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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. If you need information on specific configuration information for a switch or other networking product you can refer to the guides in the Scale Computing Knowledge base or the website of the manufacturers of the switch or product. 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 they are purchased directly from 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.
Minimum Switch Attributes

1GbE
Optional attributes are strongly encouraged but may not be required depending on your deployment needs.

- Managed switch
- 72 mpps for 24 port switches
- 144 mpps for 48 port switches
- Supports spanning tree protocol (STP) at the switch level
- Supports 802.3x flow control at the switch level
- (Optional*) VLAN support
- (Optional) Allows disabling of spanning tree protocol (STP) on a per port basis
- (Optional) Offers rapid spanning tree protocol (Rapid STP)
- (Optional) Stacking or dedicated interconnect for High Availability (HA)

10GbE SFP+
Optional attributes are strongly encouraged but may not be required depending on your deployment needs.

- Managed switch
- SFP+ ports for 10GbE SFP+
- Supports spanning tree protocol (STP) at the switch level
- Supports 802.3x flow control at the switch level
- (Optional*) VLAN support
- (Optional) Allows disabling of spanning tree protocol (STP) on a per port basis
- (Optional) Offers rapid spanning tree protocol (Rapid STP)
- (Optional) Stacking or dedicated interconnect for High Availability (HA)

10GBaseT (1GbE or 10GbE)
Optional attributes are strongly encouraged but may not be required depending on your deployment and environmental needs.

- Managed switch
- RJ-45 ports
- Supports spanning tree protocol (STP) at the switch level
- Supports 802.3x flow control at the switch level
- (Optional*) VLAN support
- (Optional) Allows disabling of spanning tree protocol (STP) on a per port basis
- (Optional) Offers rapid spanning tree protocol (Rapid STP)
- (Optional) Stacking or dedicated interconnect for High Availability (HA)

NOTE
10GbE SFP+ and 10GBaseT switches do not have the same limitations as 1GbE switch versions.

Most 10GbE SFP+ or 10GBaseT small business or enterprise switch models should be compatible with the Scale Computing HC3 family. Contact Scale Computing if you have any questions on specific 10GbE or 10GBaseT switch models.

* VLAN support is only optional if the switch will be used for backplane deployment only.
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.

1GbE Switches
- Lenovo RackSwitch G7028
  - Datasheet: http://bit.ly/2k0H449
- Lenovo RackSwitch G8052
- Dell Networking N2000 Series
  - Datasheet: http://dell.to/1UdbYSq
- HP Aruba Procurve 2920 Series
- HP Aruba Procurve 2930F Series

10GbE SFP+ Switches
- Lenovo RackSwitch G8124E
- Lenovo RackSwitch G8272
- Lenovo RackSwitch NE1032
- Dell Networking N4000 Series
- Dell X4012
  - Datasheet: https://dell.to/2NuiWZb
- ** Mellanox SX1012
- ** Mellanox SN2010

10GBaseT (1GbE or 10GbE) Switches

Optional attributes are strongly encouraged but may not be required depending on your environmental needs.
- Lenovo NE1032T
- Cisco SG350XG-2F10
- Netgear ProSafe XS712T
  - Datasheet: https://bit.ly/2DUgTGv

NOTE **
There is a known compatibility issue with the Lenovo X722 NICs and the Mellanox SX/SN series switches. See the HC3 Node Cable Requirements section to check the HC3 family NIC versions.

Mellanox SX series switches will only function with X722 NICS when a X4DACBL3-AO breakout cable is used. 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.
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 outside the general recommendations listed in this guide. Switches not on this list may also function well as long as they meet the **Minimum Switch Attributes**.

**WARNING**

If the Scale Computing HC3 system is seeing performance or redundancy concerns due to network latency, dropped packets, or other networking issues based on the use of a switch not explicitly listed in the **Recommended Switches** section, it may be a required action from ScaleCare Support to purchase an explicitly recommended switch before further troubleshooting can occur.

### 1GbE Switches

- Cisco 2960XR Series
  - 2960X-48-TD-L
  - 2960X-48-LPS-L
- HP Procurve 5406ZI Modular Switch (1GbE Module)
  - HP Part Number (Switch): J9866A

### 10GbE SFP+ Switches

- HP Procurve 5406ZI Modular Switch (10GbE Module)
  - HP Part Number (Switch): J9866A
- Netgear XSM7224s Switch (M7300 Series)
  - Netgear Product Number: M7300-24XF

### Non-Recommended Switches

These switches have not performed well or have performed inconsistently in the field in a wide variety of use cases and are **not** recommended for use with the Scale Computing HC3 system.

- Cisco Catalyst 3650
- Cisco Catalyst 3750 Family
- HP Procurve 1910
- 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
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).

NOTE

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.

This helps to mitigate scenarios where one or more HC3 nodes may believe itself isolated on the network, impacting access to any running HC3 VMs.

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

**WARNING**

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.

Scale Computing is not responsible for improper functionality or performance of the HC3 system due to a cable mismatch and/or malfunction.

**HC1100 & HC1200 (10GbE SFP+) HC3 Series Nodes**

- **HC1200/HC1250 - Intel X710 NICs.**
- **Any SFP passive or active limiting direct attach copper cable that complies with the SFF-8431 v4.1 and SFF-8472 v10.4 specifications.**
- **SFF-8472 identifier must have value 03h for SFP or SFP+ (verify the value with the cable manufacturer).**
- **Maximum cable length for passive cables is 7 meters.**
- **Support for active cables requires Intel® Network Connections software version 15.3 or later.**
- **Intel® Ethernet SFP SR Optics and Intel® Ethernet SFP LR Optics are the only 10GbE optical modules supported; you cannot use other brands of SFP (10GbE) modules with these adapters.**
- **Only the modules listed in the table under “What SFP+ and SFP modules are supported?” on the Intel FAQ page will work with the X710. Find the latest FAQ [here](#).**

**HC1100 & HC1200 (1GbE and 10GBaseT) HC3 Series Nodes**

- **HC1100/1150 HC1200/1250 - Intel X550-T2.**
- **RJ-45 Connectors.**
- **A minimum of Category 5e cables are recommended for 1GbE ports.**
- **A minimum of Category 6a cables are required for 10GBaseT ports.**
- **10GBaseT ports are both 10GbE and 1GbE capable with the recommended Category 6a and up cables. The NIC ports are designed to auto-negotiate the speed provided by your local switch.**
HC1250D & HC1250DF (10G SFP+) HC3 Series Nodes

- Intel X722 NICs.
- SFP+ Connectors
- SFP+ Direct Attach (DAC) cables are recommended.
- Maximum cable length for passive cables is 7 meters.
- Intel® Ethernet SFP SR Optics and Intel® Ethernet SFP LR Optics are the only 10GbE optical modules supported; you cannot use other brands of SFP (10GbE) modules with these adapters.
- The use of SFP transceivers to connect to a 1GbE network is not supported for either LAN or Backplane.
- See the "Supported transceivers and cables" section in the product guide here for the latest supported cables and transceivers.

HC5250 (10GbE SFP+) HC3 Series Nodes

- Intel X722 NICs.
- The 4-port SFP+ LOM adapters have empty SFP+ cages that support SFP+ SR and LR transceivers.
- See the "Supported transceivers and cables" section in the product guide here for the latest supported cables and transceivers.

HE500 (10GbE SFP+) HC3 Series Nodes

- Intel X710 NICs.
- Any SFP passive or active limiting direct attach copper cable that complies with the SFF-8431 v4.1 and SFF-8472 v10.4 specifications.
- SFF-8472 identifier must have value 03h for SFP or SFP+ (verify the value with the cable manufacturer).
- Maximum cable length for passive cables is 7 meters.
- Support for active cables requires Intel® Network Connections software version 15.3 or later.
- Intel® Ethernet SFP SR Optics and Intel® Ethernet SFP LR Optics are the only 10GbE optical modules supported; you cannot use other brands of SFP (10GbE) modules with these adapters.
- Only the modules listed in the table under "What SFP+ and SFP modules are supported?" on the Intel FAQ page will work with the X710. Find the latest FAQ here.
# Hardware Procurement

**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 are subject to the manufacturer’s warranty terms. Switches resold through Scale Computing can receive replacements through Scale Computing ScaleCare Support for the duration of the HC3 system hardware support contract subject to the manufacturer warranty terms and ScaleCare Support discretion after troubleshooting for the switch has taken place.

HC3 systems with software-only support or no support may still be able to contact their switch manufacturer directly for any switch hardware or software issues.

## NOTE

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 on Scale Computing’s behalf, implicit or explicit. Switches are considered third party hardware and are not covered under the support and warranty for the HC3 system; switches are subject to their given manufacturer warranty agreement.

### Switches

<table>
<thead>
<tr>
<th>1GbE</th>
<th>10GbE SFP+</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Dell N2024: B24-DL</td>
<td>● Dell x4012: B12-DL-10</td>
</tr>
<tr>
<td>● HP ProCurve 2930F: B24-HP</td>
<td>● Mellanox SN2010: B34-M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10GbBaseT (1GbE or 10GbE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Netgear ProSafe XS712T: B12-NG-10b</td>
</tr>
</tbody>
</table>

### Rack

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

### Cables

- **Dell**
  - 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.
## HC3 System Networking

### 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.

<table>
<thead>
<tr>
<th>HC3 Task</th>
<th>Protocol and Port</th>
<th>Usage</th>
</tr>
</thead>
</table>
| 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. |
Public (LAN) and Private (Backplane) Networks

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.

NOTE

HC3 NIC ports are active/passive bonded through the HC3 node software only. Scale Computing does not support any other configuration type at this time (teaming, bridging, etc).

LAN Network Provisioning

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 Provisioning

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 re-installation of the system.

### Best Practices for LAN and Backplane 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, 10.100.11.12, 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 network environment.

**WARNING**

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.
### 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 **Public (LAN) and Private (Backplane) Networks** section for further details on HC3 NIC configuration and provisioning.

#### Example High Availability Configuration

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.

### Best Practices for HC3 System High Availability and Redundancy

Scale Computing nodes are designed for network and data redundancy. This section offers tips and best practices for fully utilizing these features in the HC3 system. Not all high availability features will be available in Single Node Systems (SNS).

- 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).

### Networking Hardware Layouts for LAN and Backplane Ports

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

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.

Scale Computing HC1250D and HC1250DF Series

10GBaseT and 10GbE SFP+ port configuration for the HC1250D and HC1250DF models.
Scale Computing HC5100 Series

10GbE SFP+ port configuration for the HC5150D model. This HC5100 Series is currently 10GbE SFP+ only.

Scale Computing HC5200 Series

10GbE SFP+ port configuration for the HC5250D model. This HC5200 Series is currently 10GbE SFP+ only.

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.
Lenovo x3550 M5

Lenovo SR630

Lenovo SR650
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/.

Disclaimer
Any networking outside the immediate Scale Computing hardware is not covered under the support and warranty for the Scale Computing HC3 system. Scale Computing is not responsible for any issues arising from the use of this guide. Any and all questions, issues, or concerns regarding network or switch configuration should be directed to the hardware manufacturer and/or your local vendors, partners, service providers, consultants, etc.

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.