Abstract
This guide describes HPE Synergy hardware configuration options and compatibility. Hewlett Packard Enterprise assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.
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About this document

The configuration and compatibility document

HPE Synergy is the world’s first platform architected for Composable Infrastructure—built from the ground up to bridge traditional and new IT with the agility, speed, and continuous delivery needed for today’s applications. It is composed of various hardware configurations and managed by HPE OneView.

This document includes the following sections:

• **HPE Synergy architecture**
  Provides an overview of HPE Synergy management and fabric architecture.

• **HPE Synergy components configuration**
  Contains the detailed component location, numbering, and basic configuration requirements for the hardware components, including the frame, compute modules, storage modules, interconnect modules, and various infrastructure components.

• **Cabling**
  Provides examples of different hardware cabling configurations.

• **Glossary for HPE Synergy**
  Contains the definitions of common terminology associated with HPE Synergy.

Additional configuration and compatibility support documentations for HPE Synergy

The HPE OneView Support Matrix for HPE Synergy and the HPE Synergy Image Streamer Support Matrix are companion documents that provide additional configuration information for HPE Synergy. The documents are located in the Hewlett Packard Enterprise Information Library.

HPE Synergy terminology

The terms used for HPE Synergy hardware components in the software tools might be different than the terms used in this document. For example, in the software, a compute module may be called server and a frame may be called enclosure.

For more information about HPE Synergy terminology, see the HPE Synergy Glossary on the Hewlett Packard Enterprise Information Library (http://www.hpe.com/info/synergy-docs).
HPE Synergy architecture

HPE Synergy architecture overview

HPE Synergy takes the management of IT equipment and the scale at which fabrics are deployed beyond the single enclosure:

- From chassis-based management and cabling to row-based management and optimized cabling
- From chassis-based fabric scale to rack and multi-rack-based fabric scale

This system design reduces the complexity and cost of deploying and managing a large number of frames full of IT equipment.

Management architecture

HPE Synergy Composer powered by HPE OneView manages HPE Synergy. Data centers can have multiple HPE Synergy systems, each managed by a pair of HPE Synergy Composers.

Connectivity for the management appliance bays is redundantly routed internally to each frame link module in the frame. For connectivity to the management network, each frame link module supports a 10GBASE-T MGMT port with autonegotiation for 10Gb or 1Gb connections. Frame link modules provide redundant management network uplink connectivity (using multiple MGMT port uplinks) and redundant connectivity between linked enclosures (using multiple LINK ports). The frame link module manages uplink and linked enclosure connectivity automatically without user configuration nor external rack switch configuration. However, all external rack switches must be IEEE 802.1D compliant.

HPE Synergy supports the following configurations:

- Individual frame management (remote enclosure)
- Ring configuration of frames connected through the frame link module LINK port (Recommended)

Individual frame management (remote enclosure)

A single HPE Synergy frame can be managed individually by connecting the frame link module MGMT ports on each frame to the management network. A loss of any single cable or connection still allows each frame to maintain connectivity to the management network.

A frame that contains no HPE Synergy Composers is referred to as a remote enclosure (frame). All remote enclosures (frames) within an HPE Synergy system must be connected to the same subnet as the frame containing the HPE Synergy Composers.

Two Ethernet management cables and two RJ45-based management ports on the external rack switch are required for each frame being managed. The individual frame configuration is not optimal for
deploying multiple co-located frames as it does not take advantage of uplink consolidation available with a ring configuration (frame link topology). Additionally, this configuration does not support automatic discovery. Each individual frame (remote enclosure) must be manually added into HPE OneView.

Figure 1: Individual frame management network connections example

Ring configuration of frames connected through the frame link module LINK port (Recommended)

A connection between pairs of frame link modules from frame to frame creates a fully connected ring. In HPE OneView, the ring configuration is called a frame link topology. This configuration simplifies the connection to the management network. The connection through the frame link module LINK port is required to provide management network connectivity to an entire ring of frames.

A ring configuration of frames connected through the frame link module reduces cabling complexity and external rack switch port usage. This method also enables automatic discovery and configuration of the connected frame and IT components, significantly simplifying initial setup.

If the HPE Synergy Composers are in different locations than shown in the examples, then the cable routing for the MGMT port is different and tracks the locations of the HPE Synergy Composers.

Figure 2: Ring configuration of frames connected through the frame link module LINK port example

About frame link topology (HPE OneView frame management)

HPE OneView manages all frames in a management ring. In HPE OneView, the management ring is referred to as a frame link topology. A management ring that contains HPE Synergy Composers is
referred to as a primary frame link topology. A management ring that does not contain HPE Synergy Composers is referred to as a remote frame link topology.

**NOTE:** For the maximum number of frames supported in a frame link topology, see the *HPE OneView Support Matrix for HPE Synergy* (http://www.hpe.com/info/synergy-docs). The maximum number includes all the frames in primary and remote frame link topologies.

- An HPE Synergy frame link topology is visual representation of a set of HPE Synergy frames that are physically connected by cabling frame link module LINK ports between each frame.
- HPE OneView reports frame link topology on the selected Enclosure screen for all frames linked to that frame.

For more information on HPE OneView for Synergy, see the *HPE OneView Help for HPE Synergy* (https://www.hpe.com/info/synergy-docs).

**Master/Satellite fabric architecture**

HPE Synergy supports both traditional single frame-based networking as well as a multi-frame, single-switch architecture. The multiframe architecture is referred to as a Master/Satellite fabric.

In a Master/Satellite fabric configuration, there is a single fabric switch or Virtual Connect module ("Master") whose ports span across multiple frames through ("Satellite") interconnect modules.

Logically, all compute modules in a multiframe Master/Satellite configuration are directly connected to the master switch or master Virtual Connect module.

![Logical View](image)

**Figure 3: Logical view of a master/satellite configuration**

Physically, one of the frames in the multiframe configuration houses the master module, while the other frames contain the satellite modules. The frame supporting master module is referred to as a master frame and a frame supporting a satellite is referred to as a satellite frame.
Figure 4: Physical view of a multiframe master/satellite configuration

The satellite module physically and electrically transfers the fabric signals carried by the cabling from the master module to the midplane of the satellite frame. There is no switching in the satellite modules.

Depending on the data rate of the fabric, a Master/Satellite fabric configuration enables network scaling from a single frame to up to three frames using the HPE Synergy 20Gb Interconnect Link Module or five frames using the HPE Synergy 10Gb Interconnect Link Module.
HPE Synergy components configuration

HPE Synergy hardware overview

HPE Synergy enables a new class of compute modules and storage modules engineered to address the IT challenges such as those created by social, cloud, mobile, and big data. The system is managed by HPE Synergy Composer powered by HPE OneView, which provides management to dozens of HPE Synergy frames with hundreds of compute and storage modules.

HPE Synergy includes the following hardware system components:

- HPE Synergy 12000 Frame
- Appliance modules
- Compute modules
- Expansion modules
- Storage modules
- Interconnect modules

Supported racks and rack options

The frame and support rails are engineered for mounting into a 19 inch wide front panel, four-post cabinets, and racks that have been designed according to the EIA-310-D standard.

Hewlett Packard Enterprise rails are not compatible with tapped holes. There are two types of supported rail sets for the frame:

- A set for square-hole front and rear mounting flanges
- A set for round-hole flanges

The rails are compatible with a nominal rack-mounting depth of 29 1/8 in, with an adjustability range of plus ½ inch to minus 1 ½ inch. The rails work in both 1,075 mm and 1,200 mm deep racks.

A 42U/47U rack supports up to four frames.

While the square-hole rail set is the standard option, either rail set supports a fully loaded frame weighing 249.5 kg (550.0 lb). Four of these frames together approach the 1,020.6 kg (2,250.0 lb) internal IT equipment limit of both the following HPE Advanced G2 Series racks:

- 42U x 600 mm x 1,075 mm
- 42U x 600 mm x 1,200 mm

Cables, PDUs, and other cable management hardware could increase the weight sufficiently to require the use of the HPE 42U x 600 mm x 1,200 mm Enterprise G2 Series rack, which supports 1,247.4 kg (2,750.0 lb) internal IT equipment.

HPE Synergy 12000 Frame

All HPE Synergy components are installed in a 10U, rack-mounted frame.
Frame component minimum requirements

- All ten fans are required.
- A minimum of two power supply modules are required. For more information, see "Power supply configurations."
- A minimum of one interconnect module per fabric interconnect bay set is required for networking or storage connectivity. For more information, see "Interconnect module configurations."
- A minimum of one frame link module is supported in a single-frame configuration. For more information, see "Frame link module configurations."
- A minimum of one Composer is required within the HPE Synergy system. For more information, see "HPE Synergy Composer configurations."

Frame thermal requirements

⚠️ CAUTION: All bays within the frame that do not have a component installed must have a bay blank installed.

⚠️ CAUTION: Do not block the frame front-side air vents. The vents are required for air flow throughout the frame.

All device bays within the frame that do not have a component installed must have a device bay blank installed. HPE Synergy has the following blank options available:

- Half-height* device bay blank
- Appliance bay blank
- Interconnect bay blank
- Frame link module bay blank
- Power supply bay blank
*For full-height device bays, use a coupler plate (HPE part number 417849-001) to connect two half-height device bay blanks to create a full-height device bay blank.

**Information pull tabs**

Pull tabs on the HPE Synergy frame front and rear provide system information.

![Diagram of information pull tab locations](image-url)

**Figure 6: Information pull tab locations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The front pull tab (top left) has the frame product ID, serial number, and the device bay numbering for the frame front bays.</td>
</tr>
<tr>
<td>2</td>
<td>The rear pull tab (top left) has the bay numbering for the frame rear bays.</td>
</tr>
</tbody>
</table>
| 3    | The serial label pull tab is on each compute module and provides the following information:
  - Product serial number
  - iLO information
  - QR code that points to mobile-friendly documentation |
Frame front components and device bays

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Device bays—Compute modules and storage modules</td>
</tr>
<tr>
<td>2</td>
<td>Front panel—Provides access to the HPE Synergy console, via KVM or laptop.</td>
</tr>
<tr>
<td>3</td>
<td>Appliance bays</td>
</tr>
</tbody>
</table>

**Device bay numbering**

All device bays in the frame are numbered in consecutive order from lowest to highest, from left to right from top to bottom, as observed by a user looking directly at the frame.

Devices larger than half-height (multi-bay devices) are numbered according to the lowest device bay number that the multi-bay device occupies.
For an even number of device modules, they must be installed next to each other between sets of vertical partitions if all device bays in the frame are to be used.

For an odd number of single-wide full-height device modules, an even number must be installed next to each other between each vertical partition, and the odd module must be installed in device bay 2 if all device bays in the frame are to be used.

The device bay numbering is available on the Information pull tabs.

<table>
<thead>
<tr>
<th>Device bay type</th>
<th>Device bay numbering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-wide, full-height</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>Single-wide, half-height</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>Single-wide, mixed-height</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>Double-wide, full-height</td>
<td>1 3 5</td>
</tr>
<tr>
<td>Double-wide, half-height</td>
<td>1 3 5 7 9 11</td>
</tr>
<tr>
<td>Double-wide, mixed-height</td>
<td>1 3 5 9 11</td>
</tr>
</tbody>
</table>

**Device bay partitions**

**Vertical frame partitions**

There are two vertical partitions between device bays in the frame. These nonremovable partitions provide structural integrity to the frame as well as mechanical attach points for the horizontal shelf that divide a full-height bay into two half-height bays.

Up to six full-height device modules can be installed in a frame.
Figure 8: Vertical partitions

Horizontal frame partitions
The horizontal frame partitions are removable shelves that divide a full-height device bay into a half-height device bay.
Up to 12 half-height device modules can be installed in a frame.

Figure 9: Horizontal partitions
An optional horizontal half shelf can be installed between bay 1 and bay 7 to enable those bays to be used by half-height device modules when a full-height module is installed in bay 2.
Appliance modules

You can install the following appliances in the appliance bays in the front of the HPE Synergy frame:

- **HPE Synergy Composer**
- **HPE Synergy Image Streamer**

The appliance modules have the exact same form factor and externally appear the same. The label on the front of the appliance module identifies the name of the appliance module.
HPE Synergy Composer

Powered by HPE OneView, the HPE Synergy Composer provides the ability to setup, manage, and monitor single or multiple linked frames.

HPE Synergy Composer configurations

• A minimum of one HPE Synergy Composer is required per HPE Synergy management ring or management domain.

• If redundancy is required, two HPE Synergy Composer modules must be installed within the same management ring per HPE Synergy system for high availability management:

  ◦ In a single-frame installation, or in configurations where the HPE Synergy system is composed entirely of a set of single frames, both Composers must be installed in one of the frames within the HPE Synergy system.

  ◦ In a multiframe installation, each Composer module should be installed in separate frames. Installing both Composer modules in the same frame in a multiframe configuration is supported but will result in a warning indicating that the Composer modules are not configured for high availability.

  ◦ In multiframe installations comprising multiple management rings, both Composer modules must be located within the same management ring.

For configuration options for the HPE Synergy Composer, see the product Quick Specs on the Hewlett Packard Enterprise website (http://www.hpe.com/info/qc).
HPE Synergy Image Streamer

The Image Streamer is an appliance option that customizes and deploys operating systems for HPE Synergy compute modules to boot and run from, providing a stateless server experience for the compute modules.

Image Streamer configurations

Requirements and supported configurations for Image Streamer depend on whether the Image Streamers are deployed in a development environment or a production environment.

Image Streamer configurations are cabled together to create logical enclosures in HPE OneView. An Image Streamer configuration with a single-frame is used for development and proof of concept purposes only. An Image Streamer configuration with from 2 to 5 frames in a logical enclosure is used for a production configuration.

Image Streamer production configurations

For production deployments, Hewlett Packard Enterprise requires the Image Streamer configuration to be highly available by following these guidelines:

- The number of frames in the Image Streamer configuration must match the number of frames in the logical enclosure. A logical enclosure is configured of 2 to 5 frames.
- Two Image Streamers per logical enclosure configuration is required.
- Only one Image Streamer is allowed per frame. Depending on the configuration, the appliance module can be installed in either appliance bay 1 or 2.
- For Image Streamer to have redundant paths over which to provide OS images to compute modules, one redundant data fabric per logical enclosure is required. Each fabric includes one master switch configuration, so that multiple interconnect link modules can support the master interconnect module.

Production Image Streamer configurations can be deployed across two, three, four, or five frames with a management ring size as small as the logical enclosure size.

For information about Image Streamer configurations and cabling, see the HPE Synergy Cabling Guide on the Hewlett Packard Enterprise website (http://www.hpe.com/info/synergy-docs).

Two-frame HPE Synergy Image Streamer configuration

Each management ring requires a redundant pair of uplinks to the management network. Accordingly, a two-frame Image Streamer configuration is only possible if the two frames are part of a management ring that is larger than two frames. Doing so allows all four MGMT ports in the two-frame configuration to be used for Image Streamer data connections to the production Ethernet fabric.

Three-frame HPE Synergy Image Streamer configuration

A three-frame Image Streamer configuration has the same Image Streamer cabling requirements as the two-frame configuration with the third frame providing the management uplinks. Although connecting both management uplinks to the same frame is not preferred, it is supported. Connecting both uplinks to the same frame allows the three-frame configuration to support an HA pair of Composer modules. If a three-frame configuration is part of a larger management ring, it is possible for the management uplinks to be connected to different frames within the management ring. This configuration depends on the size of the management ring and the size of any other Image Streamer configurations that are part of the management ring.

Four and five-frame HPE Synergy Image Streamer configuration

A four-frame Image Streamer configuration is an optimal configuration because it supports the ability to populate a single appliance module per frame. This configuration provides for independent HA deployments for both Image Streamer and Composer. Cabling requirements are the same as a three-
frame configuration while allowing the opportunity for the management uplinks to be connected to different frames.

A five-frame Image Streamer configuration is similar to the four-frame configuration with the additional frame connected to the management ring. No additional Image Streamer or management uplink connectivity is required.

Multiple Image Streamer / logical enclosure configurations per management ring are possible as long as the HA and cabling requirements are followed.

For information about cabling the HPE Image Streamer configurations, see the HPE Synergy Cabling Guide on the Hewlett Packard Enterprise website (http://www.hpe.com/info/synergy-docs).

**Image Streamer development configuration**

Because this configuration includes only a single Composer and a single Image Streamer, Hewlett Packard Enterprise does not support this configuration as a production solution. This configuration is intended for development and proof of concept purposes only.

The Image Streamer development configuration includes a single frame with the following components installed:

- One Composer (installed in appliance bay 1)
- One Image Streamer (installed in appliance bay 2)
- Two frame link modules
- One or more Virtual Connect Ethernet modules

Installing the Composer in appliance bay 1 and installing Image Streamer in appliance bay 2 is required.

For information about Image Streamer configurations and cabling, see the HPE Synergy Cabling Guide on the Hewlett Packard Enterprise website (http://www.hpe.com/info/synergy-docs).

**Compute modules**

Compute modules are installed in the device bays in the front of the frame. Each compute module delivers high performance, efficiency, and scalability to power demanding workloads. The compute modules deliver increased virtual machine density by providing a full range of processor and storage options, and a simplified I/O architecture.

**HPE Synergy 480 Gen9 and Gen10 Compute Modules**

The HPE Synergy 480 Gen9 and Gen10 Compute Modules are half-height, single-wide form factor compute modules.
HPE Synergy 660 Gen9 and Gen10 Compute Modules
The HPE Synergy 660 Gen9 and Gen10 Compute Modules are full-height, single-wide form factor compute modules.

HPE Synergy 620 Gen9 Compute Module
The HPE Synergy 620 Gen9 Compute Module is a full-height, single-wide form factor compute module.
Figure 14: HPE Synergy 620 Gen9 Compute Module

HPE Synergy 680 Gen9 Compute Module

The HPE Synergy 680 Gen9 Compute Module is a full-height, double-wide form factor compute module created by connecting an HPE Synergy 620 Gen9 primary compute module and an HPE Synergy 680 Gen9 expansion compute module with the compute module link.
Expansion module options

Expansion modules are options for the HPE Synergy 480 Gen9 and Gen10 Compute Modules. The expansion modules support select PCIe graphics cards and MXM graphics cards.

**HPE Synergy 480 Gen9 and Gen10 Multi MXM Expansion Module**

The HPE Synergy 480 Gen9 Multi MXM Expansion Modules install on the HPE Synergy 480 Gen9 Compute Module. The HPE Synergy 480 Gen10 Multi MXM Expansion Modules install on the HPE Synergy 480 Gen10 Compute Module. Installing the expansion module creates a half-height, double-wide form factor compute module.
HPE Synergy 480 Gen9 and Gen10 PCIe Expansion Module

The HPE Synergy 480 Gen9 PCIe Expansion Module installs on the HPE Synergy 480 Gen9 Compute Module. The HPE Synergy 480 Gen10 PCIe Expansion Module installs on the HPE Synergy 480 Gen10 Compute Module. Installing the expansion module creates a half-height, double-wide form factor compute module.

Figure 17: HPE Synergy 480 Gen9 and Gen10 PCIe Expansion Module

Mezzanine port configurations

Mezzanine cards for HPE Synergy compute modules come the following sizes:

- Type C — Type C mezzanine cards can be installed on either Type C or Type D mezzanine connectors.
- Type D — Type D mezzanine cards can only be installed on Type D connectors.

The mapping from mezzanine connectors in compute modules to interconnect module bays is shown in the following table.

All mezzanine connectors in the table are not available for all compute modules. For example, the HPE Synergy 480 Gen9 Compute Module has Mezzanine connector 1, 2, and 3 on the system board. For more information on the mezzanine connectors available on each compute module, see the compute module user guide.

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector identification</th>
<th>Supported card types</th>
<th>Fabric</th>
<th>Supported ICM bays</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mezzanine connector 1 (M1)</td>
<td>Type C and Type D</td>
<td>1</td>
<td>ICM 1 and 4</td>
</tr>
<tr>
<td>2</td>
<td>Mezzanine connector 2 (M2)</td>
<td>Type C and Type D</td>
<td>2</td>
<td>ICM 2 and 5</td>
</tr>
<tr>
<td>3</td>
<td>Mezzanine connector 3 (M3)</td>
<td>Type C only</td>
<td>3</td>
<td>ICM 3 and 6</td>
</tr>
<tr>
<td>4</td>
<td>Mezzanine connector 4 (M4)</td>
<td>Type C and Type D</td>
<td>1</td>
<td>ICM 1 and 4</td>
</tr>
<tr>
<td>5</td>
<td>Mezzanine connector 5 (M5)</td>
<td>Type C and Type D</td>
<td>2</td>
<td>ICM 2 and 5</td>
</tr>
<tr>
<td>6</td>
<td>Mezzanine connector 6 (M6)</td>
<td>Type C</td>
<td>3</td>
<td>ICM 3 and 6</td>
</tr>
</tbody>
</table>

Table Continued
<table>
<thead>
<tr>
<th>Item</th>
<th>Connector identification</th>
<th>Supported card types</th>
<th>Fabric</th>
<th>Supported ICM bays</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Mezzanine connector 7 (M7)</td>
<td>Type C and Type D</td>
<td>1</td>
<td>ICM 1 and 4</td>
</tr>
<tr>
<td>8</td>
<td>Mezzanine connector 8 (M8)</td>
<td>Type C and Type D</td>
<td>2</td>
<td>ICM 2 and 5</td>
</tr>
<tr>
<td>9</td>
<td>Mezzanine connector 9 (M9)</td>
<td>Type C</td>
<td>3</td>
<td>ICM 3 and 6</td>
</tr>
<tr>
<td>10</td>
<td>Mezzanine connector 10 (M10)</td>
<td>Type C and Type D</td>
<td>1</td>
<td>ICM 1 and 4</td>
</tr>
<tr>
<td>11</td>
<td>Mezzanine connector 12 (M12)</td>
<td>Type C only</td>
<td>3</td>
<td>ICM 3 and 6</td>
</tr>
</tbody>
</table>

Mezzanine connector definitions and installation guidelines vary depending on the compute module. For more information, see the compute module user guide. For more information about supported mezzanine options, see the compute module QuickSpecs on the Hewlett Packard Enterprise website.

**Mezzanine to frame signal routing**

The HPE Synergy 12000 Frame midplane provides 4-lane high speed signal routing from all 12 device bays to the 6 interconnect module bays. A pair of interconnects installed in an interconnect bay set provide redundant connectivity for each connected mezzanine card. When a device bay contains a...
compute module, then each of the installed mezzanine cards connect to the corresponding interconnect bay sets.

Usage of these interconnections is dependent on the type of fabric chosen to be installed. For example, a 10Gb Ethernet mezzanine card uses only a single lane of each four-lane group. The SAS fabric uses all four lanes.

**Storage modules**

Storage modules can be installed in the front of the frame to provide additional storage for the compute modules.

**HPE Synergy D3940 Storage Module**

The HPE Synergy D3940 Storage Module is a half-height, double-wide 40 SFF drive bay module designed for use in HPE Synergy 12000 Frames. Through the HPE Synergy 12Gb SAS Connection Module, it provides composable direct attached storage for up to 10 compute modules in a single frame. The storage module is optimized for use as either a direct-attached storage array or as software-defined storage.

![HPE Synergy D3940 Storage Module](image)

**Figure 18: HPE Synergy D3940 Storage Module**

**HPE Synergy 12Gb SAS Connection Module**

The HPE Synergy 12Gb SAS Connection Module connects compute modules to in-frame storage resources. In conjunction with the HPE Synergy D3940 Storage Module, the SAS Connection Module connects composable direct attached storage for up to 10 compute modules in a single frame.

The HPE Synergy 12Gb SAS Connection Module is installed in interconnect module bays in the rear of the frame. For more information, see [Interconnect modules](#) on page 35.
Storage module configurations

For detailed configuration options for each of the storage modules, see the appropriate Quick Specs on the Hewlett Packard Enterprise website.

⚠️ CAUTION: Installation of the storage module into the frame without drives requires one person. Installation of the storage module into the frame with drives already installed requires two people.

HPE Synergy D3940 Storage Module configurations

• Install the storage module in any two adjoining device bays.
• Install up to four storage modules within a frame with HPE Synergy Gen9 compute modules or up to five storage modules within a frame with HPE Synergy Gen10 compute modules.
• Install an HPE Smart Array P542D Controller in mezzanine slot 1 or 4 when connecting a storage module to HPE Synergy Gen9 compute modules.
• Install an HPE Smart Array P416ie-m SR Gen10 Controller in mezzanine slot 1 or 4 when connecting a storage module to HPE Synergy Gen10 compute modules.
• The storage module is only supported for connectivity with fabric 1.

HPE Synergy 12Gb SAS Connection Module configurations

For single- or non-redundant SAS connection module configurations:

• A SAS Connection Module in ICM bay 1 connects to the primary I/O adapter on storage modules in device bays 1, 3, or 5.
• A SAS Connection Module in ICM bay 4 connects to the primary I/O adapter on storage modules in device bays 7, 9, or 11.

For redundant SAS fabric configurations with SAS Connection Modules in ICM bays 1 and 4:

• Install a second SAS I/O adapter (the first I/O adapter comes standard) for each storage module.
• Install up to four storage modules within a frame with HPE Synergy Gen9 compute modules or up to five storage modules within a frame with HPE Synergy Gen10 compute modules.

Storage module drive numbering

When installing components into the storage module, note the following drive numbering.

• 40 hot-pluggable SFF drive bays:
◦ For proper air flow, drives must be populated from back to front. Using the drive numbering image, begin populating bays 33 through 40, and continue to populate back to front, finishing with bays 1 through 8.

◦ Drive blanks are not required or provided.

• 2 hot-pluggable I/O adapter bays:

◦ The first I/O adapter must be installed in I/O adapter bay 1.

◦ I/O adapter blanks are not required or provided.

◦ I/O adapter health status is solid green or solid amber.

![Drive numbering image]

**Figure 20: Storage module drive numbering**

**Frame rear components**

![Frame rear components diagram]
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fans (10)</td>
</tr>
<tr>
<td>2</td>
<td>Interconnect modules (up to 6)</td>
</tr>
<tr>
<td>3</td>
<td>Power supplies (6)</td>
</tr>
<tr>
<td>4</td>
<td>Frame link modules (2)</td>
</tr>
</tbody>
</table>

**Rear component bay numbering**

![Rear component bay numbering diagram](image)

<table>
<thead>
<tr>
<th>Components</th>
<th>Bays</th>
<th>Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame link modules</td>
<td>1 and 2</td>
<td></td>
</tr>
<tr>
<td>Interconnect modules</td>
<td>1 and 4</td>
<td></td>
</tr>
<tr>
<td>These interconnect modules are redundant pairs on fabric 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interconnect modules</td>
<td>2 and 5</td>
<td></td>
</tr>
<tr>
<td>These interconnect modules are redundant pairs on fabric 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interconnect modules</td>
<td>3 and 6</td>
<td></td>
</tr>
<tr>
<td>These interconnect modules are redundant pairs on fabric 3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fans</td>
<td>1 through 10</td>
<td></td>
</tr>
<tr>
<td>Power supplies</td>
<td>1 through 6</td>
<td></td>
</tr>
</tbody>
</table>
NOTE: The arrow direction on each of the power supply icons indicates the recommended power routing to either A-side or B-side. For more information about A-side and B-side power distribution, see "Power cabling."

HPE Synergy Frame Link Module

The frame link module, installed in the rear of the frame, controls shared frame resources such as power and cooling and provides the connections that create a management ring. It also provides connections for accessing the HPE Synergy Console.

Figure 21: Frame Link Module

Frame link module components and LEDs
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MGMT port activity LED</td>
<td>Reports MGMT port activity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flashing green = Activity on the MGMT port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off = No activity on the MGMT port</td>
</tr>
<tr>
<td>2</td>
<td>MGMT port</td>
<td>A 10GBASE-T RJ45 connector that provides the following functions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides a management uplink to the management network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides a data connection to the data network when an Image</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Streamer management appliance is installed in the frame.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Automatically negotiates speed to 10GbE or 1GbE based on the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>connection.</td>
</tr>
<tr>
<td>3</td>
<td>MGMT port connectivity LED</td>
<td>Reports MGMT port connectivity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Solid green = MGMT port is connected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off = MGMT port is not connected.</td>
</tr>
<tr>
<td>4</td>
<td>Health LED</td>
<td>Provides the health status of the frame link module.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Solid green = Normal operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flashing amber = Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flashing red = Critical error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the Health LED indicates a warning or a critical error, connect to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE OneView or to the HPE Synergy Console for more information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and troubleshooting assistance.</td>
</tr>
<tr>
<td>5</td>
<td>UID button</td>
<td>Toggles the UID LED on or off.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Solid blue = Activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off = Deactivated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flashing blue = Firmware upgrade is in progress on the frame link</td>
</tr>
<tr>
<td></td>
<td></td>
<td>module.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do not remove either frame link module while the UID LED is flashing.</td>
</tr>
<tr>
<td>6</td>
<td>USB</td>
<td>Allows connection to the frame using a supported USB device. Devices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>include a keyboard or mouse for connecting to the HPE Synergy Console.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To connect multiple devices, a USB hub (not included) is required.</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Function</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>LINK port activity LED</td>
<td>Reports LINK port activity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flashing green = Activity on the LINK port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off = No activity on the LINK port</td>
</tr>
<tr>
<td>8</td>
<td>LINK port</td>
<td>A 10GBASE-T RJ45 connector that provides two functions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides high availability management network connectivity between:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ LINK ports on two frame link modules in the same frame for a single frame configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ Frame link modules in different frames as part of a management network ring in a multiframe configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides connectivity as part of a management network ring which connects multiple frames for automatic discovery by HPE OneView.</td>
</tr>
<tr>
<td>9</td>
<td>LINK port connectivity LED</td>
<td>Reports LINK port connectivity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Solid green = LINK port is connected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off = LINK port is not connected.</td>
</tr>
<tr>
<td>10</td>
<td>Monitor port</td>
<td>Allows connection to the frame using a monitor device or an active monitor port adapter.</td>
</tr>
</tbody>
</table>

1 The 10GBASE-T MGMT port automatically negotiates speed to 10GbE or 1GbE based on the connection.

Frame link module configurations

- A minimum of one frame link module must be installed in every frame. It can be installed in either frame link module bay.
- A second frame link module can be installed in the frame for redundancy and to provide the ability to link multiple frames together into a management ring.
- For each installed Composer, you must uplink the management cable for the FLM with the same bay number in the same frame.

HPE Synergy power supplies

The 2650W hot-pluggable power supplies provide power to the components installed in the frame.
Figure 22: HPE Synergy 12000 Frame 2650W AC Titanium Hot Plug Power Supply

Figure 23: HPE 2650W -48V DC Hot Plug Power Supply

Figure 24: HPE 2650W HVDC Hot Plug Power Supply

Figure 25: HPE 2650W 277VAC Hot Plug Power Supply
Power supply configurations

Sufficient power supplies must be installed to support the installed devices and interconnect modules. Power estimates for HPE Synergy can be provided using either the HPE Synergy Planning Tool or the HPE Power Advisor. For more information about the HPE Power Advisor or the HPE Synergy Planning Tool, see the Data Center Infrastructure Advisor page (https://dcia.itcs.hpe.com/).

The number of supported power supplies in the frame range from a minimum of two to a maximum of six power supplies. There are no power supply bay placement restrictions of power supplies in the frame. However, for best cooling and power distribution, Hewlett Packard Enterprise recommends the following best practice for power supply usage.

NOTE: The default power mode is Redundant power feed mode.

<table>
<thead>
<tr>
<th>Number of power supplies</th>
<th>Power modes</th>
<th>Power supply bay (Power feed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not supported</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>Redundant power supply mode</td>
<td>1(A) and 3(A)</td>
</tr>
<tr>
<td></td>
<td>Redundant power feed mode</td>
<td>1(A) and 3(B)</td>
</tr>
<tr>
<td>3 ¹</td>
<td>Redundant power supply mode</td>
<td>1(A), 3(A), and 5(A)</td>
</tr>
<tr>
<td>4</td>
<td>Redundant power supply mode</td>
<td>1(A), 3(A), 4(A), and 6(A)</td>
</tr>
<tr>
<td></td>
<td>Redundant power feed mode</td>
<td>1(A), 3(B), 4(A), and 6(B)</td>
</tr>
<tr>
<td>5 ¹</td>
<td>Redundant power supply mode</td>
<td>1(A), 2(A), 3(A), 4(A), and 6(A)</td>
</tr>
<tr>
<td>6</td>
<td>Redundant power supply mode</td>
<td>1(A), 2(A), 3(A), 4(A), 5(A), and 6(A)</td>
</tr>
<tr>
<td></td>
<td>Redundant power feed mode</td>
<td>1(A), 2(A), 3(B), 4(A), 5(B), and 6(B)</td>
</tr>
</tbody>
</table>

¹ If an odd number of power supplies are installed in a frame that is configured for redundant power feed mode, all power supplies are providing power to the frame, but the capacity of the odd power supply is not used to determine the overall power capacity of the frame.

To enhance cooling, populate all power supply bays with either a power supply blank or a power supply.

Power supply configuration recommendations for the frame do not depend on the type of power supply being used. However, all power supplies must be of the same type. Mixed-type power supply configurations are not supported.

HPE Synergy Fan

The fans provide air circulation and cooling for the frame components and compute modules.

IMPORTANT: All ten fans are required in the HPE Synergy 12000 Frame
HPE Synergy Fan guidelines

- Installation Guidelines — The HPE Synergy 12000 Frame ships with all 10 fans installed.
- Fan Redundancy — The upper five fan modules (fan bays 1 to 5) and the bottom five fan modules (fan bays 6 to 10) do not share a common plenum. Each group of fan bays cools specific component bays.

  Fans modules in bays 1 to 5 cool the following component bays:
  
  - Device bays 1 to 6
  - Appliance bay 1
  - Frame Link Module 1
  - Interconnect modules ICM 1, ICM 2, and ICM 3

  Fan modules in bays 6 to 10 are used to cool the following component bays:
  
  - Device bays 7 to 12
  - Appliance bay 2
  - Frame Link Module 2
  - Interconnect modules ICM 4, ICM 5, and ICM 6

- All Conditions — For both the upper and lower half of the frame, the five fans provide 4+1 redundancy for cooling under all conditions. Four fans are adequate to cool the components installed into that half of the frame.

- A single fan failure in either (or both) of the two rows of fans will continue to cool all supported configurations of Synergy. A degraded frame alert is generated indicating that a fan has failed and should be serviced.

- If more than one fan fails per row, then a more serious thermal alert is issued and no additional frame devices are allowed to power on.
Interconnect modules

The interconnect modules connect components installed in the device bays to various data center fabrics, enabling the facility to receive, process, and forward data to the destination component.

**HPE Synergy 12Gb SAS Connection Module**—Used to connect compute modules to in-frame storage resources

![HPE Synergy 12Gb SAS Connection Module](image)

**Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy**—Used in Fibre Channel configurations

![Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy](image)

**Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy**—Used in Fibre Channel configurations

![Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy](image)

**HPE Virtual Connect SE 16Gb FC Module for HPE Synergy**—Used in Fibre Channel configurations

![HPE Virtual Connect SE 16Gb FC Module for HPE Synergy](image)
Figure 30: HPE Virtual Connect SE 16Gb FC Module for HPE Synergy

HPE Synergy 40Gb F8 Switch Module—Used as the Master Ethernet switch

Figure 31: HPE Synergy 40Gb F8 Switch Module

HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy—Used as the Master Ethernet VC module

Figure 32: HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy

HPE Synergy 20Gb Interconnect Link Module—Used as the Satellite or link module

Figure 33: HPE Synergy 20Gb Interconnect Link Module

HPE Synergy 10Gb Interconnect Link Module—Used as the Satellite or link module
Figure 34: HPE Synergy 10Gb Interconnect Link Module

**HPE Synergy 10Gb Pass-Thru Module**—Used to pass traffic from the device bay mezzanine to the pass-thru port of the interconnect module

Figure 35: HPE Synergy 10Gb Pass-Thru Module

**Mellanox SH2200 25/50Gb Switch**—Used to pass traffic from the device bay mezzanine to the pass-thru port of the interconnect module

Figure 36: Mellanox SH2200 25/50Gb Switch
Interconnect module bay numbering

There are multiple configurations for the interconnect modules, and the installation of each interconnect module is dependent on the configuration and fabric.

<table>
<thead>
<tr>
<th>Compute module signal</th>
<th>Interconnect bay number</th>
<th>Interconnect bay label</th>
<th>Fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mezzanine 1, 4, 7, 10</td>
<td>1 and 4</td>
<td>🟢</td>
<td>1</td>
</tr>
<tr>
<td>Mezzanine 2, 5, 8</td>
<td>2 and 5</td>
<td>🟣</td>
<td>2</td>
</tr>
<tr>
<td>Mezzanine 3, 6, 9, 12</td>
<td>3 and 6</td>
<td>🟦</td>
<td>3</td>
</tr>
</tbody>
</table>

Interconnect module configurations

The HPE Synergy 12000 Frame supports a pair of redundant interconnect modules for each of the three fabrics. Hewlett Packard Enterprise recommends the following best practices:

- Fabric 1 primary use—Storage
- Fabric 2 primary use—Storage or networking
- Fabric 3 primary use—Networking

**NOTE:** Though each fabric has a recommended primary use, it is not required to use the primary use case. If a fabric is not being used for its primary use, it can still be used for another purpose, within the allowances.
<table>
<thead>
<tr>
<th>Fabric</th>
<th>Usage</th>
<th>ICM description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric 1</td>
<td>Storage (Primary)</td>
<td>HPE Synergy 12Gb SAS Connection Module</td>
</tr>
<tr>
<td>ICM Bays 1 and 4</td>
<td></td>
<td>Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Virtual Connect SE 16Gb FC Module for HPE Synergy</td>
</tr>
<tr>
<td>Fabric 2</td>
<td>Storage</td>
<td>Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td>ICM Bays 2 and 5</td>
<td></td>
<td>Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Virtual Connect SE 16Gb FC Module for HPE Synergy</td>
</tr>
<tr>
<td>Fabric 2</td>
<td>Networking</td>
<td>HPE Synergy 40Gb F8 Switch Module</td>
</tr>
<tr>
<td>ICM Bays 2 and 5</td>
<td></td>
<td>HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 20Gb Interconnect Link Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 10Gb Interconnect Link Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 10Gb Pass-Thru Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mellanox SH2200 25/50Gb Switch</td>
</tr>
<tr>
<td>Fabric 3</td>
<td>Networking (Primary)</td>
<td>HPE Synergy 40Gb F8 Switch Module</td>
</tr>
<tr>
<td>ICM Bays 3 and 6</td>
<td></td>
<td>HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 20Gb Interconnect Link Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 10Gb Interconnect Link Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPE Synergy 10Gb Pass-Thru Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mellanox SH2200 25/50Gb Switch</td>
</tr>
</tbody>
</table>

Always adhere to the following guidelines when planning and installing the interconnect modules in HPE Synergy frames:
• The interconnect modules are listed in order of priority from top to bottom within a fabric. For example, if the HPE Synergy 12Gb SAS Connection Module is installed, it is only supported in fabric 1 and therefore, that fabric solution is the first priority for fabric 1. If the HPE Synergy 12Gb SAS Connection Module is not used, then fabric 1 is available to be used by one of the supported HPE Synergy Fibre Channel interconnect modules. For more information about HPE Synergy 12Gb SAS Connection Module configuration, see the HPE Synergy Configuration and Compatibility Guide on the Hewlett Packard Enterprise website (http://www.hpe.com/info/synergy-docs).

• Both ICM bays within a fabric must contain the same interconnect module, unless the fabric is a Master/Satellite fabric. In a Master/Satellite fabric, one or more satellite modules can be used along with a master module to form a fabric.

• All interconnect link modules that comprise a Master/Satellite fabric must be installed in the same interconnect bay number as the corresponding master interconnect module. For example, given a three-frame configuration where the master interconnect module is installed in ICM bay 3 in one frame, the two satellite interconnect link modules in the second and third frames must also be installed in ICM bay 3.

Master interconnect module with interconnect link module configurations

The HPE Synergy Virtual Connect SE 40 Gb F8 Module or the HPE Synergy 40Gb F8 Switch Module can be configured as the master switch, with interconnect link modules to support the master interconnect module. For the HPE Synergy 10Gb Interconnect Link Module, from one to four interconnect link modules are required to support the master interconnect module. For the HPE Synergy 20Gb Interconnect Link Module, from one to two interconnect link modules are required to support the master interconnect module.

If redundancy is required, then two master switches are required per fabric. For the best availability with two or more frames, the two switches or VC modules should be installed in different frames.

As an example of a redundant fabric 3 solution, one interconnect module or VC module would be installed in ICM bay 3 in one frame and the second interconnect module or VC module would be installed in ICM bay 6 in another frame. ICM bays for the particular fabric that do not contain the interconnect modules or VC modules would contain the interconnect link modules, providing redundancy for either a interconnect module failure or frame failure.

Use one interconnect link cable to connect a 10 Gb interconnect link modules to the switch interconnect. Use two interconnect link cables to connect 20 Gb interconnect link modules to the switch interconnect.
Cabling

HPE Synergy Cabling Guide

For additional cabling scenarios and diagrams, see the HPE Synergy Cabling Guide (http://www.hpe.com/info/synergy-cabling-guide).

The HPE Synergy Cabling Guide includes:

- Multiframe cabling
- HPE Image Streamer cabling
- CAT6A patch panel LINK port cabling
- Master to satellite Interconnect cabling
- Power cabling
- HPE Synergy Console cabling

Network cabling

To ensure the frame and installed components are connected to the network, the following connections are required:

- Single-frame management network cabling example on page 41
- Master and satellite interconnect module cabling on page 42

Single-frame management network cabling example

This example shows cabling a single frame with two HPE Synergy Composers and two frame link modules installed in the frame.

**NOTE:** For high availability, Hewlett Packard Enterprise recommends installing two HPE Synergy Composers.

**NOTE:** Use a minimum of CAT6A patch cables for LINK port cabling.

**NOTE:** Do not connect frame link module LINK ports to a data center switch.

Procedure

1. Connect the MGMT ports on both frame link modules to the external management network.
2. Connect the LINK ports together.
Master and satellite interconnect module cabling

HPE Synergy supports a composable fabric that spans multiple frames and includes master interconnect modules (switches) and satellite modules (links). If your HPE Synergy configuration has a composable fabric, Hewlett Packard Enterprise recommends cabling the HPE Synergy Ethernet interconnect modules in a master switch configuration, so that multiple interconnect link modules can support the master interconnect module.

HPE OneView considers all Synergy frames that share the Virtual Connect connectivity through satellite interconnect link modules to be a single Logical Enclosure.

To cable switch modules to interconnect link modules, use the examples that follow or see the installation instructions provided with the interconnect link module.

Master interconnect module with 10G interconnect link module cabling example

1. In a multiframe system, connect either the HPE Synergy 40Gb F8 Switch Module or the HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy as the master to a satellite HPE Synergy 10Gb Interconnect Link Module in a different frame.

   Using interconnect link cables, connect the L1, L2, L3, or L4 ports on the master to the L1 port on each satellite.
2. In a single-frame or multiframe system, connect both masters with two stacking cables:

   a. Connect a stacking cable from port Q7 on the first master to port Q7 on the second module.
   b. Connect a stacking cable from port Q8 on the first master to port Q8 on the second module.

The examples shown use the HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy. The cabling varies depending on the modules being stacked.
Master interconnect module with 10G interconnect link module configuration

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of frames</td>
<td>5</td>
<td>Each network is a single physical switch/hop</td>
</tr>
<tr>
<td>Maximum half-height compute modules</td>
<td>60</td>
<td>Each network has 1:1 OSR between servers</td>
</tr>
<tr>
<td>Satellite links (CXP) per interconnect module</td>
<td>1</td>
<td>Each switch can connect to four 10G interconnect link modules</td>
</tr>
<tr>
<td>Stacking ports (QSFP+)</td>
<td>4</td>
<td>Can also be used for non-Flex uplinks</td>
</tr>
<tr>
<td>Uplink ports (QSFP+)</td>
<td>12</td>
<td>Flexports: 4 x 10G, 1 x 40 G, 4 x 2/4/8G FC</td>
</tr>
<tr>
<td>Attribute</td>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Uplink oversubscription</td>
<td>2.25:1</td>
<td>2.25:1 if using only Flexport uplinks</td>
</tr>
<tr>
<td></td>
<td>1.88:1</td>
<td>1.88:1 if also using non-Flex stacking ports as uplinks</td>
</tr>
<tr>
<td>Maximum stacked switches</td>
<td>8</td>
<td># of switches (interconnect modules do not count towards limit)</td>
</tr>
<tr>
<td>Maximum redundant fabrics per frame</td>
<td>3</td>
<td>Redundant fabrics 1, 2, and 3 (A and B)</td>
</tr>
</tbody>
</table>

**Components:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of switches</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Number of 10 G interconnect modules</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Number of interconnect link cables</td>
<td>8</td>
<td>Cable lengths allow frames to be in different racks</td>
</tr>
<tr>
<td>Number of QSFP+ stacking cables</td>
<td>2</td>
<td>In this use case, QSFP+ ports are used for stacking</td>
</tr>
<tr>
<td>Number of 10 G mezzanine cards</td>
<td>60</td>
<td>Maximum for 60 compute module (five frame) deployment</td>
</tr>
</tbody>
</table>

1 Double component counts for two redundant fabrics, and triple component counts for three redundant fabrics.

**Master interconnect module with 20G interconnect link module cabling example**

1. In a multiframe system, connect either the HPE Synergy 40Gb F8 Switch Module or the HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy as the master to a satellite HPE Synergy 20Gb Interconnect Link Module in a different frame:

   a. Using interconnect link cables, connect one of the L1 and L4 ports on the master to the L1 and L2 ports on one satellite.

   b. For a three-frame system, use interconnect link cables to connect the L2 and L3 ports on the same master to the L1 and L2 ports on the other satellite.
2. In a single-frame or multiframe system, connect both masters with two stacking cables:

   a. Connect a stacking cable from port Q7 on the first master to port Q7 on the second module.
   b. Connect a stacking cable from port Q8 on the first master to port Q8 on the second module.

   The examples shown in this section use the HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy. The cabling varies depending on the modules being stacked.

Figure 41: Multiframe stacking example
Figure 42: Single-frame stacking example

Master interconnect module with 20G interconnect link module configuration

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of frames</td>
<td>3</td>
<td>Each network is a single physical switch/hop</td>
</tr>
<tr>
<td>Maximum half-height compute modules</td>
<td>36</td>
<td>Each network has 1:1 OSR between servers</td>
</tr>
<tr>
<td>Satellite links (CXP) per interconnect module</td>
<td>2</td>
<td>Each switch can connect to two 20 G interconnect link modules</td>
</tr>
<tr>
<td>Stacking ports (QSFP+)</td>
<td>4</td>
<td>Can also be used for non-Flex uplinks</td>
</tr>
<tr>
<td>Uplink ports (QSFP+)</td>
<td>12</td>
<td>Flexports: 4 x 10G, 1 x 40 G, 4 x 2/4/8G FC</td>
</tr>
<tr>
<td>Uplink oversubscription</td>
<td>3:2</td>
<td>3:2 if using only Flexport uplinks</td>
</tr>
<tr>
<td></td>
<td>3:2</td>
<td>3:2 if also using non-Flex stacking ports as uplinks</td>
</tr>
</tbody>
</table>

Table Continued
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum stacked switches</td>
<td>8</td>
<td># of switches (interconnect modules do not count towards limit)</td>
</tr>
<tr>
<td>Maximum redundant fabrics per frame</td>
<td>3</td>
<td>Redundant fabrics 1, 2, and 3 (A and B)</td>
</tr>
</tbody>
</table>

**Components:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of switches</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Number of 20 G interconnect modules</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Number of interconnect link cables</td>
<td>8</td>
<td>Cable lengths allow frames to be in different racks</td>
</tr>
<tr>
<td>Number of QSFP+ stacking cables</td>
<td>2</td>
<td>In this use case, QSFP+ ports are used for stacking</td>
</tr>
<tr>
<td>Number of 20 G mezzanine cards</td>
<td>36</td>
<td>Maximum for 36 compute module (two or three frame) deployment</td>
</tr>
</tbody>
</table>

1 Double component counts for two redundant fabrics, and triple component counts for three redundant fabrics

**Power cabling**

The frame can be cabled for power feed redundancy or power supply redundancy.

**Cabling power supplies for power feed redundancy**

Power feed redundancy may be achieved by connecting 1+1, 2+2, or 3+3 power supplies to Phase A+B.

To cable a frame for power feed redundancy, use the following recommendation as a best practice:

1. Connect power supplies 1, 2, and 4 to the A-side power distribution unit.
2. Connect power supplies 3, 5, and 6 to the B-side power distribution unit.
3. Verify that the power supply cords are securely connected using the reusable cable tie wraps.
After power is supplied to the frame, it powers up automatically. The power and health LEDs on the front panel, Composer appliance, and frame link modules illuminate green to indicate that there are no errors or alert conditions.

**Cabling multiple frames for power feed redundant power**

To cable multiple frames for redundancy using best practices, review the following example of a redundant power feed configuration.

Your configuration can vary depending on the PDUs installed.
Connect to the HPE Synergy Console

You can connect to the HPE Synergy console using a notebook computer or a keyboard, video monitor, and mouse.

The HPE Synergy console provides access to HPE OneView running on an HPE Synergy Composer appliance.

The HPE Synergy console also provides access to the serial console for modules installed within a frame, including management appliances, interconnects, or compute modules. To access the serial console for a module, connect to the HPE Synergy console via ports in the same frame as the module.

When installing an HPE Synergy system, to access HPE OneView, connect to the HPE Synergy console via ports in a frame that has an HPE Synergy Composer appliance. After all frames in an HPE Synergy system have been claimed during hardware setup, you can connect to any frame to access HPE OneView through the HPE Synergy console.
Connecting to the HPE Synergy Console using a keyboard, video monitor, and mouse

NOTE: This procedure describes connecting a keyboard and mouse to a monitor with an integrated USB hub. Alternatively, you can use a standalone USB hub to connect a keyboard and mouse.

Prerequisites

A frame link module is installed in a frame link module bay.

Procedure

1. Connect a monitor cable to the monitor port and connect a USB cable to the USB port on either:

   • The Front panel module on the front of the frame.

   • One of the Frame Link Modules on the rear of the frame.
2. Connect a monitor to the frame with the monitor cable.

3. Connect a USB keyboard and mouse to the USB ports on the monitor, and connect the monitor USB to the frame with the USB cable.

   An alternative is to connect the USB keyboard and mouse to a USB hub connected to the frame.

### Connecting to the HPE Synergy Console using a laptop computer

**NOTE:** Do not plug the front panel laptop port into a switch. The front panel laptop port is designed to provide a single laptop access to HPE Synergy Console.

**Prerequisites**

At least one frame link module is installed in one of the frame link module bays.

**Procedure**

1. Ensure that the Ethernet port of the laptop computer is configured for DHCP.

   Alternatively, you can configure the laptop Ethernet port to the IP address: 192.168.10.2 with the subnet mask 255.255.255.0.

2. Use a CAT5 cable to connect the laptop computer Ethernet port to the laptop port on a front panel module.
3. Wait for the laptop computer to be assigned an IP address from the frame link module.

4. Access the HPE Synergy Console using either a VNC client or web browser.
   a. Web browser: Open a web browser and enter "http://192.168.10.1:5800".
   b. VNC client: Open a VNC client and connect to 192.168.10.1 port 5900.

   A VNC client will load to the web browser and open the HPE Synergy Console.
Specifications

HPE Synergy QuickSpecs

HPE Synergy has system specifications as well as individual product and component specifications. For complete specification information, see the HPE Synergy and individual HPE Synergy product QuickSpecs on the Hewlett Packard Enterprise website (www.hpe.com/info qs).
Documentation and troubleshooting resources for HPE Synergy

HPE Synergy documentation

The Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs) is a task-based repository. It includes installation instructions, user guides, maintenance and service guides, best practices, and links to additional resources. Use this website to obtain the latest documentation, including:

- Learning about HPE Synergy technology
- Installing and cabling HPE Synergy
- Updating the HPE Synergy components
- Using and managing HPE Synergy
- Troubleshooting HPE Synergy

HPE Synergy Configuration and Compatibility Guide

The HPE Synergy Configuration and Compatibility Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides an overview of HPE Synergy management and fabric architecture, detailed hardware component identification and configuration, and cabling examples.

HPE Synergy Frame Link Module User Guide

The HPE Synergy Frame Link Module User Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It outlines frame link module management, configuration, and security.

HPE OneView User Guide for HPE Synergy

The HPE OneView User Guide for HPE Synergy is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It describes resource features, planning tasks, configuration quick start tasks, navigational tools for the graphical user interface, and more support and reference information for HPE OneView.

HPE OneView Global Dashboard

The HPE OneView Global Dashboard provides a unified view of health, alerting, and key resources managed by HPE OneView across multiple platforms and data center sites. The HPE OneView Global Dashboard User Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides instructions for installing, configuring, navigating, and troubleshooting the HPE OneView Global Dashboard.

HPE Synergy Image Streamer User Guide

The HPE Synergy Image Streamer User Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It describes the OS deployment process using Image Streamer, features of Image Streamer, and purpose and life cycle of Image Streamer artifacts. It also includes authentication, authorization, and troubleshooting information for Image Streamer.
HPE Synergy Image Streamer GitHub

The HPE Synergy Image Streamer GitHub repository (github.com/HewlettPackard) contains sample artifacts and documentation on how to use the sample artifacts. It also contains technical white papers explaining deployment steps that can be performed using Image Streamer.

HPE Synergy Software Overview Guide

The HPE Synergy Software Overview Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides detailed references and overviews of the various software and configuration utilities to support HPE Synergy. The guide is task-based and covers the documentation and resources for all supported software and configuration utilities available for:

- HPE Synergy setup and configuration
- OS deployment
- Firmware updates
- Troubleshooting
- Remote support

Best Practices for HPE Synergy Firmware and Driver Updates

The Best Practices for HPE Synergy Firmware and Driver Updates is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides information on how to update the firmware and recommended best practices to update firmware and drivers through HPE Synergy Composer, which is powered by HPE OneView.

HPE OneView Support Matrix for HPE Synergy

The HPE OneView Support Matrix for HPE Synergy is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It maintains the latest software and firmware requirements, supported hardware, and configuration maximums for HPE OneView.

HPE Synergy Image Streamer Support Matrix

The HPE Synergy Image Streamer Support Matrix is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It maintains the latest software and firmware requirements, supported hardware, and configuration maximums for HPE Synergy Image Streamer.

HPE Synergy Glossary

The HPE Synergy Glossary, in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs), defines common terminology associated with HPE Synergy.

HPE Synergy troubleshooting resources

HPE Synergy troubleshooting resources are available within HPE OneView and in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs).

Troubleshooting within HPE OneView

HPE OneView graphical user interface includes alert notifications and options for troubleshooting within HPE OneView. The UI provides multiple views of HPE Synergy components, including colored icons to indicate resource status and potential problem resolution in messages.
You can also use the Enclosure view and Map view to quickly see the status of all discovered HPE Synergy hardware.

HPE Synergy Troubleshooting Guide

The HPE Synergy Troubleshooting Guide is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides information for resolving common problems and courses of action for fault isolation and identification, issue resolution, and maintenance for both HPE Synergy hardware and software components.

Error Message Guide for HPE ProLiant Gen10 servers and HPE Synergy

The Error Message Guide for HPE ProLiant Gen10 servers and HPE Synergy is in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs). It provides information for resolving common problems associated with specific error messages received for both HPE Synergy hardware and software components.

HPE OneView Help and HPE OneView API Reference

The HPE OneView Help and the HPE OneView API Reference are readily accessible, embedded online help available within the HPE OneView user interface. These help files include “Learn more” links to common issues, as well as procedures and examples to troubleshoot issues within HPE Synergy.

The help files are also available in the Hewlett Packard Enterprise Information Library (www.hpe.com/info/synergy-docs).

HPE Synergy QuickSpecs

HPE Synergy has system specifications as well as individual product and component specifications. For complete specification information, see the HPE Synergy and individual HPE Synergy product QuickSpecs on the Hewlett Packard Enterprise website (www.hpe.com/info/qs).
HPE Synergy document overview (documentation map)

www.hpe.com/info/synergy-docs
## Planning

- HPE Synergy 12000 Frame Site Planning Guide
- HPE Synergy Configuration and Compatibility Guide
- HPE OneView Support Matrix for HPE Synergy
- HPE Synergy Image Streamer Support Matrix
- Setup Overview for HPE Synergy
- HPE Synergy Software Overview Guide

## Installing hardware

- HPE Synergy Start Here Poster (included with frame)
- HPE Synergy 12000 Frame Setup and Installation Guide
- Rack Rails Installation Instructions for the HPE Synergy 12000 Frame (included with frame)
- HPE Synergy 12000 Frame Rack Template (included with frame)
- Hood labels
- User guides
- HPE Synergy Cabling Interactive Guide
- HPE OneView Help for HPE Synergy — Hardware setup

## Configuring for managing and monitoring

- HPE OneView Help for HPE Synergy
- HPE OneView User Guide for HPE Synergy
- HPE OneView API Reference for HPE Synergy
- HPE OneView REST API Scripting Help for HPE Synergy
- User Guides

## Managing

- HPE OneView User Guide for HPE Synergy
- HPE Synergy Image Streamer Help
- HPE Synergy Image Streamer User Guide
- HPE Synergy Image Streamer API Reference
- HPE Synergy Image Streamer deployment workflow
- HPE Synergy Frame Link Module User Guide

## Monitoring

- HPE OneView User Guide for HPE Synergy
- HPE OneView Global Dashboard User Guide

## Maintaining

- Product maintenance and service guides
- Best Practices for HPE Synergy Firmware and Driver Updates
- HPE OneView Help for HPE Synergy
- HPE OneView User Guide for HPE Synergy
- HPE Synergy Appliances Maintenance and Service Guide for HPE Synergy Composer and HPE Synergy Image Streamer

## Troubleshooting

- HPE OneView alert details
- HPE Synergy Troubleshooting Guide
- Error Message Guide for HPE ProLiant Gen10 servers and HPE Synergy
- Integrated Management Log Messages and Troubleshooting Guide for HPE ProLiant Gen10 and HPE Synergy
- HPE OneView API Reference for HPE Synergy
- HPE Synergy Image Streamer API Reference
Support and other resources

Accessing Hewlett Packard Enterprise Support

• For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:
  http://www.hpe.com/assistance

• To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:
  http://www.hpe.com/support/hpesc

Information to collect

• Technical support registration number (if applicable)
• Product name, model or version, and serial number
• Operating system name and version
• Firmware version
• Error messages
• Product-specific reports and logs
• Add-on products or components
• Third-party products or components

Accessing updates

• Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.

• To download product updates:
  Hewlett Packard Enterprise Support Center
    www.hpe.com/support/hpesc
  Hewlett Packard Enterprise Support Center: Software downloads
    www.hpe.com/support/downloads
  Software Depot
    www.hpe.com/support/softwaredepot

• To subscribe to eNewsletters and alerts:
  www.hpe.com/support/e-updates

• To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center More Information on Access to Support Materials page:
IMPORTANT: Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

http://www.hpe.com/support/selfrepair

Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

Remote support and Proactive Care information
HPE Get Connected
www.hpe.com/services/getconnected
HPE Proactive Care services
www.hpe.com/services/proactivecare
HPE Proactive Care service: Supported products list
www.hpe.com/services/proactivecaresupportedproducts
HPE Proactive Care advanced service: Supported products list
www.hpe.com/services/proactivecareadvancedsupportedproducts

Proactive Care customer information
Proactive Care central
www.hpe.com/services/proactivecarecentral
Proactive Care service activation
www.hpe.com/services/proactivecarecentralgetstarted

Warranty information

To view the warranty information for your product, see the links provided below:

HPE ProLiant and IA-32 Servers and Options
www.hpe.com/support/ProLiantServers-Warranties
HPE Enterprise and Cloudline Servers
www.hpe.com/support/EnterpriseServers-Warranties
Regulatory information

To view the regulatory information for your product, view the Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

www.hpe.com/info/reach

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

www.hpe.com/info/ecodata

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

www.hpe.com/info/environment

Documentation feedback

Hewlett Packard Enterprise is committed to providing documentation that meets your needs. To help us improve the documentation, send any errors, suggestions, or comments to Documentation Feedback (docsfeedback@hpe.com). When submitting your feedback, include the document title, part number, edition, and publication date located on the front cover of the document. For online help content, include the product name, product version, help edition, and publication date located on the legal notices page.
This glossary defines common terminology associated with HPE Synergy.

**appliance module**

A device installed in the appliance bays on the front of the frame that hosts various management software. Data is shared from the management software across the appliance module and out to the entire HPE Synergy system through the frame link modules.

Examples include the HPE Synergy Composer appliance module and HPE Synergy Image Streamer appliance module.

**compute module**

A device module used by HPE Synergy to run server applications. The compute module typically consists of processors, memory, drives, and mezzanine cards.

**connection module**

Connection module is the short name for the HPE Synergy 12Gb SAS Connection Module. It is an interconnect module that supports serial-attached SCSI (SAS).

**converged network adapter (CNA)**

A device that combines the functionality of a host bus adapter (HBA) with a network interface controller (NIC).

**device bay**

The device bays are located in the front of the frame where the various compute module and storage module devices are installed.

**double-wide module**

A device module that occupies two adjacent HPE Synergy device bays.

A double-wide device module can be either a full-height module (such as the HPE Synergy 680 Compute Module) or a half-height module (such as the HPE Synergy D3940 Storage Module).
**fabric**

The high-speed interface connection between the front device bays and the rear interconnect module bays, as well as between pairs of redundant interconnect module bay sets.

Three fabrics are created by the interconnect module bay sets:

- Fabric 1—ICM bays 1 and 4
- Fabric 2—ICM bays 2 and 5
- Fabric 3—ICM bays 3 and 6

**frame**

The enclosure or chassis for HPE Synergy. The HPE Synergy 12000 Frame houses and provides power and cooling for HPE Synergy component modules, such as compute, storage, appliance, interconnect, and frame link modules.
frame link module

A module that controls shared frame resources including power, cooling, and management connectivity. Up to two frame link modules can be installed in an HPE Synergy frame to provide redundant management. The frame link module also provides the connections to create a management ring.

Connections through the frame link module **LINK** ports create an HPE Synergy management ring. Connections through the frame link module **MGMT** ports enable the frame to be connected to the Synergy system.

frame link topology

The HPE OneView visual representation of the HPE Synergy management ring.

front panel

The front panel includes the UID and health LEDs for the frame, as well as notebook and KVM ports for connecting to the HPE Synergy console.

full-height module

A device module that occupies both the upper and lower device bays in an HPE Synergy 12000 Frame.

A full-height module can be either a single-wide module (such as the HPE Synergy 660 Compute Module) or a double-wide module (such as the HPE Synergy 680 Compute Module).
half-height module

A device module that occupies either the upper or lower device bay of an HPE Synergy 12000 Frame.

A half-height device module can be either a single-wide module (such as the HPE Synergy 480 Compute Module) or a double-wide module (such as the HPE Synergy D3940 Storage Module).

HPE OneView enclosure group

An enclosure group is a logical resource that defines a standard configuration for member logical enclosures. The logical interconnect groups associated with the enclosure group define the network connectivity for the enclosure group. An enclosure group can contain up to five frames.

HPE OneView logical interconnect group

One or more logical interconnect groups (LIGs) are associated with an enclosure group. They are used to define the logical interconnect configuration for every frame that is using that enclosure group. Logical interconnect group configurations include the I/O bay occupancy, uplink sets, available networks based on the uplink sets and internal networks, and downlinks.

HPE Synergy Composer

An appliance module that is installed into the HPE Synergy frame. It hosts the HPE OneView management software and sets up, manages, and monitors single or multiple linked frames.

HPE Synergy Custom SPP

An HPE Synergy Custom SPP is a comprehensive collection of firmware and system software components, all tested together as a single solution stack that includes drivers, agents, utilities, and firmware packages. Firmware bundles enable you to update firmware on your HPE Synergy system.

HPE Synergy Image Streamer

An appliance module that is installed into the HPE Synergy frame. It hosts software used to deploy and customize operating systems for use by HPE Synergy compute modules.

The HPE Image Streamer GUI can be launched from the HPE OneView OS Deployment Servers screen.

HPE Synergy Management combination

HPE Synergy Management combination is a versioned set of HPE Synergy Composer and HPE Synergy Image Streamer software.

HPE Synergy software release

HPE Synergy software releases define the versions of HPE Synergy Composer, HPE Synergy Image Streamer, and the HPE Synergy Custom SPP (Service Pack for ProLiant) that must be used together, eliminating the need to track and update individual firmware and drivers for your HPE Synergy system.
Image Streamer appliance
An individual HPE Synergy Image Streamer module placed in HPE Synergy frames.
A pair of Image Streamer modules functions together to form a highly available redundant pair.

interconnect bay set
The pair of redundant interconnect modules that comprise each of the three fabrics in an HPE Synergy frame.
Each frame has three interconnect bay sets, one for each fabric:

• Fabric 1—Interconnect bays 1 and 4
• Fabric 2—Interconnect bays 2 and 5
• Fabric 3—Interconnect bays 3 and 6

interconnect link module
An interconnect link module is a satellite interconnect module that extends connectivity of a master interconnect module to a satellite frame.
HPE Synergy supports a composable fabric that spans multiple frames and includes master interconnect modules (switches) and satellite modules (links).

interconnect link topology
The HPE OneView visual representation of the cabling that connects master interconnect modules and satellite interconnect link modules. This interconnect cabling creates a composable fabric for a set of frames.

interconnect module
Interconnect modules (ICMs) enable communication between the server hardware in the frame and the data center networks. HPE Synergy supports various interconnect modules, including:

• Switch module
• Virtual Connect module
• Interconnect link module
• Pass-through module

logical enclosure
A collection of one to five frames that are physically connected through interconnect link cables.
**management network subnet**

A logical division of a computer network, in which all frames can reach each other by broadcast at the data link layer. This network enables a system administrator to monitor and manage all components connected within the data link layer.

**management ring**

A management ring is formed by connecting the LINK ports of all frame link modules in a ring configuration. A management ring can create either a:

- Single-frame configuration
- Multiframe configuration

An HPE Synergy Composer appliance module manages the Synergy system across the management ring. The Composer can manage from either:

- Local installation—The Composer is installed within the management ring.
- Remote installation—The Composer is installed in a separate management ring within the same Synergy system.

**master frame**

The HPE Synergy frame where a master interconnect module is installed.

**mezzanine card**

A Type C or Type D card that provides an interface from mezzanine slots in compute modules to corresponding interconnect bay sets. The connections between the mezzanine cards and the interconnect modules are dependent on the type of the fabric installed.
**multiframe configuration**

In a multiframe configuration, more than one frame is connected within a management ring. Only one of the frame link modules within the ring is required to connect to the HPE Synergy system through the frame link module **MGMT** port.

A multiframe management ring is formed when the **LINK** port of an upper frame link module of one frame is connected to the **LINK** port of a lower frame link module of another frame. An internal link within the frame connecting the two frame link modules together within the frame completes all the connections to form the ring.

**pass-thru module**

A pass-thru module passes traffic directly from the mezzanine through the interconnect module. A pass-thru module requires specific planning, because the port mapping depends on which device bay the mezzanine resides and which ICM bay the pass-thru module is installed.

**primary active Image Streamer appliance**

This appliance provides the deployment server user interface, artifact management, and deployment control. You can assign the primary appliance.

**primary frame link topology**

The primary frame link topology contains at least one HPE Synergy Composer (two for high availability). The primary frame link topology is connected to the management LAN using the MGMT ports on the frame link modules.

**primary Image Streamer appliance**

The primary Image Streamer appliance pair for a deployment server. The primary appliance pair manages server deployment, creates artifacts, and provides storage for the OS volumes for the compute modules in its logical enclosure.

**primary standby Image Streamer appliance**

The standby Image Streamer appliance for the primary pair. When an active appliance becomes unavailable, the standby appliance takes over the management function of the active appliance and becomes the active appliance.

**remote frame link topology**

Remote frame link topologies do not include HPE Synergy Composers. Management LAN connectivity enables remote frame link topologies to be managed by the HPE Synergy Composers in the primary frame link topology. You can use the Add remote enclosures option to bring remote frame link topologies under management. The remote frame link topology must be in the same router domain as the primary frame link topology.

**satellite frame**

The HPE Synergy frame where only satellite interconnect link modules are installed.

**secondary Image Streamer appliance**

The secondary Image Streamer appliance pair provides storage for the OS volumes for the compute modules in its logical enclosure. If the primary appliance becomes unavailable, the Infrastructure administrator can designate a secondary appliance as the primary and manage the deployment process.

**single-frame configuration**

In a single-frame configuration, the frame is connected directly to the HPE Synergy system through the **MGMT** port of the frame link module.
A single-frame management ring requires the **LINK** port of the upper frame link module to connect to the **LINK** port of the lower frame link module. An internal link within the frame connecting the two frame link modules together completes the ring.

**single-wide module**

A device module that is the width of one HPE Synergy device bay.

A single-wide device module can be either a full-height module (such as the HPE Synergy 660 Compute Module) or a half-height module (such as the HPE Synergy 480 Compute Module).

**stacking cables**

Cables that connect QSFP+ ports across two interconnect switch modules to provide different data rate options and potentially increase port-density for the stacked switches.

**storage module**

The storage module is installed in the frame front device bays to support extra storage for the compute modules.

An example of a storage module is the HPE Synergy D3940 Storage Module. It is a half-height, double-wide module that holds up to 40 hot plug SFF drives.

**switch module**

An interconnect module that uses packet switching to receive, process, and forward data to devices on a network.
Synergy system

An HPE Synergy system is a collection of one or more management rings, managed by a single HPE Synergy Composer or pair of HPE Synergy Composers (for high availability), that must be connected to the same management network subnet.

UID button

The universal identification LED is on the front panel of the HPE Synergy frame, and illuminates to identify the frame within the data center.

Virtual Connect module

An interconnect module that uses dynamic Virtual Connect infrastructure technology to implement packet switching to receive, process, and forward data to devices on a network.
Acronyms and abbreviations

CNA
Converged Network Adaptor
CSA
Canadian Standards Association
EIA
Electronic Industries Alliance
EMI
electromagnetic interference
ESD
electrostatic discharge
FC
Fibre Channel
iPDU
Intelligent Power Distribution Unit
OSR
oversubscription ratio
PDD
power delivery device
PDU
power distribution unit
SAS
serial attached SCSI
SFF
small form factor
UPS
uninterruptible power system