Brochure

Five steps to building a Composable Infrastructure with HPE Synergy

Hewlett Packard Enterprise

In today's hyper-connected world, windows of opportunity open fast and close even faster. In this Idea Economy, anyone can change the world, creating an age of relentless competition. Every enterprise is at risk of missing a market opportunity and being disrupted by a new idea or business model. The winners in this world are companies of any size that embrace and execute good ideas to deliver value faster and better than their competitors.

Today's infrastructure is too static and changes are too process-oriented, making it slow and complex. In the Idea Economy, infrastructure must be the engine of value creation, not the bottleneck to success. What has worked in the past isn't going to work in the future, as IT must now be able to support two operating environments.

- **Traditional applications** that are designed to support and automate existing business processes such as collaboration, data processing, analytics, supply chain, and web infrastructure
- **A new breed of applications and services** that drive revenue and new customer experiences by leveraging mobility, Big Data, and cloud-native technologies

To be successful in the Idea Economy, it's imperative for businesses to participate and capitalize quickly. How quickly IT can experiment, learn, test, tune, and turn ideas into value matters more than ever.

Introducing the first Composable Infrastructure

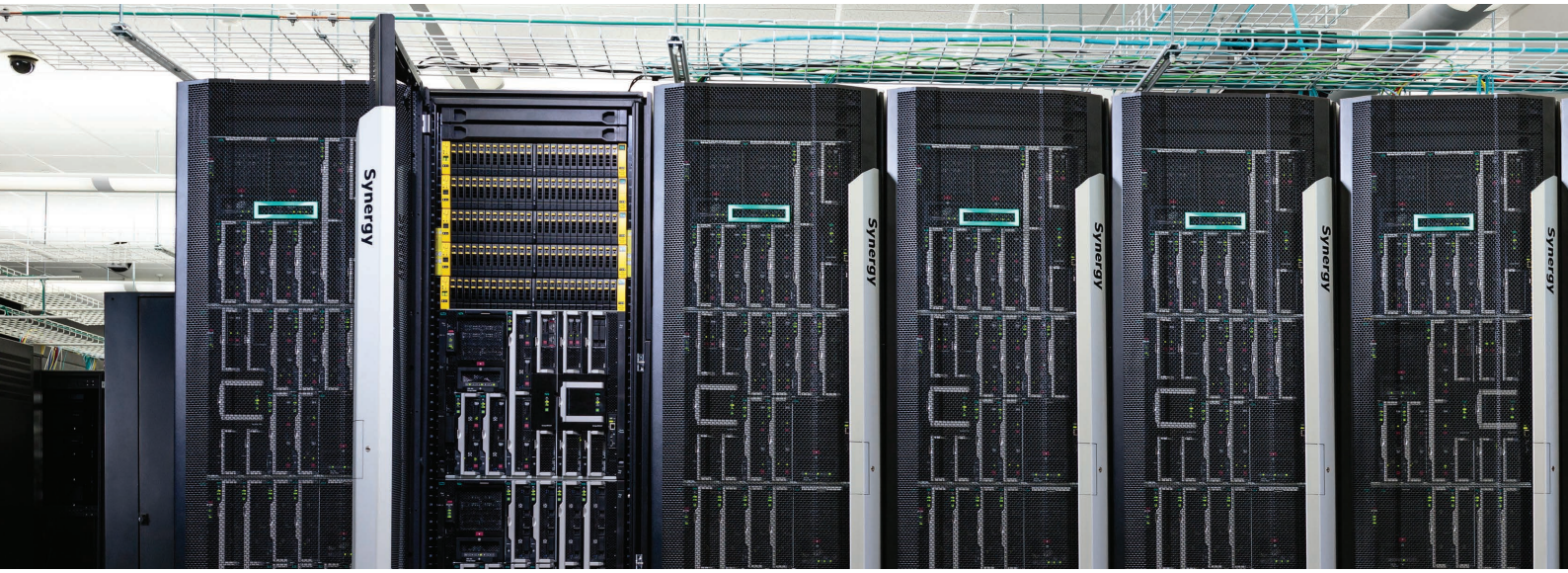
HPE Synergy, the first platform built from the ground up for Composable Infrastructure, offers an experience that empowers IT to create and deliver new value instantly and continuously. It is a single infrastructure that reduces operational complexity for traditional workloads and increases operational velocity for the new breed of applications and services. Through a single interface, HPE Synergy composes physical and virtual compute, storage, and fabric pools into any configuration for any application. As an extensible platform, it easily enables a broad range of applications and operational models such as virtualization, hybrid cloud, and DevOps. With HPE Synergy, IT can become not just the internal service provider but also the business partner to rapidly launch new applications that become the business.

The HPE Synergy experience enables IT to:

- **Run anything:** Optimize any application, reduce CAPEX, and free resources with a single infrastructure with fluid pools of physical and virtual compute, storage, and fabric
- **Move faster:** Accelerate application and service delivery through a single interface that precisely composes logical infrastructures at near-instant speeds
- **Work smarter:** Reduce operational effort and cost through internal software-defined intelligence with template-driven, frictionless operations
- **Unlock value creation:** Increase productivity and control across the data center by integrating and automating infrastructure operations and applications through a unified API

Composable Infrastructure—a new approach to architecture—powers innovation and value creation for the new breed of applications while more efficiently running traditional workloads such as:

Hybrid cloud infrastructure	Combining hardware infrastructure, software, and services to deliver a single platform that enables customers to be well positioned for the cloud
Application development	Allocate and de-provision compute, storage, and network resources per developer during the design, development, and integration phases of a project
Data management	Integration of real-time enterprise communication services that provide a consistent unified user interface and experience across multiple devices
IT infrastructure	Allocate and de-provision compute, storage, and network resources for traditional business applications such as system and network management, data file transfer, virtual desktop infrastructure (VDI), and security systems



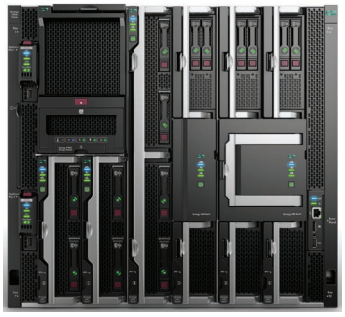


Figure 1. HPE Synergy 12000 Frame

Build your Composable Infrastructure with HPE Synergy

Step 1: Start with the HPE Synergy 12000 Frame

The HPE Synergy 12000 Frame is the foundation of HPE Synergy solution and solves the problem of IT silos at its core. The HPE Synergy Frame accommodates compute, storage, fabric, and management in a single intelligent infrastructure to significantly reduce cost and complexity while delivering performance gains to accelerate workload deployment.

The HPE Synergy Frame is designed to accept multiple generations of compute, storage, fabric, and management modules. It is built on industry standards so it fits easily into existing and new data center environments while preserving the ability to leverage existing storage and connectivity resources.

The 10U frame fits in standard racks and efficiently connects to standard power feeds. It is designed to run today's compute- and data-intensive applications and next-generation mobile-first, cloud-native applications. The direct-connect midplane delivers 16.128 Tbps of bandwidth and is future-proofed with a photonic-ready design that could exceed bandwidth requirements for the next decade.

Power and cooling

The HPE Synergy Frame integrates up to six 96 percent Titanium efficiency 2650 W 200–240 V AC power supplies. This provides your HPE Synergy Frame with up to 15,900 total watts. When set to Power Line Redundancy (N+N) the system has a balance of 7950 W per each phase of the line drops in the rack. When set to Power Supply Redundancy (N+1) the frame has 13,250 W available for use.

Table 1. HPE Synergy 12000 Frame specifications

Model	**12000 Frame**
Rack units	10U
Compute bays	12 half-height, 6 full-height, 3 full-height double-wide
Module types	Half-height, full-height, double-wide full-height compute modules, double-wide half-height storage module
Fabrics supported	3+3 redundant fabric modules Ethernet/FCoE, Fibre Channel and SAS
Management	HPE Synergy Composer powered by HPE OneView
Midplane bandwidth	16.128 Tbps
Cooling	10 fans (included)
Power	6x 2650 W, 96% efficiency, –48 V DC, 277 V AC, 380 V DC

Figure 2. HPE Synergy Composer

Integrated management

HPE Synergy Frame's unique design physically embeds HPE Synergy Composer powered by HPE OneView to compose compute, storage, and fabric resources in any configuration. HPE Synergy Frames may be linked into larger groups or domains of frames to form a dedicated management network, increasing resources available to the business and IT efficiency as the size of the infrastructure grows—achieving both CAPEX and OPEX economies of scale.

HPE Synergy Composer is a management appliance that directly integrates into the frame of the system and provides a single interface for assembling and re-assembling flexible compute, storage, and fabric resources in any configuration. Its infrastructure-as-code capability accelerates transformation to a hybrid infrastructure and provides on-demand delivery and support of applications and services with consistent governance, compliance, and integration.

HPE Synergy Composer deploys, monitors, and updates the infrastructure from one interface and one unified API. It allows IT departments to—in a single step—deploy infrastructure for traditional, virtualized, and cloud environments in just a few minutes. Resources can be updated, flexed, and redeployed without service interruptions.

HPE Synergy Composer provides enterprise-level management to deploy the exact resources to your application needs. Its software-defined intelligence uses embedded HPE OneView to aggregate compute, storage, and fabric resources in a manner that scales linearly to your application needs, instead of being restricted to the fixed ratios of traditional resource offerings.

A single HPE Synergy Composer manages one frame or multiple racks of frames linked through the Frame Link Modules (FLM). The Synergy Composer option selected determines the number of frames linked and managed. The use of two HPE Synergy Composer modules is recommended for redundancy and high availability.

HPE Synergy FLM is the integrated frame resource information control point and link to multiple frames.

- Robust, multi-frame setup and control via HPE Synergy Composer
- A dedicated 10GbE air-gapped management network for multi-frame communications
- Reports asset and inventory information for the devices in the frame
- Reports thermal and power information, including real-time actual power usage per module and per frame
- Add a second Frame Link Module in each frame for redundancy

Feature	Benefit
Flexible pools of compute, storage, and fabric	A combination of storage modules including fully integrated internal storage modules, directly connected and fully orchestrated SAN storage, software-defined storage, two-socket and four-socket compute modules, and a variety of redundant fabric modules allows it to meet a wide range of workload requirements. Customers can easily deploy the entire infrastructure needed to run an application and store its data.
Intelligent auto-discovery of resources	The HPE Synergy Frame easily mounts into existing racks, and plugs into data center resources and is operational in minutes. Compute, storage, and fabric modules are easily plugged in and are automatically discovered. This allows for quick and automatic detection of any installation errors and guidance is provided on how to correct the issue.
Frictionless lifecycle operations	Integrated software-defined intelligence enables self-discovering, self-assembling, self-securing, self-orchestrating, and self-diagnosing capabilities. Built-in templates allow operations such as setup, provisioning, and updating to be accomplished in a single step. Changes are implemented quickly and automatically for continuous application availability.

Step 2: Choose your composable storage for HPE Synergy

Creating a truly agile and efficient IT infrastructure requires the transformation of traditionally rigid physical systems into flexible physical or virtual resource pools. HPE Synergy creates a pool of flexible storage capacity using multiple storage options that can be configured almost instantly to rapidly provision infrastructure for a broad range of applications and workloads. Multiple high-density storage options let you meet a wide range of application and workload requirements. These options include fully integrated internal storage modules, software-defined storage, and directly connected, fully composable SAN storage including HPE 3PAR StoreServ flash arrays. These flexible storage options allow you to achieve the right cost/performance mix based on your specific applications and workloads.

No matter the data type, connectivity protocol, or service-level requirement, HPE Synergy offers you a variety of storage options that will help you respond effortlessly to unpredictable demands. As a key building block for many applications, available storage options are designed to store and share anything—including file, block, and object data—with enterprise-class reliability. By eliminating the complexity and limitations of siloed resources and administration, the various options including software-defined storage solutions as well as fully composable DAS and SAN storage for HPE Synergy deliver a new level of simplicity, density, and flexibility.

HPE Synergy D3940 Storage Module

Each HPE Synergy D3940 Storage Module utilizes HPE Smart Array technology to accelerate performance, plus RAID protection and encryption to improve security and availability. The HPE Synergy D3940 Storage Module can be used to create logical drives for any compute module in the same frame using stored profiles. This offers data mobility in the event that a profile needs to be shifted from one compute module to another.

The storage module maximizes DAS density by supporting up to 40 drives per module with options for flash (SSD) and disk (HDD) storage in both SAS and SATA options to achieve the right cost/performance. Its non-blocking SAS fabric allows full utilization of flash storage and up to two million IOPS per storage module with all-flash capability.

Up to five HPE Synergy D3940 Storage Modules can be configured per HPE Synergy 12000 Frame. Compute modules connect to the DAS storage module through a non-blocking SAS fabric of single or dual connection modules in the frame in single or dual I/O adapters in each storage module.

HPE StoreVirtual VSA

HPE Synergy D3940 Storage Module resources can be shared to multiple compute modules across HPE Synergy Frames using software such as HPE StoreVirtual Virtual Storage Appliance (VSA). Additional data services can be delivered via software-defined storage in the form of VSAs running on these internal storage modules, on external storage, or via HPE Helion OpenStack®.

HPE 3PAR StoreServ Storage

For larger-scale enterprise applications looking for tier-1 service, HPE 3PAR StoreServ flash arrays scale up to 24 petabytes of usable capacity per system, three million+ IOPS, sub-millisecond latency, and extreme scalability with unified management provided via HPE OneView. These arrays can be attached via traditional Fibre Channel (FC) SAN switches, iSCSI, or directly connected via HPE's FlatSAN technology.[1]

[1] FlatSAN technology will be supported on HPE Synergy post General Availability.

Table 2. HPE Synergy storage options specifications

	HPE Synergy D3940 Storage Module	HPE StoreVirtual VSA (Software-Defined Storage)	HPE 3PAR StoreServ All-Flash Arrays
Storage tier	Tier 3 (DAS)	Tier 2 (iSCSI shared)	Tier 1 (Fibre Channel or iSCSI SAN)
Maximum usable capacity (single frame)	770 TB	330 TB	24,000 TB
Maximum number of drives per frame	200	N/A	1024
Global Hot Spares	No	N/A	Global spare pooling
Maximum IOPS	2,000,000	280,000	3,000,000+
Interface bandwidth	16 Gbps	Up to 20 Gbps	16 Gbps FC/10 Gbps iSCSI or FCoE
Storage formats supported	File, Block, Object	Block	File, Block
Auto-tiering for performance optimization	No	Yes	Yes

Step 3: Choose your HPE Synergy Fabric

HPE Synergy Composable Fabric delivers high performance and composability for the delivery of applications and services. It simplifies network connectivity using disaggregation in a cost-effective, highly available, and scalable architecture. HPE Synergy Composable Fabric creates a pool of flexible fabric capacity that can be configured almost instantly to rapidly provision infrastructure for a broad range of applications.

HPE Synergy Composable Fabric's disaggregated, rack-scale design uses a master/satellite architecture to consolidate data center network connections, reduce hardware and management complexity, and scale network bandwidth across multiple frames. The master module contains intelligent networking capabilities that extend connectivity to satellite frames through the HPE Synergy Fabric Interconnect Link Module, which eliminates the need for a top-of-rack (ToR) switch and substantially reduces cost. The reduction in components also simplifies fabric management at scale while consuming fewer ports at the data center aggregation layer.

The master modules offer flexible licensing option for uplink FC connections. The basic offering has support for Ethernet and FCoE, however, customers can upgrade to uplinks FC licensing based on their needs. The FC licensing is offered on a per module basis.

With HPE Synergy Composable Fabric, scaling is fast, simple, and requires no downtime. When adding a new frame using HPE Synergy's Fabric Interconnect Link Module, the new frame is automatically discovered as an extension of the existing fabric, and the east/west design (no-hop with satellite modules) scales so the performance of the existing workload is not negatively impacted.

In addition to the composable fabric, and traditional switch options, Hewlett Packard Enterprise offers other interconnects such as a pass-thru module or a SAN switch.

The Mellanox SH2200 Switch Module for HPE Synergy is a high-speed Ethernet switch offering an advanced layer 2 and layer 3 feature set with hardware-based tunneling offload. It is designed for demanding data center environments requiring a high-performance, deterministic low-latency network fabric, such as high-performance computing (HPC), trading, financial, and network functions virtualization (NFV).

For customers who want to maintain their existing network, Hewlett Packard Enterprise offers a pass-thru module that provides full compute module connectivity to an existing network switch. The HPE Synergy 10 Gb Pass-Thru Module allows for a one-to-one connection between a compute module and a ToR switch. It is an alternative to allow you to manage the switch outside of the frame with the operating system (OS) of your choice.

The Brocade 16 Gb Fibre Channel SAN Switch Module for HPE Synergy provides high-performance, low-latency networking with cut-through mode FC SAN capabilities. This switch is ideal for financial services, trading applications, medical imaging, and rendering.

Table 3. HPE Synergy Fabric portfolio overview

	Composable—HPE OneView managed	Traditional—CLI managed, HPE OneView monitored	Corresponding adapters
Converged—Disaggregated topology	HPE Virtual Connect SE 40 Gb F8 Module for Synergy HPE Synergy 10/20 Gb Interconnect Link Module	HPE Synergy 40 Gb F8 Switch Module HPE Synergy 10/20 Gb Interconnect Link Module Mellanox SH2200 Switch Module for HPE Synergy	HPE Synergy 2820C 10 Gb CNA HPE Synergy 3820C 10/20 Gb CNA HPE Synergy 6810C 25/50 Gb Ethernet Adapter
Native Fibre Channel—No disaggregated topology	HPE Virtual Connect SE 16 Gb FC Module for HPE Synergy	Brocade 16 Gb/24 FC Switch Module Brocade 16 Gb/24 FC Switch Module Pwr Pk Brocade 16 Gb/12 FC SAN Switch Module	HPE Synergy 3530C 16 Gb FC HBA HPE Synergy 3830C 16 Gb FC HBA

Table 4. Interconnect modules specifications

	HPE Virtual Connect SE 40 Gb F8 Module for HPE Synergy (Master Module)	HPE Virtual Connect SE 16 Gb FC Module for HPE Synergy	HPE Synergy 40 Gb F8 Switch Module (Master Module)	Mellanox SH2200 Switch Module for HPE Synergy
Network connections	12x 10/20 Gb downlinks to compute modules, 6x 40 Gb QSFP+ uplinks	12x 16 Gb downlinks to compute modules, 8x 16 Gb FC SFP+, and 4x 64 Gb FC QSFP+ uplinks	12x 10/20 Gb downlinks to compute modules, 6x 40 Gb QSFP+ uplinks	12 x 25/50 Gb Ethernet downlinks to compute module Ethernet adapters 8 x QSFP28 external uplink ports configurable as 1x100 Gb, 1x40 Gb, 4x25 Gb OR 4x10 Gb Ethernet ports connected to external LAN switches
Media types	40 Gb QSFP+ SR4, LR4; 40 Gb QSFP+ AOC and DAC cables; 10 Gb SFP+ support through QSFP+ to SFP+ adapter	B-Series 4x 16 Gb QSFP+ and/or 16 Gb SFP+	40 Gb QSFP+ SR4, LR4; 40 Gb QSFP+ AOC and DAC cables; 10 Gb SFP+ support through QSFP+ to SFP+ adapter	Optional HPE 100 Gb QSFP28 SR4, HPE 40 Gb QSFP+ SR, SR 300 M and LR modules, 40 Gb QSFP+ DAC and AOC cables
Management	HPE Synergy Composer and native CLI (ready-only); SSH IPv4 and IPv6	HPE Synergy Composer	CLI (SSH and console) IPv4 and IPv6; SSH IPv4 and IPv6; CLI scripting for configuration and troubleshooting; unmanaged support module access through HPE Synergy Composer	Monitored by HPE OneView; CLI support, SSH and Console, IPv4 and IPv6, for configuration and troubleshooting, integrated with security architecture and multi-level user administration
FC interfaces	8 Gb licensing option per module basis	No licensing	N/A	N/A
Extended management features	Embedded SNMP v1 and v2	Embedded SNMP v1	HPE OneView user authorization and authentication for read access to switch	SNMP v1, v2, v3
High-availability features	M-LAG, non-disruptive firmware upgrade (NDFU)	Dual modules provide 2 data paths from the SAN to each compute module	M-LAG, NDFU, Link Aggregation Protocol, active-active data plane, and active-standby control plane	LACP, M-LAG
Security	LDAP (HPE Synergy Composer)	LDAP (HPE Synergy Composer)	LDAP	LDAP
Maximum per frame	6	4	6	6
Warranty in year(s) (parts/labor/onsite)	3/3/3	3/3/3	3/3/3	3/3/3

Table 5. Satellite module specifications

	HPE Synergy 10 G Interconnect Link Module	HPE Synergy 20 G Interconnect Link Module
Network connections	12x 10 Gb downlinks to compute modules and 1x 120 Gb interconnect link ports	12x 20 Gb downlinks to compute modules and 2x 120 Gb interconnect link ports
Performance	Less than 8 nanoseconds	
Protocol support	As supported by master module	
High-availability features	Leveraged from master module	
Maximum per enclosure	6 (should be aligned with master module)	
Number of satellite modules support per master module	4	2
Warranty in year(s) (parts/labor/onsite)	3/3/3	

Fibre Channel switches

HPE Synergy offers a complete end-to-end solution for customers who require traditional network-managed switches. For customers who want traditional switch functionality at the edge, Hewlett Packard Enterprise offers FC switches to complement the Ethernet switch listed earlier to connect the frame and compute modules.

Table 6. Fibre Channel switch specifications

	Brocade 16 Gb/12 Fibre Channel SAN Switch Module for HPE Synergy	Brocade 16 Gb/24 Fibre Channel SAN Switch Module for HPE Synergy	Brocade 16 Gb/24 Power Pack+ Fibre Channel SAN Switch Module for HPE Synergy
Switch module type	Single slot	Single slot	Single slot
Network connections	12 (internal or external, dynamic) 16 Gbps ports; upgradable up to 36 FC ports external via 12-port LTU options, 4/8/16 Gbps auto-sensing (8x SFP+ and 4x QSFP+) (uplink) **Note:** Short-wave, long-wave, and extended long-wave laser transceivers are supported	24 (internal or external, dynamic) 16 Gbps ports; upgradeable up to 36 external via 12-port LTU option, 4/8/16 Gbps auto-sensing (8x SFP+ and 4x QSFP+) (uplink) **Note:** Short-wave, long-wave, and extended long-wave laser transceivers are supported	24 (internal or external, dynamic) 16 Gbps ports; upgradeable up to 36 external via 12-port LTU option, 4/8/16 Gbps auto-sensing (8x SFP+ and 4x QSFP+) (uplink) **Note:** Short-wave, long-wave, and extended long-wave laser transceivers are supported
Media types	Hot pluggable, supports 4x16 QSFP+ (16/8/4 Gbps) and/or SFP+ (16/8/4 Gbps)		
Performance	16 Gbps line speed, full duplex		
Aggregate device bandwidth (maximum)	576 Gbps (36 ports x 16 Gbps)		
ISI trunking	Support for multiple trunks with max. 8 SAN ports for up to 128 Gbps throughput per trunk group		
Port types	D_Port (diagnostic port), E_Port, F_Port; optional port type control Brocade Access Gateway mode: F_Port and NPIV-enabled N_Port		
Classes of service	Class 2, Class 3, Class F (inter-switch frames)		
Management access	Web tools, SMI-S provider, SNMP, Telnet, and Secure Telnet		
High-availability features	Redundant switches; hot pluggable; non-disruptive software upgrades		
Security	In-flight encryption		
Maximum switches per 12000 Frame	Up to 6		
Warranty in year(s) (parts/labor/onsite)	3/3/3		

Table 7. Converged network adapter specifications

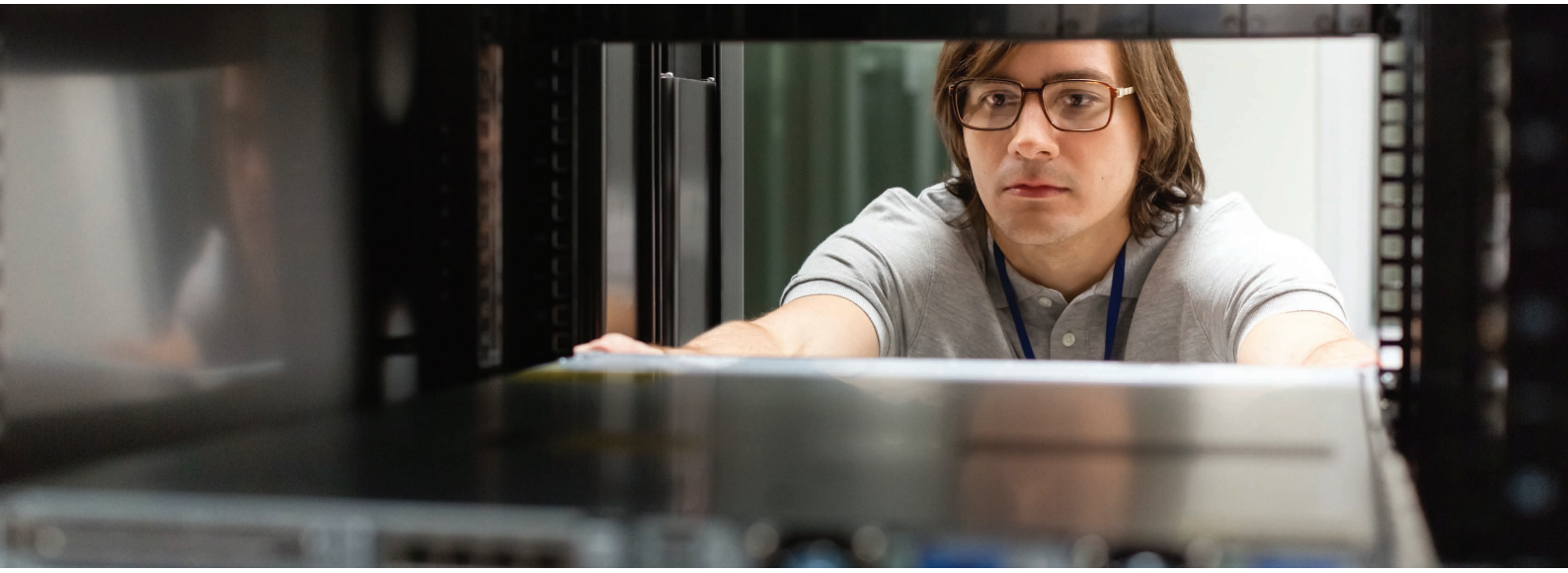
	HPE Synergy 2820C 10 Gb Converged Network Adapter	HPE Synergy 3820C 10/20 Gb Converged Network Adapter
Hardware features		
TOE, accelerated iSCSI, and iSCSI boot	TOE, accelerated iSCSI, and iSCSI boot	
HPE Synergy Compute Module support	HPE Synergy 480 Gen9, HPE Synergy 660 Gen9	
LEEE compliance	802.3, 802.3ab, 802.3u, 802.3x, 802.3ad, 802.3p, 802.1q, 802.3ae, 802.3ap	
Ports/type	2x 10 Gb	2x 10/20 Gb
Form factor	Type C mezzanine	
Network controller	QLogic 57840S	
Software features		
Adapter teaming	Yes	
PxE	Yes	
Warranty in year(s) (parts/labor/onsite)	1/0/0 with a maximum at the remaining warranty of the HPE product in which it is installed (to a maximum three-year limited warranty)	

Table 8. Ethernet adapter specifications

	HPE Synergy 6810C 25/50 Gb Ethernet Adapter
Hardware features	
HPE Synergy Compute Module Support	HPE Synergy 480, 620, 660, 680 Gen9, HPE Synergy 480, 660 Gen10
Secure Boot	Secure Boot safeguards the system and ensure no rogue drivers are being executed on start-up
Ports/type	2x 50/100 Gbps bi-directional; 100/200 bi-directional theoretical bandwidth
Form factor	Type C mezzanine
Network Processor	Cavium QL45604
IEEE Compliance	802.1p, 802.1Qaz, 802.1Qbb, 802.1AS, 802.3ad, 802.3by, 1588, 802.3-2012, 802.3by-2016, 802.1q
Software features	
PxE	Yes
Warranty in year(s) (parts/labor/onsite)	1/0/0 with a maximum at the remaining warranty of the HPE product in which it is installed (to a maximum three-year limited warranty)

Table 9. Fibre Channel adapter specifications

	HPE Synergy 3530C 16 Gb Fiber Channel Host Bus Adapter	HPE Synergy 3830C 16 Gb Fibre Channel Host Bus Adapter
Hardware features		
HPE Synergy Compute Module support	HPE Synergy 480, HPE Synergy 660 Gen9	
Ports/type	2x 16 Gb	
Form factor	Type C mezzanine	
Network controller	LPe16002	QLE2682
Software features		
Warranty in year(s) (parts/labor/onsite)	1/0/0 with a maximum at the remaining warranty of the HPE product in which it is installed (to a maximum three-year limited warranty)	



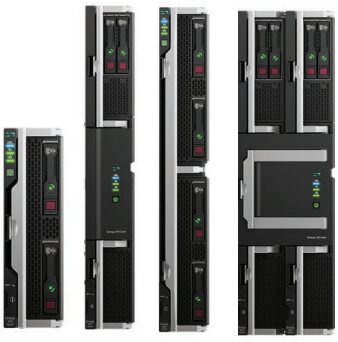


Figure 3. HPE Synergy Compute Module portfolio

Step 4: Optional HPE Synergy Image Streamer management appliance
In the hyper-connected Idea Economy, fluid alignment between infrastructure and workloads—and the fast deployment of end-to-end resources—is paramount. HPE Synergy provisions compute modules with bootable images created from your golden images. By inputting a few specifications into server profile or template, HPE Image Streamer automatically creates the bootable images and automatically configures the streaming of those images onto compute modules. This capability enables HPE Synergy with the most powerful profiles and templates in the industry—with software-defined control over compute, storage, fabrics, and OS images—and deploys as well as updates infrastructure with unmatched speed and agility.

Within the HPE Synergy Frame, the HPE Image Streamer maintains a physical appliance repository for your golden images. These golden images can be rapidly cloned to create unique bootable images for compute modules. It enables HPE Synergy to quickly deploy a new compute module or update an existing one. This is far faster than the traditional, sequential process of building servers—physical provisioning followed by OS, hypervisor installation, I/O drivers, application stacks, and more. Administrators using HPE Image Streamer can design bootable images for compute modules, with the OS and application stacks included, for ready-to-run environments.

HPE Image Streamer ensures high availability by providing redundant repositories of bootable images, which are used in a reliable manner. The separation of management and data networks provides additional security and dedicated bandwidth. In addition, security vulnerabilities due to PxE boot are eliminated, and no external network connectivity or functions are required for operation.

Each workload-specific image is streamed to stateless compute resources over a high-speed connection.

Step 5: Choose your HPE Synergy Compute
Driving a truly agile and efficient IT infrastructure requires the transformation of traditionally rigid physical systems into flexible physical or virtual resource pools. HPE Synergy Compute creates a pool of flexible compute capacity for general purpose to mission-critical workloads that can be configured almost instantly to rapidly provision infrastructure for a broad range of applications and IT tiers, then seamlessly recompose or update it with frictionless change management.

HPE Synergy supports both two-socket and four-socket compute modules that provide the performance, scalability, density optimization, storage simplicity, and configuration flexibility to power a variety of workloads, including business processing, IT infrastructure, web infrastructure, collaborative, and high-performance computing.

Table 10. HPE Synergy Compute Module specifications, Gen10

	HPE Synergy 480 Compute Module Gen10	HPE Synergy 660 Compute Module Gen10
Number of processors	1 or 2	4
Processor family	Intel® Xeon® Processor Scalable Family	Intel Xeon Processor Scalable Family
Memory slots	Up to 24, 12 per processor	Up to 48, 12 per processor
Maximum memory per server	1.5/3.0 TB (64 GB/128 GB DIMMs)	3/6 TB (64 GB/128 GB DIMMs)
Maximum drive bays	2	4
Drive types	Small form factor HDDs or SSDs, micro form factor SSDs; PCIe NVMe SSDs; USB and micros USB; NVMe SSDs for workload acceleration; USB and microSD, internal M.2 drives	
Maximum local storage	6 TB	15 TB
Maximum direct attached storage	Max. 770TB per frame; 200 drives	Max. 614.4 TB per 160 drives
SAN supported	HPE 3PAR, HPE XP, HPE XP7, HPE MSA, or LeftHand	
I/O expansion slots	3	5
Networking speeds	2.56 Tbps east-west throughput in any configuration, per fabric	
Form Factor	Half-height	Full-height
Management	HPE Synergy Composer powered by HPE OneView, iLO5	
Warranty in year(s) (parts/labor/onsite)	3/3/3	3/3/3

Table 11. HPE Synergy Compute Module specifications, Gen9

	HPE Synergy 480 Gen9 Compute Module	HPE Synergy 620 Gen9 Compute Module	HPE Synergy 660 Gen9 Compute Module	HPE Synergy 680 Gen9 Compute Module
Number of processors	1 or 2	1 or 2	4	4
Processor family	Intel® Xeon® E5	Intel Xeon E7	Intel Xeon E5	Intel Xeon E7
Memory slots	Up to 24, 12 per processor	Up to 48, 24 per processor	Up to 48, 12 per processor	Up to 96, 24 per processor
Maximum memory per server	1.5/3 TB (64 GB/128 GB DIMMs)	3/6 TB (64 GB/128 GB DIMMs)	3/6 TB (64 GB/128 GB DIMMs)	6/12 TB (64 GB/128 GB DIMMs)
Maximum drive bays	2	2	4	4
Drive types	Small form factor HDDs or SSDs, micro form factor SSDs; PCIe NVMe SSDs; USB and micros USB; NVMe SSDs for workload acceleration; USB and microSD			
Maximum local storage	7.68 TB	7.68 TB	15.36 TB	15.36 TB
Maximum direct attached storage	Max. 768 TB per frame; 200 drives	Max. 614.4 TB per frame; 160 drives	Max. 614.4 TB per frame; 160 drives	Max. 614.4 TB per frame; 160 drives
SAN supported	HPE 3PAR, HPE XP, HPE XP7, HPE MSA, or LeftHand			
I/O expansion slots	3	5	6	10
Networking speeds	2.56 Tbps east-west throughput in any configuration, per fabric			
Form factor	Half-height	Full-height	Full-height	Full-height, double-wide
Management	HPE Synergy Composer powered by HPE OneView, iLO			
Warranty in year(s) (parts/labor/onsite)	3/3/3	3/3/3	3/3/3	3/3/3

Implementing and utilizing your Composable Infrastructure with HPE Pointnext

Hewlett Packard Enterprise can help you transform to a hybrid infrastructure with HPE Synergy as the foundation. With transformation expertise, Hewlett Packard Enterprise can help you design the right solution, integrate your solution into your existing environment, proactively support your ongoing environment, further automate your infrastructure, and help you flexibly finance your investment.

Your path to Composable Infrastructure is unique, and we help you to evolve your organization's culture, people, processes, and technology.

Service	Purpose	Benefit
HPE Transformation Workshops	Kick-start your projects confidently. Facilitate collaboration of your business and IT organizations. Define your top-line strategy for creating a composable, software-defined, cloud-ready infrastructure. We help clarify your business requirements and the issues that IT and operation teams must resolve to meet these requirements.	Receive a detailed executive briefing, a high-level report summarizing the agreed-upon strategies, and a high-level plan including the functional requirements that need to be considered.
Modernization and Migration Services	Choose the right platform for the right workload at the right cost, and evolve your IT infrastructure, processes, and organization taking advantage of "on-hybrid infrastructure" innovations such as composable, converged, and software-defined technologies.	HPE experts advise, transform, integrate, and implement for platform refresh, data center consolidation, virtualization, migration, and automation projects.
HPE Flexible Capacity	HPE Flexible Capacity is a pay-per-use model for on-premise infrastructure. This gives the customer the needed HPE Synergy capacity in their data center, plus a buffer of additional capacity to use when needed. As HPE Synergy becomes a more dynamic environment in the customer's IT, HPE Flexible Capacity provides enough room to grow and shrink the IT environment, but you only pay for actual metered use.	HPE Flexible Capacity helps customers migrate to HPE Synergy if they do not want to make (or can't make) a capital investment. Technology transitions and refresh can be built in, and infrastructure and services are billed monthly, cutting transition costs as you migrate to new technology.
HPE Datacenter Care-Infrastructure Automation	HPE Datacenter Care-Infrastructure Automation (DC-IA) is an extension to HPE Datacenter Care and delivers enterprise-grade support, advice, guidance, and best practices for infrastructure automation. With highly trained experts who have specific expertise on integrating Chef with HPE OneView, HPE DC-IA is holistic support for infrastructure as code—where infrastructure is versioned, testable, and repeatable.	This brings a fast path to a software-defined approach to infrastructure, which promises to automate IT infrastructure into software, increasing speed, agility, and reliability.
HPE Education Services	Training your IT staff is critical to help drive the value of technology, with increased efficiencies and better business outcomes.	Training is key to the transformation and management of HPE Synergy.

Optimize your IT investment strategy with new ways to acquire, pay for, and use technology, in lock-step with your business and transformation goals.
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Hewlett Packard Enterprise helps you modernize today and implement HPE Synergy. No matter where you are on the journey, we have services to help you get to your destination.

With HPE Synergy, you accelerate IT and everything goes faster. Operations teams can easily automate and accelerate internal processes. Developers can now take advantage of the open API to quickly access infrastructure resources to speed the application development process. Learn how HPE Synergy can help you break free from the ordinary and accelerate the extraordinary to become a value creation partner for the entire enterprise.

Learn more at
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