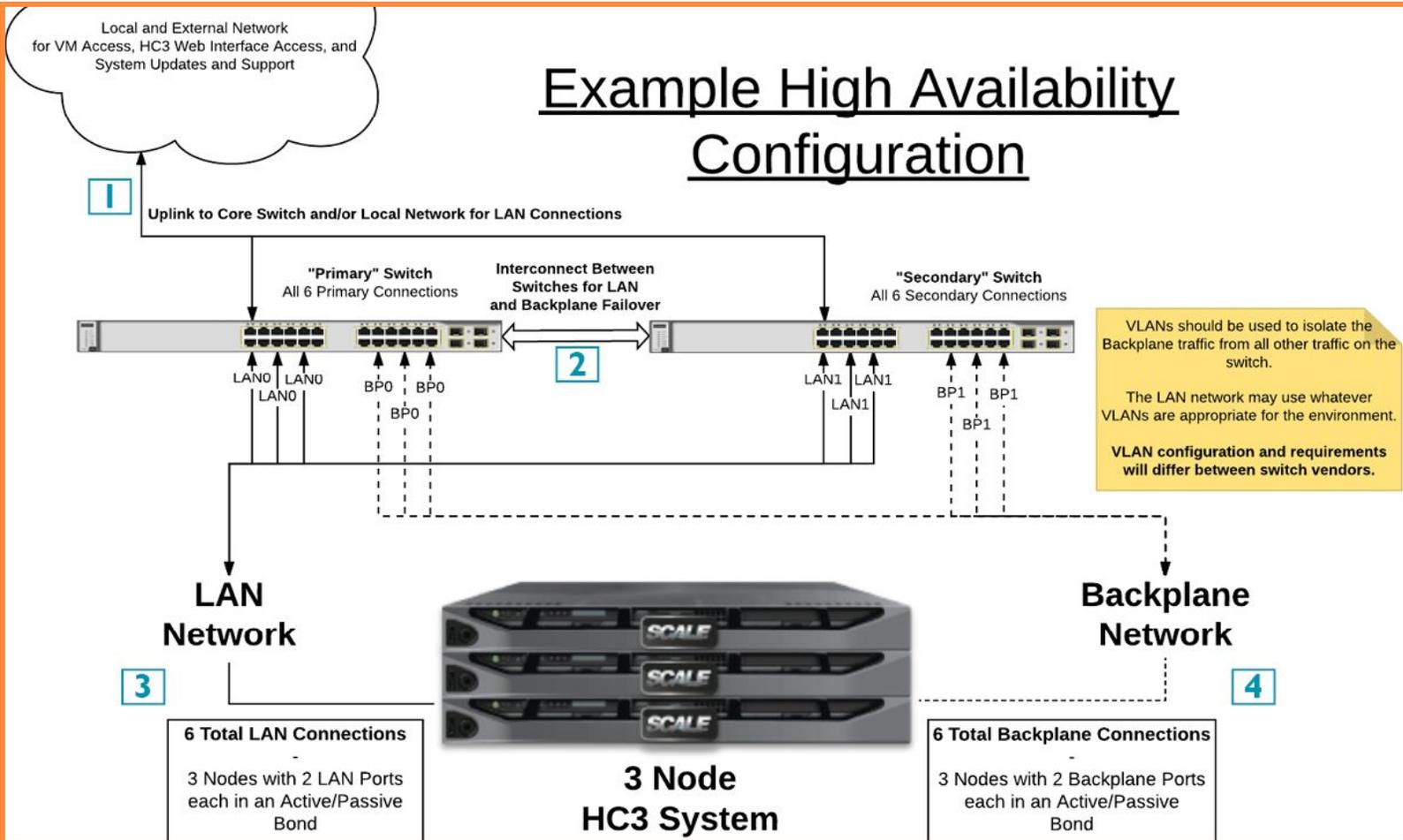
Below is an example IP scheme for a four node system. **This is not the required IP scheme**, but an example of proper assignment using best practices. You should use an IP scheme that is compatible with your network environment.

Example IP Scheme

LAN Network	Backlane Network
192.168.155.20	10.10.10.20
192.168.155.21	10.10.10.21
192.168.155.22	10.10.10.22
192.168.155.23	10.10.10.23
Subnet Mask: 255.255.255.0	Subnet Mask (Immutable): 255.255.255.0
Gateway: 192.168.155.1	

HC3 SYSTEM HIGH AVAILABILITY AND REDUNDANCY

The image below shows an example HA configuration for a three node cluster. This is NOT the only configuration possible nor is it the recommended configuration for all nodes and switches—but the example does take into account failover and high availability at the NIC, hardware, and switch level. See the [HC3 System Networking Overview](#) section for further details on HC3 NIC configuration and provisioning.



1. **Uplink**—Each switch containing a LAN connection should have an uplink to the local network and/or core switch for VM and HC3 web interface access. The LAN connection should ideally have internet access for system updates and remote support as well.
2. **Interconnect**—The interconnect shown in the image is generic for any physical and/or virtual bridge between the two switches that will allow the LAN and Backplane connections to continue communication in the event that one or more primary NICs may become unavailable. For the duration of the period the secondary port(s) may be active (failover from the primary to the secondary NIC is automated and almost always non-disruptive), it is necessary that the NIC on the secondary switch can continue to communicate with those on the primary switch. This is particularly important on the Backplane network in order for the node in question is not isolated from the system.
3. **LAN Network**—The LAN network is for VM data access, HC3 web interface access, system updates, and remote support access.
4. **Backplane Network**—The Backplane network is for inter-system communication ONLY. The Backplane IPs should be non-public and non-routable in the local network. No outside traffic should ever be able to access the system Backplane network and two or more HC3 systems should NEVER share a backplane switch or VLAN.

Scale Computing nodes are designed for network and data redundancy, however, not all high availability features will be available in Single Node Systems (SNS). Ensure best practices are applied to get the most from HC3 redundancy and high availability.

- Use two switches for each HC3 system and balance one LAN and one backplane connection on each switch, separated by VLANs with interconnects between the switches; this configuration ensures not only port failover on the nodes, but also port failover on the switches and full switch redundancy if a switch were to fail. (Not applicable for SNS).
- Use two different UPS for each of the system nodes' power supplies and switches, and even different power circuits; this configuration ensures the best possible node and switch power redundancy.
- Always use all four network ports on the nodes, both LAN and both backplane NICs.
- Always use both power supplies on the nodes.
- Nodes should not be geographically dispersed amongst different physical locations; when you set up nodes for your system, select one physical location for the system.
- Scale Computing provides non-disruptive rolling software updates, reliant on enough free RAM being available to operate with one node unavailable. (Not applicable for SNS).
- Automated VM failover is configured in the event of a node failure scenario; this ensures running VMs will resume operation on the running nodes if their current node fails for any reason. (Not applicable for SNS).

NETWORK PORT REQUIREMENTS

The following are the network ports the HC3 system may use for various tasks. These ports should be enabled as indicated in the HC3 system network environment for full system functionality.

	Protocol and Port	Usage
HC3 System & Log Time	UDP Port 123	Network Time Protocol (NTP) Keep local system time for system functions and logs.
HC3 System Email Alerts	TCP Generally Port 25, 587	Outgoing Simple Mail Transfer Protocol (SMTP) Port 25 is the non-secure default for many environments. Port 587 is the default for many secure SMTP servers. The port used is dependent on environmental configurations.
HC3 System Remote Support (Necessary for ScaleCare Support Assistance)	TCP Port 22	Outbound Secure Shell (SSH) HC3 System LAN Network Outbound Only An outbound connection to remote-support.scalecomputing.com (206.246.135.234) is required for ScaleCare Remote Support Assistance.
HC3 Cloud Unity (In Partnership with Google)	TCP Port 22 TCP Port 10022 TCP Port 10032	HC3 System LAN Network Outbound Only Port 22 is used for ScaleCare Remote Support Assistance and the Google Cloud tunnel connection between the designated Gateway VM on the HC3 system and the registered Google Cloud Instance. HC3 System LAN Network Inbound and Outbound Port 10022 is used for secure replication between the HC3 system and the registered Google Cloud Instance. HC3 System LAN Network Inbound and Outbound Port 10032 is used for the Google Cloud tunnel connection between the designated Gateway VM on the HC3 system and the registered Google Cloud Instance.
HC3 Replication and Remote System Management	TCP Port 10022	Local HC3 System to Remote HC3 System LAN Network Inbound and Outbound An inbound and outbound connection is required between the LAN networks of each system for the secure HC3 replication and Remote System View/Management features.
System Updates	TCP Port 80, 443	HC3 System LAN Network An outbound connection to updates.scalecomputing.com (206.246.135.231) is required for HC3 system software updates.

MINIMUM SWITCH ATTRIBUTES

10GbE SFP+ and 10GBaseT switches do not have the same limitations as 1GbE switch versions. Contact Scale Computing if you have any questions on specific 10GbE or 10GBaseT switch models. Almost all forms of Home, Workgroup, Departmental, or Unmanaged switches **do not** have sufficient switching performance and will not be functional with the Scale Computing system

	1GbE	10GBaseT (1GbE or 10GbE)	10GbE SFP+
Required Features	Managed switch Supports spanning tree protocol (STP) at the switch level Supports 802.3x flow control at the switch level		
	RJ-45 ports 72 mpps for 24 port switches 144 mpps for 48 port switches	RJ-45 ports	SFP+ ports for 10GbE SFP+
Optional Features *	VLAN support - Only optional if the switch will be used for backplane only Management of spanning tree protocol (STP) on a per port basis Offers rapid spanning tree protocol (Rapid STP) Stacking or dedicated interconnect for High Availability (HA)		

* Optional features are strongly encouraged but may not be required depending on your deployment and environmental needs.

KNOWN SUCCESSFUL SWITCHES (UNTESTED)

These switches are known to have been successful in various customer deployments. Switches listed here have not been tested by Scale Computing and Scale Computing does not offer any guidelines for configuration.

If the Scale Computing HC3 system is seeing performance or redundancy concerns due to network issues caused by the use of a switch not on [the Recommended Switches list](#), purchase of a recommended switch from the list may be required before further troubleshooting can occur.

	Switch	1GbE Ports	10GBaseT Ports	10GbE SFP+ Ports
1GbE Switches	Cisco 2960X-48-TD-L	48x RJ-45		2x SFP+
	Cisco 2960X-48-LPS-L	48x RJ-45		4x SFP+
	HP Procurve 5406ZL Modular	Modular		N/A
10GbE SFP+ Switches	Netgear M7300-24XF		4x RJ-45	24x SFP+
	HP Procurve 5406ZL Modular			Modular
	Lenovo RackSwitch G8124E			24x SFP/SFP+
	Lenovo RackSwitch G8272			48x SFP/SFP+ 6x QSFP+

RECOMMENDED SWITCHES

These switches are expected to work based on specifications, successful customer deployments, and/or internal testing. Switches not listed here may work as long as they meet the requirements in Minimum Switch Attributes.

	Switch	1GbE Ports	10GBaseT Ports	10GbE SFP+ Ports	
1GbE Switches	Lenovo RackSwitch G7028	24x RJ-45		4x SFP+	
	Lenovo RackSwitch G8052	48x RJ-45		10x SFP+	
	Dell Networking N2024	N2024 24x RJ-45		2 SFP+	
	Dell Networking N2048	N2048 48x RJ-45		2 SFP+	
	Dell Networking N2128	N2128 28x RJ-45		2 SFP+	
	HP Aruba Procurve 2930F Series (Replaces Procurve 2920)	2930F 24G 24x RJ-45 2930F 48G 48x RJ-45		4x SFP+	
10GBaseT Switches	Lenovo NE1032T		24x RJ-45	8x SFP+	
	Cisco SG350XG-2F10		10x RJ-45	2x SFP+	
	Netgear ProSafe XS712T		12x RJ-45	2x SFP+	
10GbE SFP+ Switches	Lenovo RackSwitch NE1032			32x SFP+	
	Dell Networking N4032F			N4032F 24x SFP+	
	Dell Networking N4064F			N4064F 48x SFP+	
	Dell X4012			12x SFP/SFP+	
	Mellanox SX1012 There is a known compatibility issue with the Lenovo X722 NICs and the Mellanox SX/SN series switches. Mellanox SX series switches will only function with X722 NICS when a X4DACBL3-AO breakout cable is used.				12x 40/56GbE - 48x 10GbE
	Mellanox SN2010 There is a known compatibility issue with the Lenovo X722 NICs and the Mellanox SX/SN series switches. There is a Mellanox software patch available for the Mellanox SN series switches that MUST be applied to the SN2010 prior to connecting Lenovo X722 NICs to the switch.				18x 10/25GbE, 4x 40/100GbE

SPANNING TREE PROTOCOL (STP)

The Spanning Tree Protocol (STP) is a network protocol that ensures a loop-free topology for bridged local area networks (LANs). STP allows a network design to include spare (redundant) links to provide automatic backup paths via STP without the need for manual intervention.

When STP is enabled, the protocol monitors the participating ports and/or VLANs. Should there be a change in topology (a port goes active or a port goes down), STP blocks traffic on participating ports until the network topology is determined. When a topology change is discovered, the ports participating in STP are in a Blocking state; they will then move through a Listening, Learning, and, finally, a Forwarding state (when traffic is then forwarded and moving again).

If STP is required for the environment, enable Rapid STP (RSTP) on the Scale Computing node ports if it is available on the switch. RSTP allows a switch port to rapidly transition into the forwarding state during topology changes, mitigating scenarios where one or more HC3 nodes may believe itself isolated on the network.

FLOW CONTROL

Flow control is useful for managing the data rates between two links. It helps prevent a fast sending connection from overwhelming a slower receiving connection and causing retransmits. Scale Computing recommends enabling flow control on the ports where the HC3 system uplinks to the local network.

HC3 NODE CABLE REQUIREMENTS

Scale Computing is not responsible for improper functionality or performance of the HC3 system due to a cable mismatch and/or malfunction. There is no industry standard for 10GbE SFP+ adapters and the protocols they use. **It is the customer's responsibility to ensure they are purchasing cables that are compatible with not only their make and model of switch, but also the NICs installed in their purchased Scale Computing nodes. This may require custom cables designed with specific end-points in mind.** See [Hardware Procurement](#) for more information.

	Broadcom BCM5720	Intel X550-T2	Intel X710	Intel X722	ThinkSystem I350-T2
Details and Compatibility	RJ-45 Minimum Cat5e cables recommended	RJ-45 Minimum Cat5e Cables for 1GbE Minimum Cat6a Cables for 10GbE NIC ports will auto-negotiate the speed provided by the switch	SFP+ See FAQ for Compatibility Intel does not support any other brand's modules for these adapters, see FAQ	SFP+ See FAQ for Compatibility Intel does not support any other brand's modules for these adapters, see FAQ The use of SFP transceivers with HC1250D(F) nodes to connect to a 1GbE network is not supported for either LAN or Backplane	RJ-45 Minimum Cat5e cables recommended
HE500	-	-	Option 4x 10GbE SFP+	-	Base 4x 1GbE RJ-45
HE550	-	-	Option 4x 10GbE SFP+	-	Base 4x 1GbE RJ-45
HE550F	-	-	Option 4x 10GbE SFP+	-	Base 4x 1GbE RJ-45
HE500T	Single Node System 2x 1GbE RJ-45	-	-	-	-
HE500TF	Single Node System 2x 1GbE RJ-45	-	-	-	-
HC1200	-	Base 4x 10GBaseT RJ-45	Option 4x 10GbE SFP+	-	-
HC1250	-	Base 4x 10GBaseT RJ-45	Option 4x 10GbE SFP+	-	-
HC1250D	-	-	-	Base (LOM Adapter) 4x 10GBaseT RJ-45 Option 4x 10GbE SFP+ NOT Compatible with Scale Computing resold cables or transceivers; must purchase elsewhere.	-

<p>HC1250DF</p>	-	-	-	<p>Base (LOM Adapter) 4x 10GBaseT RJ-45</p> <p>Option 4x 10GbE SFP+</p> <p>NOT Compatible with Scale Computing resold cables or transceivers; must purchase elsewhere.</p>	-
<p>HC5250D</p>	-	-	-	<p>Base 4x 10GbE SFP+</p> <p>Option (LOM Adapter) 4x 10GBaseT RJ-45</p> <p>10GbE SFP+ NOT Compatible with Scale Computing resold cables or transceivers; must purchase elsewhere.</p>	-

PHYSICAL NIC LAYOUTS

Physical NIC port configurations for 1GbE, 10GBaseT, and 10GbE SFP+ node options. In all instances, L0/L1 indicates the LAN network while B0/B1 indicates the backplane network. 0 indicates the primary port while 1 indicates the backup port.

WARNING

The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.

SCALE COMPUTING HC1100 SERIES

1GbE port configuration for the HC1100, HC1150, HC1150D, and HC1150DF models.



10GbE SFP+ port configurations for the HC1100, HC1150, HC1150D, and HC1150DF models. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



SCALE COMPUTING HC1200 AND HC1250 SERIES

10GBaseT port configuration for the HC1200 and HC1250 models.

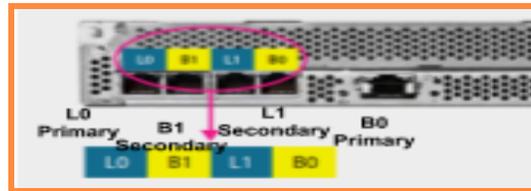


10GbE SFP+ port configuration for the HC1200 and HC1250 models. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



SCALE COMPUTING HC1250D AND HC1250DF SERIES

10GBaseT and 10GbE SFP+ port configurations. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



SCALE COMPUTING HC5100 SERIES

10GbE SFP+ port configuration for the HC5150D model. The HC5100 Series is currently 10GbE SFP+ only. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



SCALE COMPUTING HC5200 SERIES

10GBaseT and 10GbE SFP+ port configuration for the HC5250D model. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.

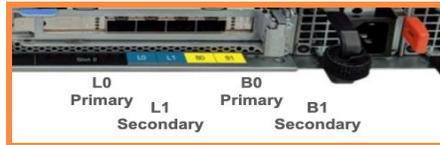


SCALE COMPUTING HE500 SERIES

1GbE port configuration for the HE500, HE550, and HE550F models.

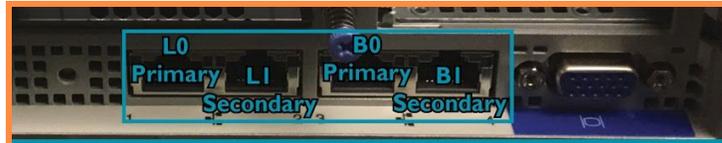


10GbE SFP+ port configurations for the HE500, HE550, and HE550F models. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



LENOVO X3550 M5

1GbE port configuration.



10GbE port configuration. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.

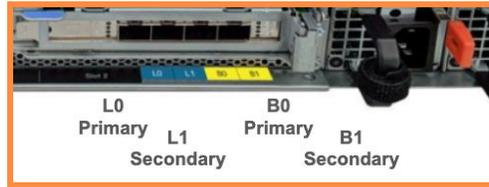


LENOVO SR250

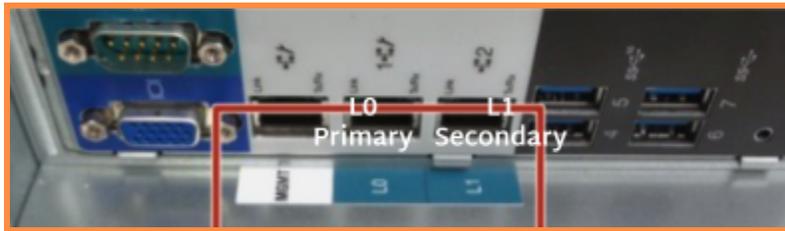
1GbE port configuration.



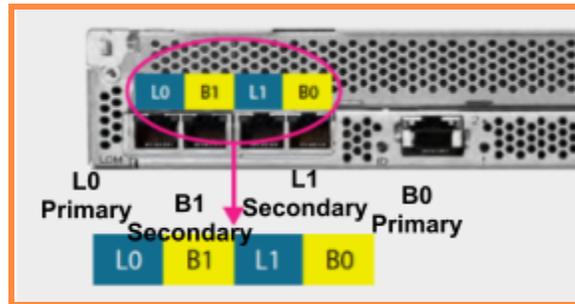
10GbE SFP+ port configuration. The 1GbE ports are permanently disabled on all 10GbE SFP+ only node series and are not functional for HC3 system use.



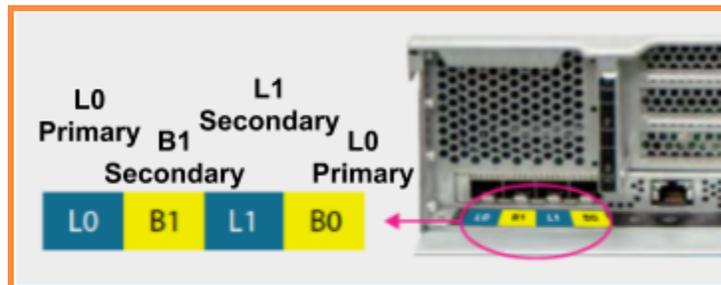
LENOVO ST250



LENOVO SR630



LENOVO SR650



HARDWARE PROCUREMENT

Switches made available for purchase through Scale Computing are for customer convenience only. Any switch or switch hardware purchased through Scale Computing does not denote any support obligation.

Switches or cables resold through Scale Computing may be eligible to receive replacements for the duration of the HC3 system hardware support contract subject to the manufacturer warranty terms and ScaleCare Support discretion. HC3 systems with software-only support or no support may still be able to contact their switch manufacturer directly for any switch or cable hardware or software issues.

SCALE COMPUTING

Customers are required to provide all of their own network switches, cables, and/or converters. Scale Computing does offer some items for purchase for customer convenience.

Switches or cables purchased through Scale Computing may be eligible to receive replacements through Scale Computing for the duration of the asset's hardware support, subject to manufacturer warranty terms and Scale Computing discretion.

Switches

1GbE

- Dell N2024: B24-DL
- HP ProCurve 2930F: B24-HP

10GBaseT

- Netgear ProSafe XS712T: B12-NG-10b

10GbE SFP+

- Dell x4012: B12-DL-10
 - Compatible with Scale Computing Dell Cable
- Mellanox SN2010: B34-M
 - Compatible with Scale Computing Mellanox Cables

Rack

Mellanox

- Short-depth 1U rack installation kit for 1 or 2 SN2010 switches: FRK-BMX

Cables

Dell (**NOT** compatible with [X722 NICs](#))

- Passive Direct Attach Copper Twinax 3 meter cable: BSFP3m-Cable

Mellanox

- Mellanox stacking cable: BMX-Stacking
- Mellanox 3 meter breakout cable: BMX-Breakout

DELL

Customers are required to provide all of their own network cables. Any Dell switches purchased through Scale Computing do not include cables—cables are a separate purchase.

Dell N2000 Series: Stacking Cable Product Numbers

- 3 meter cable: 470-AAPX
- 1 meter cable: 470-AAPW
- .25 meter cable: 470-AAPV

HP

Customers are required to provide all of their own network cables. Any HP switches purchased through Scale Computing do not include cables—cables are a separate purchase.

HP 2930F Series: Stacking Module and Cable Product Numbers

- Stacking module: JL325A
- 1 meter cable: J9735A
- .5 meter cable: J9734A

MELLANOX

Customers are required to provide all of their own network cables. Any Mellanox switches purchased through Scale Computing do not include cables—cables are a separate purchase.

Mellanox SN2010: QSFP to SFP+ Adapter (40GbE to 10GbE Adapter)

- Network adapter: MAM1Q00A-QSA

CISCO

Customers are required to provide all of their own network cables following Cisco guidelines.

FEEDBACK & SUPPORT

DOCUMENT FEEDBACK

Scale Computing welcomes your suggestions for improving our documentation. Please send your feedback to documentation@scalecomputing.com.

TECHNICAL SUPPORT AND RESOURCES

There are many technical support resources available for use. Access this document, and many others, at <http://www.scalecomputing.com/support/login/>.

Online Community

Scale Computing has an online forum and community! This is a great medium in which to solicit the advice of your peers, benefit from their experience, find and discuss documentation, and participate in ongoing conversations. Please note this community is not intended to provide ScaleCare Support assistance or replace other Scale Computing communication channels. Find the Scale Legion HC3 Discussion Forum at <https://scalelegion.community>.

Online Support

You can submit support cases and view account information online through the Scale Computing Customer and Partner Portals at <http://www.scalecomputing.com/support/login/>. You can also Live Chat with support through www.scalecomputing.com during standard hours Monday-Friday from 8-8 local time.

Telephone Support

Support is available for critical issues 24/7 by phone at +1 877-SCALE-59 (+1 877-722-5359) in the US and at +44 (0) 808 234 0699 in Europe. Telephone support is recommended for the fastest response on priority issues, and the only response after standard Support hours.