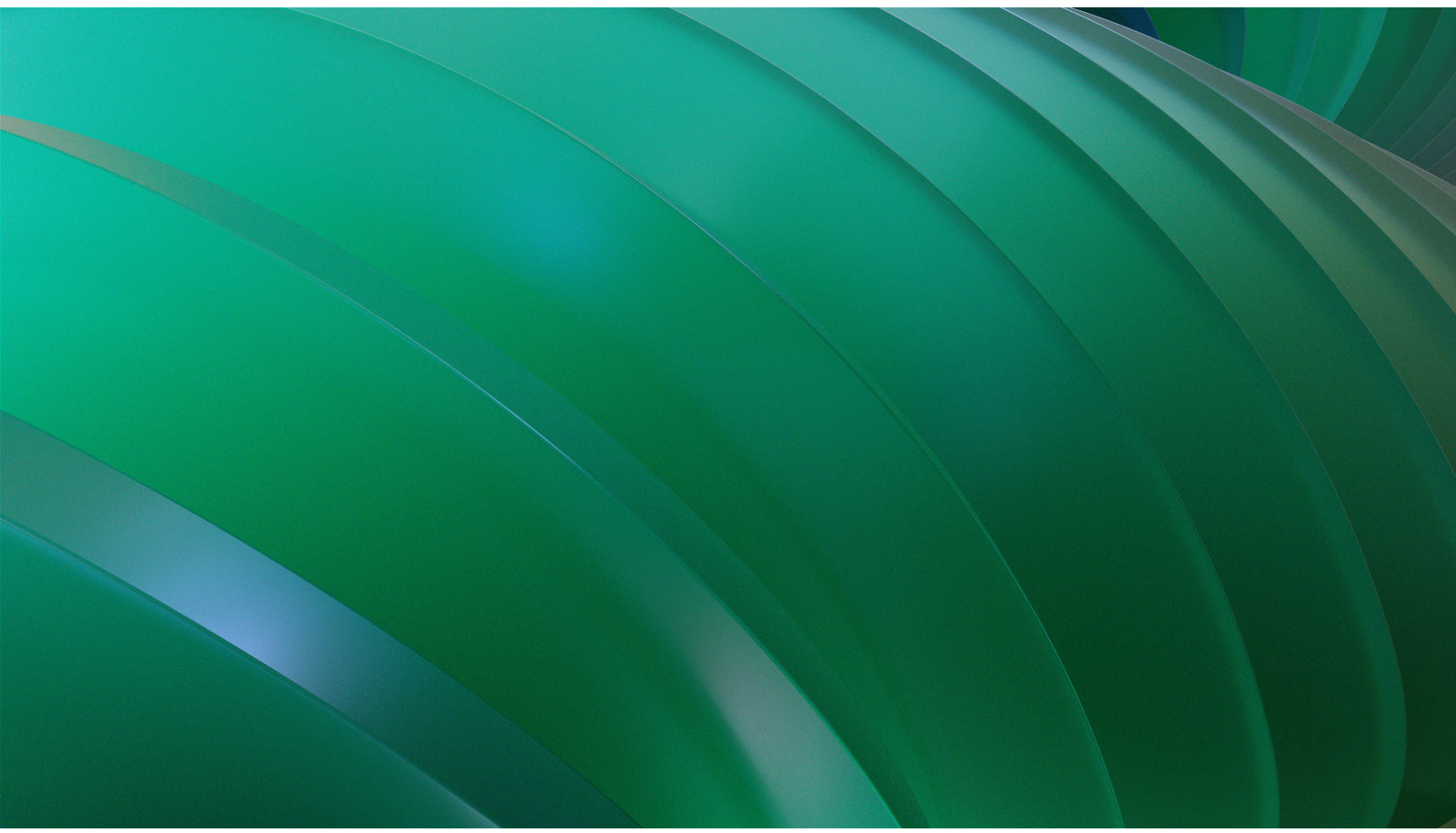




Hewlett Packard
Enterprise

Technical white paper

HPE Virtual Connect SE 100Gb F32 Module for Synergy: Flat SAN technical reference



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Abstract

The HPE Virtual Connect SE 100Gb F32 Module for Synergy direct-attach Fibre Channel hardware, known as Flat SAN, introduces a revolutionary approach to storage networking by directly connecting HPE Synergy Compute Modules to HPE Fibre Channel storage arrays. By harnessing the advanced capabilities of the HPE Virtual Connect SE 100Gb F32 Module for Synergy, this solution effectively helps eliminate the traditional complexities associated with storage area network (SAN) fabrics. Flat SAN technology simplifies network management, reduces latency, and enhances power efficiency by bypassing conventional SAN infrastructure. Additionally, Flat SAN technical reference document provides detailed guidance on the configuration process.

Introduction to Flat SAN

In today's fast-evolving enterprise data centers, the demand for storage solutions that offer simplicity, cost-effectiveness, and high performance is ever increasing. Traditional SAN architectures while reliable, often require complex setups with Fibre Channel (FC) switches, which lead to higher costs and added management complexity. To address these challenges, Hewlett Packard Enterprise has introduced Flat SAN technology, a streamlined approach to storage connectivity specifically designed for HPE Synergy environments.

Flat SAN, powered by the HPE Virtual Connect SE 100Gb F32 Module, revolutionizes storage networking by enabling direct connections between HPE Synergy Blade Systems and FC storage arrays. This helps eliminate the need for conventional SAN fabrics, allowing servers to connect directly to storage devices through the interconnect module uplink ports. This architecture not only helps ensure high performance but also supports multipathing, providing redundancy and enhancing reliability.

One of the key advantages of Flat SAN is its ability to connect multiple storage arrays. With the multiple interconnect module ports, you can connect up to four storage arrays to a single interconnect module port by utilizing an HPE Premier Flex MPO to 4x Lucent Connector fiber cable (MPO-LC split cable). This configuration significantly reduces the complexity of managing multiple storage devices while maintaining high data throughput.

To help ensure that all servers within the system can access and fully utilize the connected storage arrays, proper configuration of the HPE OneView management software is essential. With the proper HPE OneView setup, every server in the enclosure can seamlessly access the storage resources, resulting in an optimized and efficient storage solution for the entire data center.

By simplifying the storage network, Flat SAN reduces both the costs and complexities associated with traditional SAN setups while improving manageability and operational efficiency. This paper explores the technical capabilities of Flat SAN, including its key features, and the essential components required for a successful deployment. Additionally, it offers step-by-step guidance on configuring Flat SAN in modern data centers, demonstrating how this innovative technology can deliver more agile, scalable, and efficient storage solutions.

The following figures represent the Flat SAN connection using single storage array and multiple (two or more) storage arrays.

Figure 1 shows a Flat SAN connection between the HPE Synergy interconnect module and HPE GreenLake for Block Storage built on HPE Alletra Storage MP.

Figure 2 shows a Flat SAN setup with HPE GreenLake for Block Storage built on HPE Alletra Storage MP and HPE Alletra Storage 6000 (multiple storage arrays) demonstrating how HPE Synergy blade servers directly connect to these storage arrays using Flat SAN.



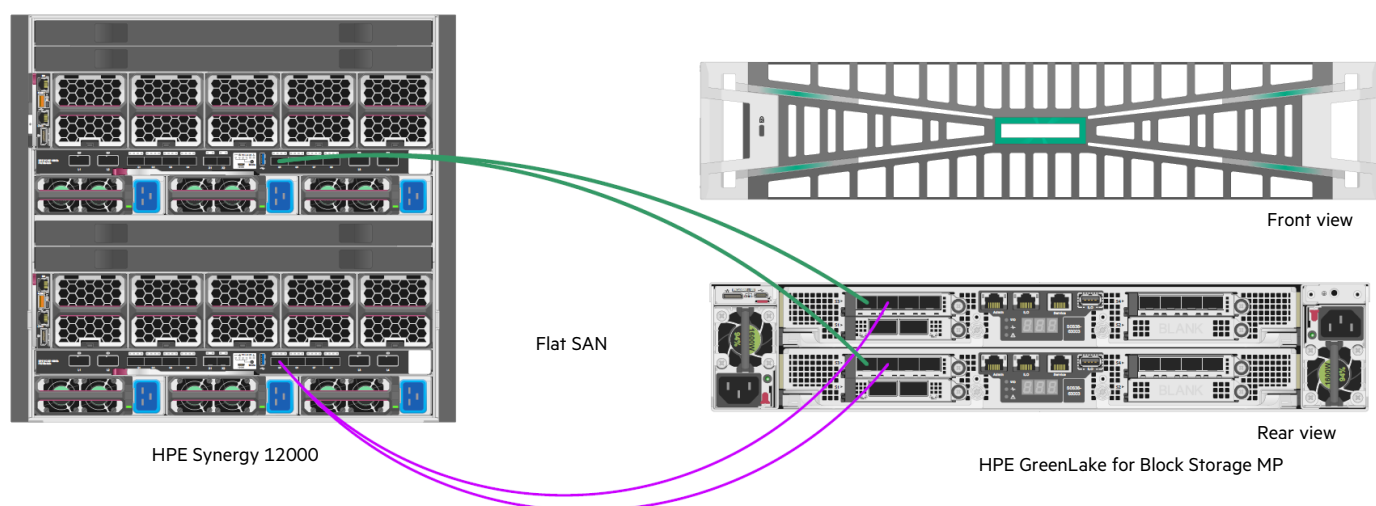


Figure 1. A Flat SAN connection between the HPE Synergy interconnect module and HPE GreenLake for Block Storage built on HPE Alletra Storage MP

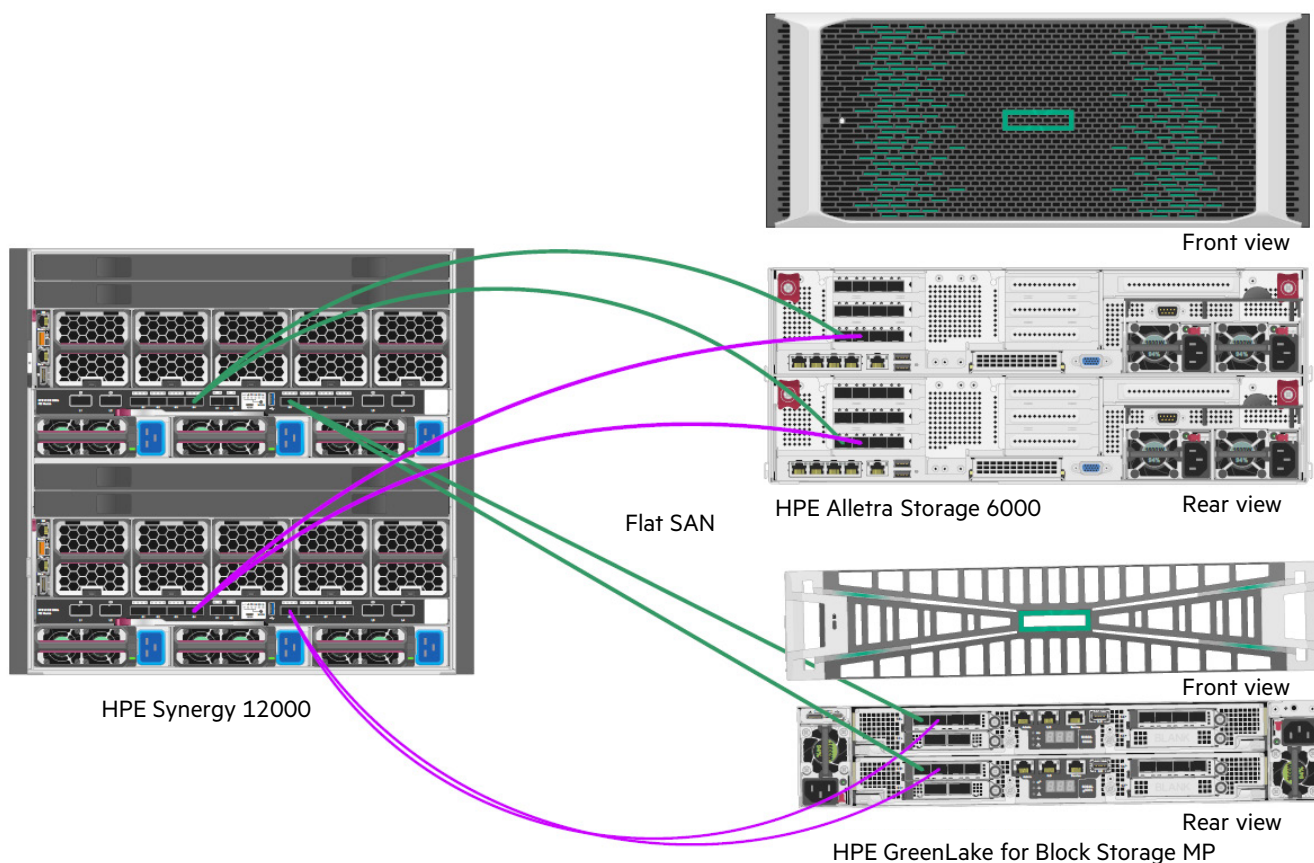


Figure 2. A Flat SAN setup with HPE GreenLake for Block Storage built on HPE Alletra Storage MP and HPE Alletra 6000 (multiple storage arrays) demonstrates how HPE Synergy blade servers directly connect to these storage arrays using Flat SAN



The introduction of the HPE Virtual Connect SE 100Gb F32 Module for Synergy

The HPE Virtual Connect SE 100Gb F32 Module for Synergy is a fundamental building block of composable infrastructure. This module helps eliminate the need for top-of-the-rack switches and substantially reduces cost. The resulting reduction in switching equipment also simplifies the management of the fabric at scale while consuming fewer ports at the data center aggregation layer.

Using the midplane of the HPE Synergy frame, each HPE Virtual Connect SE 100Gb F32 Module for Synergy provides two downlink connections (or lanes) connecting to 12 compute modules that are housed in the 12 vertical device bays on the front side of each HPE Synergy frame. Each downlink can be configured as Ethernet or Fibre Channel over Ethernet (FCoE). An FC upgrade license needs to be purchased separately to enable the FC uplink functionality. Six QSFP28 ports, each with 100 Gb Ethernet bandwidth, are provided on each module for uplinks. Additionally, each of the uplink ports can be configured as 4x25 Gb Ethernet or 4x32 Gb FC for connection to upstream Ethernet and FC switches using splitter cables.

A concise explanation of the port functionality on the HPE Virtual Connect SE 100Gb F32 Module for Synergy

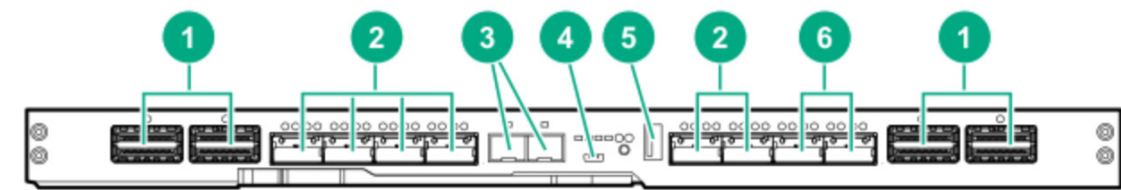


Figure 3. A concise description of the HPE Virtual Connect SE 100Gb F32 Module for Synergy ports

Table 1. Components of HPE Virtual Connect SE 100Gb F32 Module for Synergy and their descriptions

Item	Component	Description
1	Interconnect link ports L1–L4	For linking interconnect link modules
2	QSFP28 uplink ports Q1–Q6	10/25/40/100 Gb Ethernet or 8/16/32 Gb FC
3	SFP+ uplink ports X1–X2	For image streamer
4	Micro-USB	For serial port (115200,8,1)
5	USB	USB 3.0 port (unused)
6	QSFP28 uplink ports Q7–Q8	For Ethernet stacking links

Supported firmware versions for the Flat SAN feature on the HPE Virtual Connect SE 100Gb F32 Module for Synergy

[HPE Synergy Software Releases—Overview](#)

HPE Storage array support

Table 2. HPE Storage arrays support with the HPE Virtual Connect SE 100Gb F32 Module for Synergy for the Flat SAN configuration

Sl. No	HPE Storage array	Minimum firmware supported for Flat SAN	Supported speeds
1	HPE GreenLake for Block Storage built on HPE Alletra Storage MP	10.2.0.25	32 Gb and 16 Gb
2	HPE Alletra Storage 5000/6000	6.10	32 Gb and 16 Gb
3	HPE Alletra Storage 9000	9.5.15.9	32 Gb and 16 Gb
4	HPE Nimble Storage HF, AF, CS, SF	6.1.x	32 Gb and 16 Gb
5	HPE Primera 600	4.5.0.34	32 Gb and 16 Gb
6	HPE 3PAR StoreServ 8000/9000/20000	3.3.1 MU3	32 Gb and 16 Gb

[HPE Storage Single Point of Connectivity Knowledge—SPOCK](#)



Flat SAN-supported CNAs/adapters, SFPs, and cables for HPE Virtual Connect SE 100Gb F32 Module for Synergy

Adapters:

- HPE Synergy 4820C 10/20/25 Gb converged network adapter (876449-B21)
- HPE Synergy 6820C 25/50 Gb converged network adapter (P02054-B21)

SFPs or transceivers:

- HPE Synergy 100GbE/4x25GbE/4x32 Gb FC QSFP28 Transceiver (882251-B21)
- HPE QSFP28 to SFP28 Adapter (845970-B21)
The adapter allows for a smooth shift from a quad-lane port to a single-lane optical transceiver while maintaining high performance. Because it provides the option to employ lower-speed SFP28 modules in empty QSFP28 ports or when a lower-speed connection is required, it enables a much more flexible migration path toward 100GbE. Our 845970-B21 HPE compatible adapter can be plugged directly into equipment that has a 100 Gb QSFP28 port, and SFP28 transceivers can be inserted into the adapter to expand the installation flexibility. The SFP28 transceiver will transmit using the first lane 25 Gb from all four available 100G QSFP28 lanes. The most common scenarios in which our HPE compatible QSFP28 to SFP28 adapter is used are when datacom systems are being upgraded to higher switching capacity hardware. This migration process is normally carried out in a step-by-step, node-by-node fashion; however, it may reach a point where a new hardware QSFP28 port is required to be linked to an older hardware SFP28 port on occasion.

Cables:

- HPE Premier Flex MPO to 4x Lucent Connector fiber cable
Various cable lengths are available, and you can order the appropriate size based on your requirements.
- HPE LC to LC multimode fiber cable
If an HPE QSFP28 to SFP28 adapter is used, an LC-to-LC cable is required for the connection. Various cable lengths are available, and you can order the appropriate size based on your requirements.

Connection details for Flat SAN to the HPE Virtual Connect SE 100Gb F32 Module for Synergy across different models of HPE Storage arrays

The following configurations are best for connecting to interconnect modules and storage arrays, using transceivers and fiber cables.

Connecting an HPE 100 Gb module to HPE Storage arrays with SFP+ ports (4x 8/16/32 Gb to 4x 8/16/32 Gb)

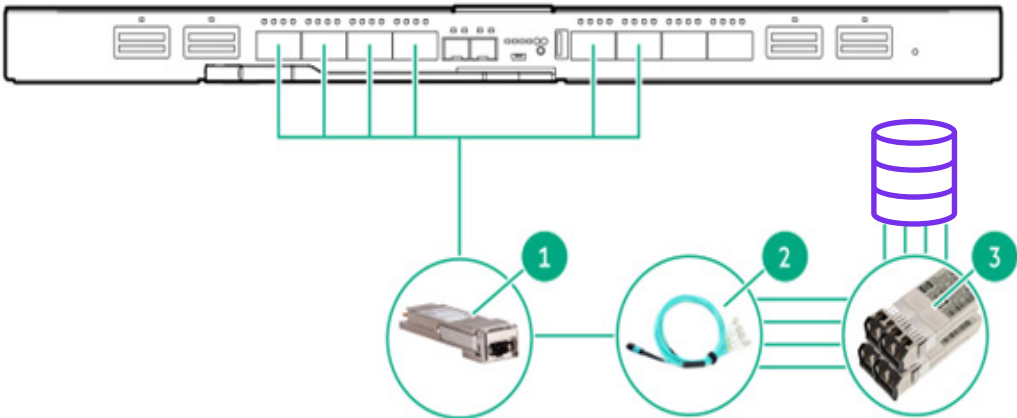


Figure 4. Connection details for Flat SAN to the HPE Virtual Connect SE 100Gb F32 Module for Synergy for different models of HPE Storage arrays

Table 3. Connection details for Flat SAN to the HPE Virtual Connect SE 100Gb F32 Module for Synergy and their descriptions

Item	Description
1	4x 32 Gb FC or 4x 25GbE MPO QSFP28 transceiver
2	MPO to 4x LC breakout multimode fiber optic cable
3	16/32 Gb FC SW SFP transceivers (4) in the same or different storage arrays



Connecting an HPE Virtual Connect SE 100Gb F32 Module for Synergy to storage array with SFP+ ports (8/16/32 Gb to 8/16/32 Gb)

The HPE Virtual Connect SE 100Gb F32 Module for Synergy supports direct connection to FC SAN using a native FC to HPE storage systems.

The HPE Virtual Connect SE 100Gb F32 Module for Synergy supports 8 Gb, 16 Gb, and 32 Gb FC connections.

One HPE Synergy 32 Gb FC upgrade LTU (PN: R3P67A(AE)) per interconnect module requires native FC ports on the HPE Virtual Connect SE 100Gb F32 Module for Synergy with one of the following transceivers:

- 4x 32 Gb FC/4x 25GbE MPO QSFP28 transceivers
- 16 Gb or 32 Gb FC SFP+ transceivers

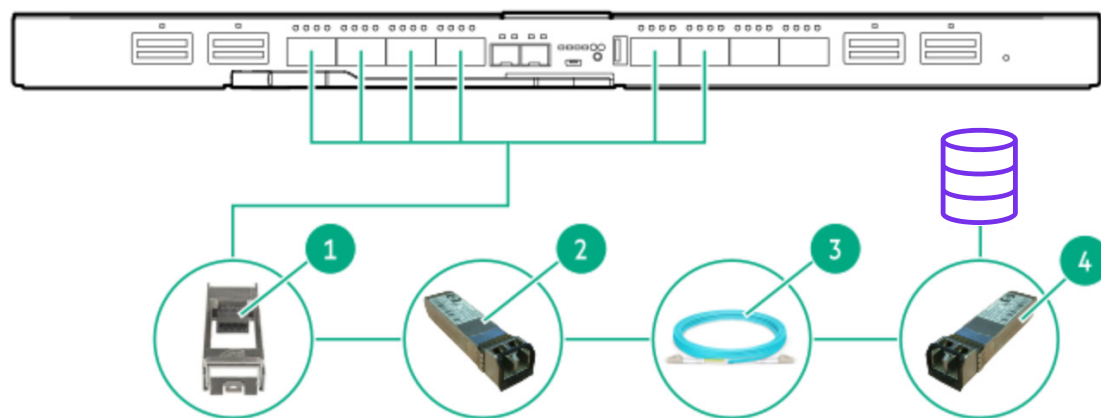


Figure 5. Connection details of an HPE Virtual Connect SE 100Gb F32 Module for Synergy to storage array with SFP+ ports

Table 4. Connection details of an HPE Virtual Connect SE 100Gb F32 Module for Synergy to storage array with SFP+ ports and their descriptions

Item	Description
1	QSFP28 to SFP28 adapter
2	16 Gb or 32 Gb FC SW SFP+ transceiver
3	LC-to-LC multimode OM3 or OM4 fiber optic cable (The maximum length depends on the cable type and speed)
4	16 Gb or 32 Gb FC SW SFP transceiver in the storage array



Configuration of HPE OneView for the Flat SAN setup

To configure Flat SAN in HPE OneView, we follow these steps:

- **Create network:** Begin by creating separate networks for Flat SAN connections. Ensure to specify the appropriate settings such as direct attach network from the fabric type drop-down menu.
- **Create logical interconnect group (LIG):** Next, create an LIG and select the previously created networks for Flat SAN connections. Choose the appropriate uplink ports and specify the correct speed for each connection.
- **Create enclosure group:** Proceed to create an enclosure group and associate it with the LIG created in the previous step. This allows the servers within the enclosure to connect to the Flat SAN networks.
- **Create logical enclosure:** Finally, create a logical enclosure and add the physical enclosures that contain the servers. This enables centralized management of the servers and their connections to the Flat SAN networks.

HPE OneView configuration—Create a network

1. Log in to HPE OneView. Access the HPE OneView dashboard using your credentials
2. Navigate to the **Networking** section, then click on Networks
3. Click on the **Create Network** option
4. Enter **Flatsan** as the name of the network. (User can give any name)
5. Choose **Fibre Channel** as the network type
6. Select **Direct Attach** from the fabric type drop-down menu
7. Specify the preferred and maximum bandwidth values. (You can use default values or specify custom values based on your requirements)
8. Review the configuration settings
9. Click on the **Create** button to create the **FLATSAN** network

Create Network?

Name

Flatsan

Type

☐ Ethernet

☒ Fibre Channel

☐ FCoE

☐ RoCE

Fabric type

Direct attach

Preferred bandwidth

2.5

Gb/s

Maximum bandwidth

50

Gb/s

Figure 6. HPE OneView configuration to create a network



HPE OneView configuration—LIG

Create an uplink set in the LIG

1. **Navigate to NETWORKING>Logical Interconnect Groups** section
2. **Click on Create Logical Interconnect Group:** There should be an option or button to create a LIG. Click on it to start the creation process
3. **Configure LIG settings:** You'll be prompted to configure various settings for the LIG. This includes:
 - a. **Name**—Give your LIG a descriptive name
 - b. **Interconnect type**—Choose the physical interconnect that will be part of this LIG. In our case, the interconnect type is HPE Virtual Connect SE 100Gb F32 Module for Synergy
 - c. **Enclosure count**—The number of enclosures presented in the configuration defaults to 1. The user can select the exact count based on the configuration. The available options in the drop-down are 1 to 5
 - d. **Interconnect bay set**—Select the interconnect bay number
 - e. **Redundancy**—Select **Redundant** if the connections between A-side interconnect module (1, 2, or 3) and B-side interconnect module (4, 5, or 6) are established through Q7 and Q8 stacking link ports. If the stacking link ports are not connected, configure separate LIGs for both the A-side interconnect modules (1, 2, or 3) and the B-side interconnect modules (4, 5, or 6)
4. **Downlink speed:** There are two options: 25 Gb/s and 50 Gb/s. Based on the adapter you are using, select the appropriate downlink speed
5. **Select Interconnects**
6. **Create an uplink set (Add uplink set)** by following these steps:
 - a. Provide a name for the uplink set (user-defined)
 - b. Enable consistency checking with the **Exact match or Not checked** option. **Exact match**—Uplink set configuration must be an exact match between LIG and a logical interconnect. Any additional configuration will be removed from the logical interconnect during update from group. **Not checked**—Uplink set configuration may deviate between LIG and logical interconnect
 - c. Set the type to **Fibre Channel**
 - d. Define the network by selecting the appropriate option on the network page
 - e. Click on **Add uplink ports** and choose the proper interconnect module where the storage array ports for the uplink ports.

Note:

Automatic speed configuration is not supported, so you will need to manually set the connection speed. Choose the speed based on the specifications of your storage array and your specific performance requirements. This ensures that the connection is optimized for your storage environment, providing reliable data transfer rates that meet your needs.



In the following screenshots, we configured the speed to 32 Gb.

Create Uplink Set?

General

Name

Flatsan

Consistency checking

Exact match

Type

Fibre Channel

Networks

Network

Flatsan

✕ 🔍

Uplink Ports

Interconnect Module	▲ Enclosure ▲	Bay	Port	Speed	
Virtual Connect SE 100Gb F32 Module for Synergy	1	3	Q6:1	32 Gb/s	✕
Virtual Connect SE 100Gb F32 Module for Synergy	1	3	Q6:2	32 Gb/s	✕
Virtual Connect SE 100Gb F32 Module for Synergy	1	3	Q6:3	32 Gb/s	✕
Virtual Connect SE 100Gb F32 Module for Synergy	1	3	Q6:4	32 Gb/s	✕

Add uplink ports

Remove uplink ports

Remove all

Create

Create +

Cancel

Figure 7. HPE OneView configuration to create an uplink set in LIG



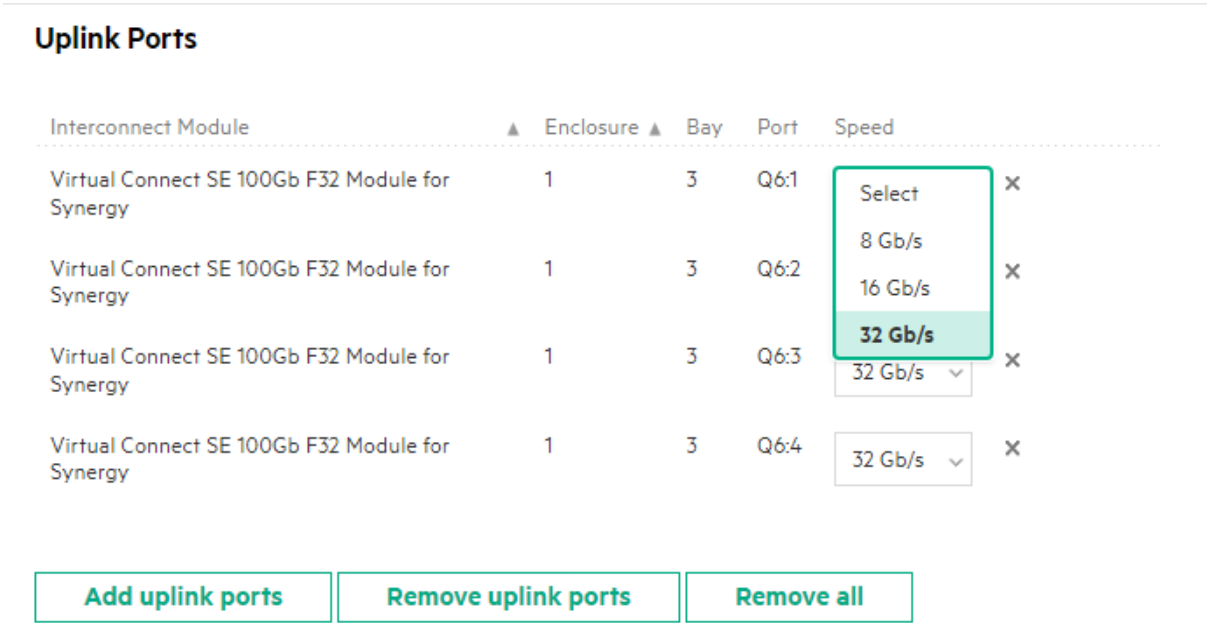


Figure 8. HPE OneView configuration to create an uplink set in LIG by configuring the speed to 32 Gb

HPE OneView configuration—Create enclosure group

Prerequisites

- Privileges: Infrastructure administrator or server administrator
- At least one created LIG

Procedure

1. From the main menu, select **SERVERS > Enclosure Groups**, and then do one of the following:
 - a. Select **Actions > Create**
 - b. Click + **Create enclosure group**
2. Specify a unique name for a new enclosure group
3. Select the enclosure group size that matches the interconnect link topology of the enclosures to be included in the logical enclosure. Choose the appropriate enclosure count from the drop-down list
4. Choose how to manage IP addresses for compute blade HPE iLO and interconnect management processors
5. Select LIGs to reflect the interconnect topology you want to use
6. Select power and environmental settings to match the power distribution and the data center environment
7. Click **Create** to create the enclosure group or click **Create +** to create multiple enclosure groups
8. Verify that the enclosure group has been added by confirming it is listed in the list pane

HPE OneView configuration—Create a logical enclosure

Prerequisites

- Privileges: Infrastructure administrator or server administrator
- At least one created LIG—if there are managed interconnects in the enclosure group (not required if there are only unmanaged interconnects)
- At least one created enclosure group
- Virtual MAC addresses are enabled when the configuration contains an HPE Virtual Connect SE 100Gb F32 Module for Synergy



About this task

After HPE Synergy frames are discovered automatically during hardware setup, manually create a logical enclosure. The logical enclosure must contain the number of HPE Synergy frames that are connected together with interconnect link cables. For example, if you have three HPE Synergy frames cabled together, create a logical enclosure that contains all three HPE Synergy frames. The interconnect link topology of the interconnects in the enclosures determines whether a logical enclosure can be created from them. You can assign manual IP addresses to interconnect bays and device bays while creating a logical enclosure.

Procedure

1. From the main menu, select **SERVERS > Logical Enclosures**, and then select **Actions > Create**.
2. Specify a unique name for a new logical enclosure.
3. Select **Enclosures** and **Enclosure group**.
4. Select **Firmware baseline**.
5. To override the IP address allocated through the enclosure group setting, select **Manual** in the **IPv4 addresses** and **IPv6 addresses** sections. Enter the required IPv4 or IPv6 address for a specific interconnect or device bay. You can use **Autofill device IPv4/IPv6 addresses** or **Autofill interconnect IPv4/IPv6 addresses** to assign addresses sequentially from a specified starting address.
 - a. The IP address must fall within an existing subnet.
 - b. If manual check box is not selected, the IP addresses will be assigned using the policy specified in the enclosure group.
6. Click **Create** to complete the action or click **Create +** to create another logical enclosure.
7. Verify that the logical enclosure has been created in the list pane and that one or more enclosures are now in a configured state.

For more information, see the following references:

- [HPE Synergy Configuration and Compatibility Guide](#)
- [HPE Synergy Documentation Quick Links](#)

Key considerations:

1. Since the maximum bandwidth of any QSFP28 port is 100 Gb when 4x32 Gb FC connections are used, each of the FC connections comes up with 32 Gb speed and setup but is limited to only 25 Gb bandwidth for that connection.
2. If a full 32 Gb bandwidth is desired for any QSFP28 port, then an HPE QSFP28/SFP28 adapter with a 32 Gb FC transceiver will populate the QSFP28 port. In addition, the user must provision the uplink as a singular (1:1) uplink port to achieve the full bandwidth for FC. If the port is configured in a 4:1 mode, then the port will be divided into four lanes with only one lane enabled and will only achieve 25 Gb speed.
3. Mixing Ethernet and FC port types on single interconnect module is not supported with the transceiver mentioned previously.
4. The module should have an HPE Synergy 32 Gb FC upgrade license for the FC functionality to work.
5. Supported modes include 4x8 Gb FC, 4x16 Gb FC, and 4x32 Gb FC.
6. Flat SAN supports only FC arrays.
7. Any port from Q1 to Q6 can be used for Flat SAN connections.
8. Multiple FC storage arrays can be connected to a single interconnect module as Flat SAN connections. All six ports (Q1–Q6) can be used simultaneously for Flat SAN connections.
9. QSFP28 to SFP28 cables should be used for Flat SAN connections.
10. HPE OneView configuration is required. Specific network and LIG creation must be done for Flat SAN configuration.

In multiframe configuration, storage array must be connected to the HPE Virtual Connect SE 100Gb F32 Module for Synergy. Connecting storage array to satellite HPE Synergy 50Gb Interconnect Link Module is not supported.



Conclusion

In summary, implementing Flat SAN not only streamlines storage configuration and management by reducing reliance on traditional SAN infrastructure but also with the HPE Virtual Connect SE 100Gb F32 Module for Synergy, which offers enhanced flexibility in configuration. This combination significantly decreases the complexity and time required for network administration, making it an efficient solution for modern data environments.

Additional links:

HPE OneView:

[HPE Synergy Software Releases—Overview](#)

HPE Virtual Connect:

[HPE Virtual Connect SE 100Gb F32 Module for Synergy](#)

SPOCK link:

[HPE Storage Single Point of Connectivity Knowledge—SPOCK](#)

HPE QuickSpecs:

[HPE GreenLake for Block Storage MP | HPE Store India](#)

HPE Support Center:

[Product Page Selector | HPE Support](#)

Learn more at

[HPE Virtual Connect SE 100Gb F32 Module for Synergy](#)

