## Overview

HPE Synergy 660 Gen9 Compute Module

The HPE Synergy 660 Gen9 Compute Module delivers higher performance and scalability for your demanding, enterprise data-intensive workloads. The powerful processors and broader memory footprint in a full-height form factor give your applications like structured databases and business processing the resources they demand**.**
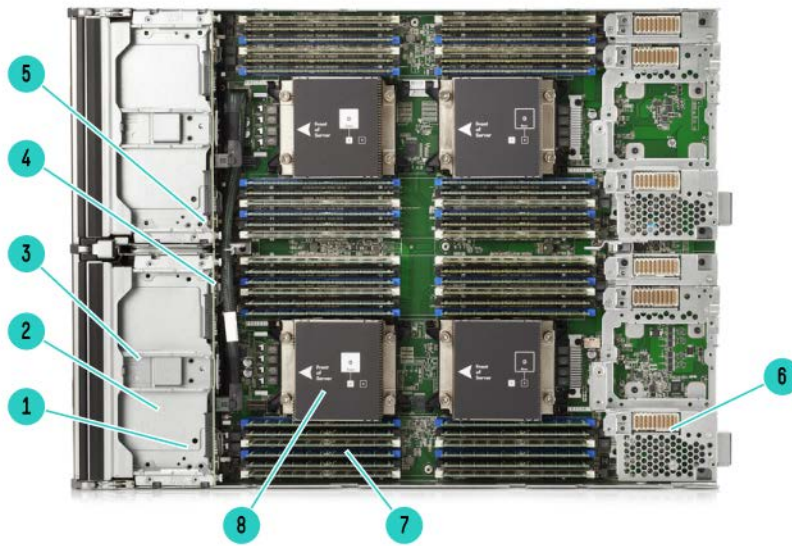
HPE Synergy 660 Gen9 Compute Module – Internal View

1. iLO Management engine
2. TPM Connector (under drive cage)
3. Hot Plug Drive bays (4 SFF Drives or 8 M.2 uFF Drives)
4. USB 3.0 connector

5. Micro SD slot
6. Mezzanine Connectors (x16 PCIe 3.0)
7. Forty Eight (48) DIMM slots (12 slots per processor)
8. Up to four (4) Intel Xeon processors

HPE Synergy is a single infrastructure of physical and virtual pools of compute, storage, and fabric resources, and a single management interface that allows IT to instantly assemble and re-assemble resources in any configuration. As the foundation for the New Style of Business infrastructure, HPE Synergy eliminates hardware and operational complexity so IT can precisely deliver infrastructure to applications faster and with greater flexibility.

Hewlett Packard Enterprise

Standard Features

NOTE: This document covers the HPE Synergy 660 Gen9 compute module only. For information on HPE Frame 12000 Frame, interconnect, and mezzanine components, please see the HPE Synergy 12000 Frame TechSpecs

NOTE: For the Standard Features shipped in the "Factory Integrated Models", please see the "Configuration Information - Factory Integrated Models" section.

Processor Up to four of the following	Processors information will be available in Spring 2016
Chipset	Intel® C610 Series Chipset
	Intel® E5-4600v3 Processor Family
	NOTE: For more information regarding Intel chipsets, please see the following: **http://www.intel.com/products/server/chipsets/**
On System Management Chipset	HPE iLO (Firmware HPE iLO4 2.0), 4GB NAND with 1GB USB user space configurable via UEFI and accessible via iLO. Read and learn more in the **iLO QuickSpecs.**
	NOTE: For more information, visit: **http://www.hpe.com/go/ilo**
Memory Protection	Advanced ECC
	Memory Mirroring
	Memory Online Spare Mode (Rank Spare Mode)

Memory
One of the following depending on Model

Type	**Memory information will be updated in Spring 2016.**
DIMM Slots Available	
Maximum (LRDIMM)	
Maximum (RDIMM)	

NOTE: HPE memory from previous generation servers (DDR3) is not compatible with this compute module. HPE SmartMemory is required to realize the memory performance improvements and enhanced functionality listed in this document for Gen9. For additional information, please see the HPE SmartMemory QuickSpecs at:
http://www8.hp.com/h20195/v2/GetHTML.aspx?docname=c04111535
NOTE: LRDIMM and RDIMM are distinct memory technologies and cannot be mixed within a compute module.
NOTE: Depending on the memory configuration and processor model, the memory speed may run at 2133MHz, 1866MHz, or 1600MHz.

Network Controller   HPE Synergy 3820C 10/20Gb Converged Network Adapter
NOTE: Supports full hardware offload of FCoE storage protocol processing for highest performance converged Ethernet data and storage networks.
HPE Synergy 3520C 10/20Gb Converged Network Adapter
NOTE: Composes multiple network flows including FCoE, RoCE, PMD for DPDK or Etherrnet within each connection.
HPE Synergy 2820C 10Gb Converged Network Adapter
NOTE: Delivers flexibility to compose multiple network flows including Ethernet and FCoE or iSCSI

Standard Features

	within each connection.
	Standard iLO Network Controller:
	One (1) 1Gbps port for the HPE iLO 4 to HPE Synergy Composer link.

Mezzanine connectors	Six (6) I/O expansion mezzanine connectors:

* x16 PCIe 3.0 Type D (supports Type C and Type D mezzanine cards) (mezzanine connector 1).
  NOTE: This mezzanine connector supports dual-port mezzanine cards: one port is routed to interconnect module bay 1 and the other to bay 4.
* x16 PCIe 3.0 Type D (supports Type C and Type D mezzanine cards (mezzanine connector 2).
  NOTE: This mezzanine connector supports dual-port mezzanine cards:. one port is routed to interconnect module bay 2 and the other to bay 5.
  NOTE: A second processor must be installed (in processor slot 2) to have access to mezzanine connector 4.
* x16 PCIe 3.0 Type C (supports Type C mezzanine cards) (mezzanine connector 3).
  NOTE: This mezzanine connector supports dual-port mezzanine cards: one port is routed to interconnect module bay 3 and the other to bay 6.

Mezzanine options include:
* Dual-port 10/20Gb compute module mezzanine adapter options for additional network ports
* Dual-port 16Gb Fibre Channel HBA for SAN connectivity

HPE Compute Module ROM

HPE ROM (read only memory) is now digitally signed using HPE's Corporate Signing Service. This signature is verified before the flash process starts, reducing accidental programming and preventing malicious efforts to corrupt system ROM.

HPE ROM provides for essential initialization and validation of hardware components before control is passed to the customer-installed operating system. The ROM also provides the capability of booting from various fixed media (HDD, CD-ROM) and removable media (USB), to continue operation to the operating system.

HPE ROM performs very early configuration of the video controller, to allow monitoring of initialization progress via an attached monitor. If configuration or hardware errors are discovered during this early phase of hardware initialization, suitable messages are now displayed on the connected monitor. Additionally, these configuration or hardware errors are logged to the Integrated Management Log (IML) to assist in diagnosis.

HPE's ROM is used to configure the following:
* Processor and chipset status registers
* System memory, memory map, and memory initialization
* System hardware configuration (integrated PCI devices and optional PCIe cards).
* Customer-specific BIOS configuration using the HPE ROM-Based Setup Utility (RBSU).

NOTE: For further information, please refer to HPE's RBSU (ROM based setup utility) user guide: http://www.hp.com/support/rbsu

HPE Server Unified Extensible Firmware Interface (UEFI) or Legacy Mode

HPE's System BIOS is an EDK2 UEFI solution, and adheres to the latest revisions of UEFI Class 2 specifications which supports both legacy boot and UEFI boot operation. The HPE Synergy 660 Gen9 defaults to UEFI boot operation and can be factory or field configured for Legacy boot operation.

NOTE: For UEFI boot operation, boot environment and OS image installations should be configured properly to support UEFI.

NOTE: For more information on HPE's System BIOS and UEFI, see the UEFI Information Library: http://www.hp.com/go/uefi/docs .

NOTE: HPE Legacy FIO Mode Setting (758959-B22) can be selected to configure the system in UEFI mode in the factory.

To modify the compute module configuration ROM default settings, press F9 in the HPE POST screen to

Standard Features

enter the UEFI System Utilities screen. By default, the System Utilities menus are in the English language. UEFI enables numerous new capabilities, including both industry standard functionality and features specific to HPE servers. Following are some of the features that UEFI enables and that the HPE Synergy 660 Gen9 can support when configured for UEFI boot operation:

- Secure Boot - A new feature in which the system firmware, option card firmware, operating systems, and software collaborate to greatly enhance platform security.
- Operating system specific functionality - Microsoft Windows 2012 supports several features only when installed in UEFI mode.
- Support for > 2.2 TB (using GPT) boot drives - Such drives could previously only be used for boot drives when using RAID solutions such as HPE Smart Array.
- UEFI Shell - Provides a pre-boot environment for running scripts and tools. The HPE UEFI Shell provides both standard capabilities as well as numerous enhancements.
- PXE boot support for IPv6 networks.
- PXE Multicast Boot allowing for faster PXE deployments for large numbers of servers.
- Boot support for option cards that only support a UEFI option ROM.

NOTE: When the server is configured for UEFI Boot Mode, PXE servers must be configured with a UEFI boot image.

NOTE: When the server boots in UEFI mode, it does not boot media with a legacy OS installation. This includes DOS targets and Windows or Linux systems installed in Legacy mode. The reverse is also true for servers that boot in Legacy mode.

Storage Controller	Choice of: • HPE Smart Array P240nr Controller with 1GB Flash-Backed Write Cache (FBWC) supporting RAID 0, 1, 10, 5, 6, and 1 ADM • HPE Smart Array P542D Controller with 2GB Flash-Backed Write Cache (FBWC) supporting RAID 0, 1, 10, 5, 50, 6, 60, 1 ADM, and 10 ADM • HPE H240nr Smart HBA supporting RAID 0, 1, 10, 5 • HPE B140i (chipset SATA)

Maximum Internal Storage **One of the following depending on Model**			
Hot Plug SFF SAS	8.0TB		4 x 2.0TB
Hot Plug SFF SATA	8.0TB		4 x 2.0TB
Hot Plug SFF SAS SSD	3.84TB		2 x 1.92TB
Hot Plug SFF SATA SSD	6.4TB		4 x 1.6TB
Hot Plug SFF NVMe SSD	8.0TB NVMe		4 x 2.0TB NVMe

NOTE: The Synergy 660 Gen9 compute module includes the HPE hot plug small form factor (SFF) SmartDrive carrier for enhanced management and reduced maintenance errors. HPE drives from previous generation servers (prior to Gen8) are not compatible with the Synergy 660 Gen9 drive bays.

Interfaces		
Micro SDHC Slot	One (1) internal Micro Secure Digital High Capacity (Micro SDHC) card slot
USB 3.0 Port	One (1) internal USB 3.0 connector for USB flash media drive keys
USB 3.0 Port	One (1) external USB 3.0 connector for USB flash media drive keys

NOTE: The above internal options are intended for integrated hypervisor virtualization environments.

Industry Standard Compliance	ACPI 2.0 Microsoft® Logo certifications USB 3.0 Support IPMI 2.0

Standard Features

Secure Digital 2.0
TPM 1.2 Support
IEEE (specific IEEE standards depending on Ethernet adapter card(s) installed)
Advanced Encryption Standard (AES)
Triple Data Encryption Standard (3DES)
SNMP
SSL 2.0
DMTF Systems Management Architecture for Server Hardware Command Line Protocol (SMASH CLP)
Active Directory v1.0
PCIe 3.0
ASHRAE A3

Operating Systems and Virtualization Software Support for Compute modules	**Microsoft Windows Server** **Red Hat Enterprise Linux (RHEL)** **SUSE Linux Enterprise Server (SLES)** **VMware**
Enclosures	HPE Synergy 12000 Frame, is the base for all Synergy products and supports: • Up to 12 half-height or 6 full-height Compute Modules, mixing allowed • One HPE Synergy 12000 Frame will support up to six (6) HPE Synergy 660 Gen9 Compute Modules
Graphics	Integrated Matrox G200eh video controller • 1600 x 1200 (32 bpp) • 1920 x 1200 (16 bpp) HPE iLO Management On System Management Memory • 16 MB Flash Video Memory • 256 MB DDR 3 with ECC (112 MB after ECC and video)
Form Factor	HPE Synergy 660 Gen9 is a full-height compute module that plugs into the HPE Synergy Frame 12000.

HPE management solution	**HPE Synergy Composer with HPE OneView**	HPE Synergy integrates HPE OneView to deliver 'composable infrastructure' with a view of resources. This flexible and scalable solution provides IT managers with the architecture to implement their software-defined data center (SDDC) -- and to address the changing business needs and the challenges of today's enterprise data centers.
	HPE Integrated Lights Out	Monitor your servers for ongoing management, service alerting, reporting and remote management with iLO. Learn more at **http://www.hp.com/go/ilo**
	UEFI	Configure and boot your servers securely with industry standard Unified Extensible Firmware Interface (UEFI). Learn more at **http://www.hp.com/go//uefi**
	HPE RESTful API	RESTful API is an application programming interface. RESTful Web Service API served by iLO's web server. **http://www.hp.com/go/restfulapi**
	Intelligent Provisioning	Provision servers by discovering and deploying 1 to few servers with Intelligent Provisioning. Learn more at **http://www.hp.com/go/intelligentprovisioning**
Server Utilities	**HPE Smart Update**	Optimize firmware and driver updates with HPE Smart Update solutions. Learn more at **http://www.hp.com/go/smartupdate**.
	Scripting Tool Kit and	Provision 1 to many servers using your own scripts to discover and deploy them

Standard Features

Windows PowerShell	with HPE Scripting Tool Kit for Windows and Linux or HPE Scripting Tools for Windows PowerShell. Learn more at **http://www.hp.com/go/STK** or **http://www.hp.com/go/powershell**
HPE RESTful Interface Tool	HPE RESTful API tool is a scripting tool to provision servers using RESTful API Interface to discover and deploy servers at scale. Learn more at **http://www.hp.com/go/restfulapi**
HPE iLO Mobile Application	Enables the ability to access, deploy, and manage your server anytime from anywhere from select smartphones and mobile devices. For additional information please visit: **http://www.hp.com/go/ilo/mobileapp**

Security
- Power-on password
- Administrator's password
- Keyboard password (QuickLock)
- HPE iLO Management On System Management Chipset with:
    - SSL encryption
    - Secure Shell version 2
    - Advanced Encryption Standard (AES) and Triple Data Encryption Standard (3DES) on browser, CLP and XML scripting interface
    - AES and RC4 encryption of video
- External USB port enable/disable
- Network server mode
- Serial interface control
- TPM (Trusted Platform Module) 1.2 option
- Advanced Encryption Standard (AES)
- Intel® Advanced Encryption Standard-New Instructions (AES-NI)

Availability

Memory
- Advanced ECC uses single device data correction (SDDC) to detect and correct single and all multi-bit error that occurs within a single DRAM chip. Both x4 and x8 SDDC are supported (x8 requires lockstep mode).
- Memory online spare mode (also known as rank spare mode) detects a rank that is degrading and switches operation to the spare rank.
- Memory demand and patrol scrubbing to prevent accumulation of correctable errors and reducing the likelihood of unplanned downtime.
- Failed DIMM isolation improves the service time thus improving the overall system availability.
- Address parity protection available on RDIMMs and LRDIMMs detects address bit errors to improve service time and overall system availability.

Mezzanine options and I/O
- Multiple I/O mezzanine connectors that support a wide variety of mezzanine cards each supporting multiple data paths routed to redundant interconnect modules.
- Network Adapter Teaming (bonding) provides network fault tolerance, transmit load balancing, and switch-assisted load balancing.

Storage
- Four (4) Small Form Factor hot-plug SAS drive bays.
- Choice of the HPE Smart Array P240nr Controller with 1GB FBWC, HPE Synergy Smart Array P542D Controller with 2GB FBWC, HPE H240nr Smart HBA, or the HPE B140i (Chipset SATA).
- RAID 0,1, and 5 support for all storage controller offerings.
- Optional dual-port Fibre Channel mezzanine card(s) for redundant SAN connections.

Processor/Chipset

Standard Features

- Processor internal sensors & thermal control protection against over-temperature conditions.
- Cache parity/ECC protects cache data from accidental data corruption.
- Machine Check Architecture (MCA) detects and captures hardware errors such as system bus, memory ECC, parity, and cache, and improves service time.
- Intel® QPI Protocol Protection allows detection of data errors using a checksum of 8-bits.
- Core Disable for FRB (fault resilient boot) allows a system to power-on despite a failing core-pair. It uses BIST (built-in self test) results to detect a failure and disables the target core-pair upon subsequent boot.

HPE Synergy 12000 Frame

- Up to 12 half-height or 6 full-height Compute Modules, mixing allowed
- Ten fans and single Frame Link Module included with every system
- Two appliance bays for redundant management appliances, embedded OneView and other solutions to come via REST
- Up to six 2650 Watt Power Supplies of Titanium class efficiency providing 7950 Watts of redundant power
- Up to 6 ICM module/switch bays for full redundancy of 3 fabrics.
- 2 slots for Frame Link Modules, offers links to multiple frames through a private air-gapped management network
- HPE Thermal Logic technology to maximize power and cooling efficiency
- HPE Intelligent Resources technology built-in to every option for OneView Auto-Discovery of resources.

Warranty

This product is covered by a global limited warranty and supported by Hewlett Packard Enterprise Services and a worldwide network of Hewlett Packard Enterprise Authorized Channel Partners. Hardware diagnostic support and repair is available for three years from date of purchase. Support for software and initial setup is available for 90 days from date of purchase. Enhancements to warranty services are available through HPE Support services or customized service agreements. Certain restrictions and exclusions apply. Drives have either a one year or three year warranty; refer to specific drive QuickSpecs for details.

NOTE: Compute module warranty includes 3-year Parts, 3-year Labor, 3-year on-site support. Warranty repairs may be accomplished through the use of Customer Self Repair (CSR) parts. These parts fall into two categories: 1) Mandatory CSR parts are designed for easy replacement. A travel and labor charge will result when customers decline to replace a Mandatory CSR part; 2) Optional CSR parts are also designed for easy replacement but may involve added complexity. Customers may choose to have HPE replace Optional CSR parts at no charge. Additional information regarding worldwide limited warranty and technical support is available at
http://h18004.www1.hp.com/products/servers/platforms/warranty/index.html.

Optional Features

Fibre Channel Support	Up to two (2) optional Fibre Channel mezzanine HBAs are supported on the HPE Synergy 660 Gen9.
Compatible SAN	HPE Synergy 660 Gen9 Compute Modules are optimized for HPE MSA, EVA, 3PAR, XP, and LeftHand
HPE Virtual Connect	HPE Synergy composable fabric delivers high performance and composability for the delivery of applications and services. The composable fabric is based on master/satellite architecture The HPE Virtual Connect SE 40Gb F8 Module, master module, based on composable fabric is designed for Composable Infrastructure. Its disaggregated, rack-scale design uses a master/satellite architecture to consolidate data center network connections, reduce hardware and scales network bandwidth across multiple HPE Synergy Frames. The master module contains intelligent networking capabilities that extend connectivity to satellite frames through Interconnect Link Modules. This eliminates top of rack switch need 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 HPE VC SE 40Gb F8 modules eliminate up to 95% of network sprawl at the compute module edge with one device that converges traffic inside frames and directly connects to external LANs. Each redundant pair of Virtual Connect modules provide eight adjustable downlink connections (six Ethernet and two Fibre Channel, or eight Ethernet) to dual-port 10Gb and in case of 20Gb Converged Network Adapters 16 adjustable downlinks connections 14 Ethernet and two Fibre Channel) on each compute module. Up to six uplinks using QSFP+ interfaces are available for connection to upstream Ethernet switches. Including splitter cables up to 24 uplinks are available for connection to upstream Ethernet and Fibre Channel. The HPE VC SE 40Gb F8 modules avoid the confusion of traditional and other converged network solutions by eliminating the need for multiple Ethernet and Fibre Channel switches, extension modules, cables and software licenses. Also, Virtual Connect wire-once connection management is built-in enabling compute modules adds, moves and replacement in minutes instead of days or weeks. The Master/Satellite disaggregated architecture removes fixed of ratios of interconnects in every frame and allows extending networking resources pool for Virtual Connect to satellite frames. For more information on Virtual Connect and converged network options, see **http://www.hp.com/go/virtualconnect**.

Storage Software	Whether you need to solve a specific data protection, archiving, or storage command and control challenge, or deliver on strategic consolidation, compliance, or continuity initiatives, look no further than HPE storage software. Our storage software helps you reduce costs, simplify storage infrastructure, protect vital assets and respond faster to business opportunities.
	
	Storage software that gets the job done:
	• **Data Protection and Recovery Software**
	  Whether you're a large enterprise or a smaller business, HPE data protection and recovery software will cost-effectively protect you against disaster and ensure business continuity.
	• **Data Archive and Migration Software**
	  HPE's storage software enables you to comply with data retention and retrieval requirements, improve application performance, and reduce costs by efficiently migrating infrequently accessed or less valuable data to lower cost storage.
	• **Storage Resource Management Software (SRM)**
	  HPE's storage resource management software reduces operational costs and provides the command and control foundation you need to efficiently manage and visualize your physical and virtual environments.
	• **Data Replication Software**

Optional Features

Hewlett Packard Enterprise offers array-based and host-based replication software for use in disaster recovery, testing, application development and reporting.

- **Storage Device Management Software**
Maximize your investment in HPE storage and networking with software that enables hardware-specific configuration, performance tuning and connectivity management.

- **HPE StoreVirtual VSA**
HPE StoreVirtual VSA allows you to create fully featured shared storage on a VMware vSphere or Microsoft Hyper-V virtualized server. This server model starting November 2013, includes a limited license for HPE StoreVirtual VSA software with 1TB of capacity. To download the license key and StoreVirtual VSA software, visit: **http://www.hp.com/go/unlockVSA**
NOTE: You will need your server serial number in order to complete the registration form. Fully functional, capacity-based licenses are available in 4TB, 10T and 50TB sizes. For more information and access to the 60-day free trial, visit: **http://www.hp.com/go/tryVSA**

NOTE: For more information available Storage Software including QuickSpecs, please see: **http://www.hp.com/go/storage/software**

Service and Support HPE Technology Services offers you a rich portfolio of consulting and support services designed to add value to our core products and solutions. We have the know-how and experience to put technology to work for you. We work closely with you, as your strategic partner, leveraging our full services portfolio to make sure that everything works to help optimize your enterprise.

Choose from services aligned to our product offerings and lifecycle. From proactive onsite services to innovative support when your products are connected to Hewlett Packard Enterprise, you choose the precise level of attention and support your business demands.

HPE Technology Services for HPE Synergy

HPE Technology Services delivers confidence, reduces risk and helps customers realize agility and stability. Connect to Hewlett Packard Enterprise to help prevent problems and solve issues faster. Our support technology lets you to tap into the knowledge of millions of devices and thousands of experts to stay informed and in control, anywhere, any time.

Protect your business beyond warranty with HPE Support Services

HPE support services offer complete care and support expertise with committed response choices that are designed to meet your IT and business needs.

HPE Foundation Care services offer scalable reactive support-packages for HPE Synergy and software. You choose the type and level of service that is most suitable for your IT and business needs.

HPE Proactive Care keeps your system stable and reliable helping to prevent problems and reduce outages through proactive service management and enhanced technical response.

Advise, transform, integrate, support, automate, and flex

HPE Technology Services helps you get the most out of what you have today and transition to HPE Synergy, a composable infrastructure, at your pace and from wherever you are on the journey.

Start with the HPE Transformation Workshop to ensure that your business and IT organizations collaborate, define the topline strategy for composable, software-defined, cloud-ready infrastructure and kick-start your projects confidently. This workshop clarifies your business requirements and the issues that IT and operations teams must resolve in order to meet these requirements. A detailed executive briefing or high-level report summarizes the strategies, high-level plan and functional requirements.

HPE Modernization and Migration Services helps you 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, software-defined, technologies. Hewlett Packard Enterprise experts advise, transform, integrate and implement for platform refresh, datacenter consolidation virtualization, migration and automation projects.

Optional Features

HPE Flexible Capacity is a pay per use model for on premise infrastructure.   This offers needed HPE Synergy capacity in the datacenter, plus a buffer of additional capacity.   As HPE Synergy will be a dynamic environment, this provides enough room to grow your environment, but only pay for actual metered use. Technology transitions and refresh can be built in, infrastructure and services are billed monthly, enabling you to align costs to business use.

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. The service also includes Enterprise editions of automation tools including Enterprise Chef and selected others. The DC-IA Center of Excellence (CoE) is staffed with highly trained experts who have specific expertise on integrating Chef with HPE OneView.

Choose the right support to maximize uptime, free up your resources, and achieve improved value—as you get the most out of the existing IT assets while accelerating time-to-revenue.

Optimized Support   **HPE Proactive Care Advanced - 24x7 coverage, three year Support Service**

Builds and incorporates on Proactive Care and also gives customers personalized technical and operational advice from an assigned, local Account Support Manager for personalized technical collaboration, flexible access to specialist skills to help optimize business critical IT, and Critical Incident Management to help so the business is not affected if there is a system or device outage. This recommendation provides 24x7 coverage with four-hour response for hardware and Basic Software Support and Collaborative Call Management for selected non-HPE software that offers two-hour callback for supported software issues.

http://www8.hp.com/h20195/v2/GetPDF.aspx/4AA5-3259ENW.pdf

Standard Support   **HPE Proactive Care with 24x7 coverage, three year Support Service**

Hardware and software support services designed specifically for your technology with rapid access to Advanced Solution Center specialists for start to finish case management plus proactive reports and recommendations for firmware and software management and best practice advice. This recommendation provides 24x7 coverage with four-hour response for hardware and Basic Software Support and Collaborative Call Management for selected non-HPE software that offers two-hour callback for supported software issues.

http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-8855ENW.pdf

Deploy and integrate   **HPE Synergy First Frame Installation and Startup -** Provides for hardware installation (HPE Synergy compute modules, Storage Modules, Virtual Connect modules, Interconnect Link Modules, Frame Link Modules, and HPE Synergy D3940 Storage Modules) and software startup for the first frame of your HPE Synergy deployment. Additional frames can be added using the HPE Synergy Additional Frame Installation and Startup Service.

HPE Synergy Additional Frame Installation and Startup Service - Add additional frames to your HPE Synergy First Frame Startup service or expand your existing HPE Synergy Infrastructure.

HPE Education Services

Training your IT staff is critical to help drive the value of HPE Synergy with increased efficiencies and better business outcomes. Training is key to the transformation and management of HPE Synergy.

Parts and Materials   Hewlett Packard Enterprise will provide HPE-supported replacement parts and materials necessary to maintain the covered hardware product in operating condition, including parts and materials for available and recommended engineering improvements.

Parts and components that have reached their maximum supported lifetime and/or the maximum usage limitations as set forth in the manufacturer's operating manual, product quick-specs, or the technical product data sheet will not be provided, repaired, or replaced as part of these services.

The defective media retention service feature option applies only to Disk or eligible SSD/Flash Drives

Optional Features

replaced by Hewlett Packard Enterprise due to malfunction.

For more information Additional Support Services can be found at HPE Support Services Central
http://ssc.hpe.com

Configuration Information – Factory Integrated Models

NOTE: Not all models are available in all regions. Check with your local country Hewlett Packard Enterprise offices for availability.

NOTE: This section lists some of the steps required to configure a Factory Integrated Model (configure-to-order or CTO compute module). To ensure only valid configurations are ordered, Hewlett Packard Enterprise recommends the use of an Hewlett Packard Enterprise approved configurator. Contact your local sales representative for information on CTO product offerings and requirements.

NOTE: Configure-to-order compute modules must start with a CTO Compute Module.

NOTE: FIO indicates that this option is only available as a factory installable option.

NOTE: All Factory Integrated Models will be populated with sufficient drive blanks based on the number of initial drives ordered with the server.

NOTE: The Factory integrated diskless model ships with a grill blank in place of the drive cage and drive backplane.

Step 1: Base Compute Module Configuration (Select a configurable Compute Module)

Models	HPE Synergy 660 Gen9 Configure-to-order SAS Compute Module	HPE Synergy 660 Gen9 Configure-to-order SATA Compute Module	HPE Synergy 480 Gen9 Configure-to-order with Expanded Storage Compute Module
SKU Number	TBD	TBD	TBD
Processors	Processor Kits information will be available in Spring 2016.		
DIMM Slots	Memory Kits information will be available in Spring 2016.		
Storage Controllers Supported	• HPE Dynamic Smart Array B140i Or one of the following controller options: • HPE H240nr Smart Host Bus Adapter • HPE Smart Array P240nr/1GB FBWC	• HPE Dynamic Smart Array B140i Or one of the following controller options: • HPE H240nr Smart Host Bus Adapter • HPE Smart Array P240nr/1GB FBWC	• HPE Smart Array P542D/2GB FBWC
PCIe Expansion	Six (6) x16 PCIe I/O mezzanine connectors		
Drives Supported	Four HPE small form factor (SFF) hot-plug SAS drive bays with support for four (4) SFF drives	Four HPE small form factor (SFF) hot-plug SATA drive bays with support for four (4) SFF drives or up to eight(8) uFF drives	Four HPE small form factor (SFF) hot-plug SAS drive bays with support for four (4) SFF drives or up to eight(8) uFF drives
Security	One (1) TPM connector		
USB and MicroSD	One (1) front USB 3.0 port, One (1) internal USB 3.0 port, One (1) MicroSD		
Management	HPE iLO Management Engine, HPE OneView		

Step 2: Choose Required Options (one of the following from each list unless otherwise noted)

HPE Processors

Processor information will be available in Spring 2016.

HPE Memory

Memory information will be available Spring 2016

Configuration Information – Factory Integrated Models

HPE Networking	**20Gb Mezzanine Adapters**

NOTE: The compute module requires a minimum of one (1) mezzanine network adapter.

NOTE: Mezzanine network adapters can be installed in any mezzanine connector. Hewlett Packard Enterprise best practice is to install the first network adapter in mezzanine connector 3 to facilitate installation of Type C and D mezzanines in mezzanine connectors 1 or 2

HPE Synergy 2820C 10Gb Converged Network Adapter

HPE Synergy 3820C 10/20Gb Converged Network Adapter

HPE Synergy 3520C 10/20Gb Converged Network Adapter

Step 3: Choose Additional Factory Integration Options

HPE Storage Controllers

HPE Smart Array P240nr/1GB FBWC 12Gb 1-port Int FIO SAS Controller

HPE Smart Array P542D/2GB FBWC 12Gb Mezzanine SAS Controller

HPE Compute Module Smart Array P542D SAS Cable

HPE Smart Storage Battery with 260mm Cable Kit

HPE H240nr 12GB 1-port Int FIO Smart Host Bus Adapter

B140i RAID Enable Kit - BIOS Setting

NOTE: If the HPE Smart Array P240nr or the HPE H240nr Smart Host Bus Adapter are not selected, the B140i controller(chipset SATA) will be enabled to support SATA devices for the internal drive bays. If RAID is required when using the B140i controller, please choose 'HPE FIO B140i RAID Enable Kit - BIOS Setting' (784308-B21).

NOTE: The HPE Smart Array P542D is required for connection to storage resources in the HPE Synergy D3940 Storage Module.

NOTE: To support local drive bay and D3940 Storage Module connectivity on the same controller the HPE Smart Array P542D (759557-B21) and P542D SAS cable are required with the HPE Synergy 480 Gen9 Configure-to-order Expanded Storage Compute Module (732352-B21).

NOTE: The HPE Smart Storage Battery (782958-B21) is included with the HPE Smart Array P240nr Controller. If the Smart Array P542D Controller is selected the Smart Storage Battery is required to support battery-backed FBWC.

Step 4: Choose Additional Options for Factory Integration

NOTE: For additional options, please refer to the "Core Options" and "Additional Options" section below. For additional options please see the Core Options and Additional sections below; or the following:

- HPE Synergy 12000 Frame QuickSpecs:
  <placeholder for URL>

Additional Options

HPE Networking	**10/20Gb Mezzanine Adapters**
	HPE Synergy 2820C 10Gb Converged Network Adapter
	NOTE: Please see QuickSpecs for technical specifications and additional information at <Insert URL>
	HPE Synergy 3820C 10/20Gb Converged Network Adapter
	NOTE: Please see QuickSpecs for technical specifications and additional information at <Insert URL>
	HPE Synergy 3520C 10/20Gb Converged Network Adapter
	NOTE: Please see QuickSpecs for technical specifications and additional information at <Insert URL>

HPE Fibre Channel	HPE Synergy 3830C 16Gb Fibre Channel Host Bus Adapter
	NOTE: Please see QuickSpecs for technical specifications and additional information at <Insert URL>
	HPE Synergy 3530C 16Gb Fibre Channel Host Bus Adapter
	NOTE: Please see QuickSpecs for technical specifications and additional information at <Insert URL>

HPE Processors	**QuickSpecs will be updated with processor information in Spring 2016**

HPE Memory	**QuickSpecs will be updated with processor information in Spring 2016**

HPE Drives	**NOTE:** The HPE Synergy 660 Gen9 compute module supports the HPE hot-plug small form factor (SFF) SmartDrive carrier for enhanced management and reduced maintenance errors. HPE drives from generation G7 servers and before are not compatible with the HPE Synergy 660 Gen9 drive bays.
	NOTE: The mixing of standard SAS drives with SAS SSD is supported within the compute module, but limits the RAID configuration to two separate RAID 0 volumes. Mixing of other drives types is not supported.
	NOTE: HPE drives have either a one year or three year warranty; refer to the specific drive QuickSpecs for details.
	NOTE: Please see the QuickSpecs for technical specifications and additional information at **http://www8.hp.com/h20195/v2/GetDocument.aspx?docname=c04111725**.
	HPE SFF(2.5in) Flash Adapter with Dual 340GB 6G SATA Read Intensive UFF(1.0in) Solid State Drives
	HPE 340GB 6G SATA Read Intensive UFF(1.0in) Solid State Drive
	HPE SFF(2.5in) Flash Adapter with Dual 120GB 6G SATA Read Intensive UFF(1.0in) Solid State Drives
	HPE 120GB 6G SATA Read Intensive UFF(1.0in) Solid State Drive
	HPE uFF SATA Drives
	6G SATA LE Hot Plug SFF (2.5-inch) SC EL G1 Solid State Drives

Additional Options

HPE 960GB 6G SATA Light Endurance SFF 2.5-in SC Enterprise Light 3yr Wty G1 Solid State Drive

6G SATA Hot Plug with SmartDrive SFF (2.5-inch) Midline (MDL) Drives

HPE 1TB 6G SATA 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive

HPE 500GB 6G SATA 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive

NOTE: Please see the QuickSpecs for technical specifications and additional information at **http://www8.hp.com/h20195/v2/GetDocument.aspx?docname=c04111725**.

12G SAS (2.5-inch) 512e SC HDD

HPE 600GB 12G SAS 15K rpm SFF (2.5-inch) SC 512e Enterprise 3yr Warranty Hard Drive

HPE 1TB 12G SAS 7.2K rpm SFF (2.5-inch) SC 512e 1yr Warranty Hard Drive

HPE 1.8TB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 512e 3yr Warranty Hard Drive

HPE 2TB 12G SAS 7.2K rpm SFF (2.5-inch) SC 512e 1yr Warranty Hard Drive

SAS Hot Plug with SmartDrive SFF (2.5-inch) Enterprise Drives

HPE 1.2TB 6G SAS 10K rpm SFF (2.5-inch) SC Dual Port Enterprise 3yr Warranty Hard Drive

HPE 146GB 6G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

SAS Hot Plug SmartDrive SFF (2.5-inch) Midline Drives

HPE 1TB 6G SAS 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive

HPE 500GB 6G SAS 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive

NOTE: Please see QuickSpecs for technical specifications and additional information at **http://h18000.www1.hp.com/products/quickspecs/12244_div/12244_div.html**.

6G SATA (2.5-inch) 512e SC HDD

HPE 1TB 6G SATA 7.2K rpm SFF (2.5-inch) SC 512e 1yr Warranty Hard Drive

HPE 2TB 6G SATA 7.2K rpm SFF (2.5-inch) SC 512e 1yr Warranty Hard Drive

12G SAS Write Intensive SFF (2.5-inch) SC 3yr Wty H2 Solid State Drive

HPE 200GB 12G SAS Write Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

HPE 400GB 12G SAS Write Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

HPE 800GB 12G SAS Write Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

HPE 1.92TB 12G SAS Read Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

12G SAS SFF (2.5-inch) SC 3yr Wty H2 Solid State Drive

HPE 1.2TB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

HPE 900GB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

HPE 600GB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

HPE 300GB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

6G SATA Value Endurance Hot Plug SFF (2.5-inch) Enterprise Boot Solid State Drives

HPE 120GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Boot 3yr Wty Solid State Drive

HPE 80GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Boot 3yr Wty Solid State Drive

6G SATA Value Endurance Hot Plug SFF (2.5-inch) Enterprise Value Solid State

Additional Options

Drives

HPE 1.6TB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 800GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 600GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 480GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 300GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 240GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

6G SATA Value Endurance SFF (2.5-inch) SC Enterprise Value M1 Solid State Drives

HPE 120GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty M1 Solid State Drive

HPE 240GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty M1 Solid State Drive

HPE 480GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty M1 Solid State Drive

HPE 800GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty M1 Solid State Drive

6G SATA ME Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives

HPE 800GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive

HPE 400GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive

HPE 200GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive

HPE 100GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive

6G SAS VE (2.5-inch) SC EV Solid State Drives

HPE 480GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty G1 Solid State Drive

HPE 240GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty G1 Solid State Drive

HPE 120GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty G1 Solid State Drive

12G SAS ME SFF (2.5-inch) SC Enterprise Mainstream H2 Solid State Drives

HPE 1.6TB 12G SAS Mainstream Endurance SFF 2.5-in ENT Mainstream SC 3yr Wty H2 Solid State Drive

HPE 200GB 12G SAS Mainstream Endurance SFF 2.5-in ENT Mainstream SC 3yr Wty H2 Solid State Drive

HPE 400GB 12G SAS Mainstream Endurance SFF 2.5-in ENT Mainstream SC 3yr Wty H2

Additional Options

Solid State Drive

HPE 800GB 12G SAS Mainstream Endurance SFF 2.5-in ENT Mainstream SC 3yr Wty H2 Solid State Drive

12G SAS VE SFF (2.5-inch) SC EV Solid State Drives

HPE 1.6TB 12G SAS Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

HPE 800GB 12G SAS Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive

6G SATA Read Intensive (2.5-inch) SC G2 Solid State Drive

HPE 240GB 6G SATA Read Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

HPE 480GB 6G SATA Read Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

HPE 960GB 6G SATA Read Intensive SFF 2.5-in SC 3yr Wty Solid State Drive

SAS Hot Plug with SmartDrive SFF (2.5-inch) Enterprise Drives

HPE 300GB 12G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

HPE 450GB 12G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

HPE 600GB 12G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive

NOTE: The mixing of standard SAS drives with SAS SSD is supported within the compute module, but limits the RAID configuration to two separate RAID 0 volumes. Mixing of other drives types is not supported

HPE NVMe PCIe Read Intensive SFF (2.5-inch) Solid State Drives

HPE 2TB NVMe PCIe Read Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 1.2TB NVMe PCIe Read Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 400GB NVMe PCIe Read Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE NVMe PCIe Mixed Use SFF (2.5-inch) Solid State Drives

HPE 2TB NVMe PCIe Mixed Use SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 1.6TB NVMe PCIe Mixed Use SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 800GB NVMe PCIe Mixed Use SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 400GB NVMe PCIe Mixed Use SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE NVMe PCIe Write Intensive SFF (2.5-inch) Solid State Drives

HPE 2TB NVMe PCIe Write Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 1.6TB NVMe PCIe Write Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 800GB NVMe PCIe Write Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

HPE 400GB NVMe PCIe Write Intensive SFF 2.5-in SC2 3yr Wty Solid State Drive

NOTE: The HPE Synergy 660 Gen9 Configure-to-order Expanded Storage Compute Module (732365-B21) is required to support HPE NVMe PCIe drives.

HPE Security   HPE Trusted Platform Module Option

HPE Trusted Platform Module 2.0 Kit

NOTE: The TPM (Trusted Platform Module) is a microcontroller chip that can securely store artifacts used to authenticate the server platform. These artifacts can include passwords, certificates and encryption keys. Windows® BitLocker™ Drive Encryption (BitLocker) is a data protection feature available in Windows Server® 2008 R2 and 2012. BitLocker leverages the enhanced security capabilities of a Trusted Platform

Additional Options

Module (TPM) version 1.2. The TPM works with BitLocker to help protect user data and to ensure that a server running Windows Server 2008 R2 and 2012 has not been tampered with while the system was offline.

NOTE: For more information about TPM, including a white paper, go to **http://www.hp.com/go/TPM**.

NOTE: OS pre-installed units will come with the partition required for TPM deployment.

NOTE: The TPM key is unique to every TPM deployed server and must be retained. Misplacing or losing the key could result in data loss.

HPE Storage Controllers	HPE Smart Array P240nr/1GB FBWC 12Gb 4-ports Int SAS Controller
	HPE Smart Array P542D/2GB FBWC 12Gb Mezzanine SAS Controller
	HPE H240nr 12Gb 4-ports Int Smart Host Bus Adapter
	HPE Compute Module Smart Array P542D SAS Cable
	HPE Smart Storage Battery with 260mm Cable Kit

NOTE: If the HPE Smart Array P240nr or the HPE H240nr Smart Host Bus Adapter are not selected, the B140i controller (chipset SATA) will be enabled to support SATA devices for the internal drive bays. If RAID is required when using the B140i controller, please choose 'HPE FIO B140i RAID Enable Kit - BIOS Setting' (784308-B21).

NOTE: The HPE Smart Array P542D is required for connection to storage resources in the HPE Synergy D3940 Storage Module.

NOTE: To support local drive bay and D3940 Storage Module connectivity on the same controller the HPE Smart Array P542D (759557-B21) and P542D SAS cable are required with the HPE Synergy 660 Gen9 Configure-to-order Expanded Storage Compute Module (732365-B21).

NOTE: The HPE Smart Storage Battery (782958-B21) is included with the HPE Smart Array P240nr Controller. If the Smart Array P542D Controller is selected the Smart Storage Battery is required to support battery-backed FBWC.

HPE Secure Encryption	HPE Secure Encryption No Media E-LTU per Drive
	HPE Secure Encryption No Media Flexible License per Drive

NOTE: HPE Secure Encryption is supported on the HPE Smart Array P240nr, HPE Smart Array P542D, and H240nr (running in RAID mode) as an option. HPE Secure Encryption licensing is based on the number of physical drives requiring encryption.

NOTE: For more information about HPE Secure Encryption, go to **http://www.hp.com/go/hpsecureencryption.**

HPE Flash Media Kits	**HPE Enterprise Mainstream Flash Media Kits for Memory Cards**
	HPE 8GB USB Enterprise Mainstream Flash Media Drive Key Kit
	HPE 8GB microSD Enterprise Mainstream Flash Media Kit
	HPE 32GB microSD Enterprise Mainstream Flash Media Kit
	HPE Dual 8GB microSD Enterprise Midline USB Kit

NOTE: Please see the QuickSpecs for Technical Specifications and additional information: **http://h18000.www1.hp.com/products/quickspecs/13971_div/13971_div.html**

Technical Specifications

Memory Subsystem Architecture

Each processor socket contains four memory channels that support three DIMMs each for a total of twelve (12) DIMM per installed processor or a grand total of forty eight (48) DIMMs for the compute module.

Memory Population Rules and Guidelines:

- A minimum of one DIMM is required per processor.
- Install DIMMs only if the corresponding processor is installed.
- If only one processor is installed in a two processor system, only half of the DIMM slots are available.
- DIMM sizes can be mixed in channel. To maximize performance, it is recommended to balance the total memory capacity between all installed processors and to load the channels similarly whenever possible.
- LRDIMM and RDIMMs are all distinct memory technologies and cannot be mixed within a compute module.
- DIMMs of different speeds may be mixed in any order; the compute module will select a common optimal speed.
- The maximum memory speed is a function of the memory type, memory configuration, and processor model.
- The maximum memory capacity is a function of the memory type and number of installed processors.
- HPE memory from previous generation servers is not compatible with the HPE Synergy 660 Gen9 Compute Module.
- To realize the performance memory capabilities listed in this document, HPE SmartMemory is required. For additional information, please see the HPE SmartMemory QuickSpecs at:
  http://www8.hpe.com/h20195/v2/GetHTML.aspx?docname=c04111535

System Unit			
	Dimensions (H x W x D) (with bezel)	63.5mm x 430.3mm x 600mm	
	Weight (approximate)	Maximum: all processors, 48 DIMMs, drives, mezzanine cards, and one flash cache battery installed)	35.6 Lbs
		Minimum: two processor and 1 DIMM / processor installed	26.6 Lbs
	Power Specifications	For power specifications including input requirements, BTU rating, and power supply output, please see the HPE Synergy Frame TechSpecs. To review typical system power ratings use the HPE Power Advisor which is available via the online tool located at **http://www.hp.com/go/hppoweradvisor**	
	System Inlet Temperature	Operating	10° to 35°C (50° to 95°F) at sea level with an altitude derating of 1.0°C per every 305 m (1.8°F per every 1000 ft) above sea level to a maximum of 3050 m (10,000 ft), no direct sustained sunlight. Maximum rate of change is 20°C/hr (36°F/hr). The upper limit and rate of change may be limited by the type and number of options installed. System performance during standard operating support may be reduced if operating with a fan fault or above 30°C (86°F).
		Non-operating	-30° to 60°C (-22° to 140°F). Maximum rate of change is 20°C/hr (36°F/hr).

Technical Specifications

Extended Ambient Operating Support	For approved hardware configurations, the supported system inlet range is extended to be: 5° to 10°C (41° to 50°F) and 35° to 40°C (95° to 104°F) at sea level with an altitude derating of 1.0°C per every 175 m (1.8°F per every 574 ft) above 900 m (2953 ft) to a maximum of 3050 m (10,000 ft).	
	The approved hardware configurations for this system are listed at the URL: **NOTE: Qualifications for extended ambient configurations are detailed at: https://www.hpe.com/servers/ASHRAE**	
Relative Humidity (non-condensing)	Operating	Minimum to be the higher (more moisture) of -12°C (10.4°F) dew point or 8% relative humidity. Maximum to be the lower (less moisture) of 24°C (75.2°F) dew point or 90% relative humidity.
	Non-operating	5 to 95% relative humidity (Rh), 38.7°C (101.7°F) maximum wet bulb temperature, non-condensing.
Altitude	Operating	3050 m (10,000 ft). This value may be limited by the type and number of options installed. Maximum allowable altitude change rate is 457 m/min (1500 ft/min).
	Non-operating	9144 m (30,000 ft). Maximum allowable altitude change rate is 457 m/min (1500 ft/min).
Acoustic Noise	For acoustic noise specifications, please see the HPE Synergy Frame 12000 TechSpecs located at: <placeholder	

HPE Smart Array P240nr Controller	**Disk Drive Interface**	12Gb/s SAS (Serial Attached SCSI) 6Gb/s SATA (Serial ATA)
	Server Interface	x8 5G PCIe 3.0 provides 8GB/s maximum bandwidth
	Cache Memory	1GB flash backed write cache (FBWC) cache standard
	Logical Drives Supported	64 (with included 1GB cache)
	Host Memory Addressing	64-bit, supporting servers memory space greater than 4GB
	RAID Support	RAID 1 (mirroring), RAID 0 (striping), RAID 5, RAID 10
	Other	Upgradeable firmware with recovery ROM Online drive flash (with SAS drives)

HPE Dynamic Smart Array B140i Controller	**Disk Drive Interface**	6Gb/s SATA (Serial ATA)
	Compute module Interface	Embedded x4 PCIe 2.0
	SAS Connectors	2 internal SATA ports
	Cache Memory	None
	SAS Speed	6Gb/s SATA links
	Logical Drives Supported	Up to 10 logical volumes (4 physical drives)
	Host Memory Addressing	64-bit, supporting greater than 4GB compute module memory space

Technical Specifications

	Hot Plug Support	Yes
	RAID Support	RAID 1 (Mirroring), RAID 0 (Striping), RAID 5
	Other	Upgradeable firmware with recovery ROM
HPE Smart Array P542D Controller	**Storage Interface**	12 Gb/s SAS (Serial Attached SCSI)
		6 Gb/s SATA (Serial Advanced Technology Attachment)
	SAS Connectors	Two (2) external ports supporting x4 SAS links each and two (2) internal ports supporting x4 SAS links each
	SAS Speed	x16 12 Gb/s per physical link
	PCIe Link Rate	PCIe 3.0 x8 links
	Memory Bus Speed	DDR3-1866 MHz, 72-bit wide bus at 14.92 GB/s (2 GB cache module)
	Logical Drives Supported	64 logical drives
	Max Drives Supported	Up to 256 drives (Up to 128 drives per logical drive)
	RAID Support	RAID 6, 60 (Advanced Data Guarding) RAID 5, 50 (Distributed Data Guarding) RAID 1, 10 (Drive Mirroring) RAID 1 ADM, 10 ADM (Advanced Data Mirroring) RAID 0 (Striping)
	Upgradeable Firmware	Flashable ROM with redundant firmware images
HPE Smart HBA H240nr Controller	**Disk Drive Interface**	12Gb/s SAS (Serial Attached SCSI) 6Gb/s SATA (Serial ATA)
	Compute module Interface	x8 5G PCIe 3.0 provides 8GB/s maximum bandwidth
	Cache Memory	None
	Logical Drives Supported	64
	Host Memory Addressing	64-bit, supporting compute modules memory space greater than 4GB
	RAID Support	RAID 1 (mirroring) and RAID 0 (striping)
	Other	Upgradeable firmware with recovery ROM Online drive flash (with SAS drives)
HPE Synergy 2820C 10Gb Converged Network Adapter	**Type**	Dual-port 10Gb mezzanine
	Network Processor	QLogic 57840S with integrated MAC/PHY
	Data Transfer Method	x8 PCI Express 3.0
	Network Transfer Rate	Two ports, each at 20Gbps full duplex; 40Gbps aggregate full duplex theoretical bandwidth
	IEEE Compliance	802.3, 802.3ab, 802.3u, 802.3x, 802.3ad, 802.3p, 802.1q, 802.3ae, 802.3ap

Technical Specifications

	Standard Features	Delivers flexibility to compose multiple network flows including Ethernet and FCoE or iSCSI within each connection.
		Full hardware offload of FCoE and iSCSI storage protocol processing for highest performance converged Ethernet data and storage networks.
		Flex-10 Technology allows you to fine tune bandwidth for up to four partitioned FlexNIC's and FlexHBA's to optimize connectivity for different application needs.
		From 100Mb/s to 10Gb/s on up to four "Physical Function" NICs per port, in increments of 100Mb/s for NIC. The combined bandwidth of NICs cannot exceed port bandwidth i.e. 10 Gb.
		A single Type C mezzanine form factor provides flexible network and storage I/O for any HPE Synergy Compute Module.
		Provides up to 40 Gb/s of converged bi-directional Ethernet bandwidth. Industry-leading throughput and latency performance.
		Supports Tunnel Offload with NVGRE and VXLAN.
		Hardware acceleration and offloads for stateless TCP/IP, TCP Offload Engine (TOE).
		Orchestrates reliable adapter firmware updates with an entire HPE Synergy infrastructure from a single tool, HPE Synergy Composer.
		Integrated PHY and MAC.
		Support for Preboot eXecution Environment (PXE).
		Support for SR-IOV (Windows, Linux, VMware).
		Support for Network Partitioning (NPAR) when using Pass-thru modules.
HPE Synergy 3820C 10/20Gb Converged Network Adapter	**Type**	Dual-port 10/20Gb mezzanine
	Network Processor	QLogic 57840S with integrated MAC/PHY
	Data Transfer Method	x8 PCI Express 3.0
	Network Transfer Rate	Two ports, each at 40Gbps full duplex; 80Gbps aggregate full duplex theoretical bandwidth
	IEEE Compliance	802.3, 802.3ab, 802.3u, 802.3x, 802.3ad, 802.3p, 802.1q, 802.3ae, 802.3ap

Technical Specifications

	Standard Features	Delivers flexibility to compose multiple network flows including Ethernet and FCoE or iSCSI within each connection. Full hardware offload of FCoE and iSCSI storage protocol processing for highest performance converged Ethernet data and storage networks. Flex-20 Technology allows you to fine tune bandwidth for up to four partitioned FlexNIC's and FlexHBA's to optimize connectivity for different application needs. From 100Mb/s to 20Gb/s on up to four "Physical Function" NICs per port, in increments of 100Mb/s for NIC. The combined bandwidth of NICs cannot exceed port bandwidth i.e. 20 Gb. A single Type C mezzanine form factor provides flexible network and storage I/O for any HPE Synergy Compute Module. Provides up to 80 Gb/s of converged bi-directional Ethernet bandwidth. Industry-leading throughput and latency performance. Supports Tunnel Offload with NVGRE and VXLAN. Hardware acceleration and offloads for stateless TCP/IP, TCP Offload Engine (TOE). Orchestrates reliable adapter firmware updates with an entire HPE Synergy infrastructure from a single tool, HPE Synergy Composer. Integrated PHY and MAC. Support for Preboot eXecution Environment (PXE). Support for SR-IOV (Windows, Linux, VMware). Support for Network Partitioning (NPAR) when using Pass-thru modules.
HPE Synergy 3520C 10/20Gb Converged Network Adapter	**Type**	Dual-port 10/20Gb mezzanine
	Network Processor	Emulex XE-100 series
	Data Transfer Method	x8 PCI Express 3.0
	Network Transfer Rate	Two ports, each at 40Gbps full duplex; 80Gbps aggregate full duplex theoretical bandwidth
	IEEE Compliance	802.3ae, 802.1Q, 802.3x, 802.1p, 802.3ad/LACP, 802.1AB(LLDP), 802.1Qbg, 802.1Qbb, 802.1Qaz, 802.3ap

Technical Specifications

	Standard Features	Composes multiple network flows including FCoE, RoCEv2, PMD for DPDK or Ethernet within each connection.
		Dual 20Gb ports provide up to 80Gb bi-directional per adapter.
		Flex-20 Technology allows fine tuning bandwidth for up to eight partitioned FlexNICs and FlexHBAs to optimize connectivity for different application needs.
		From 100Mb/s to 20Gb/s on up to four "Physical Function" NICs per port, in increments of 100Mb/s for NIC. The combined bandwidth of NICs cannot exceed port bandwidth i.e. 20 Gb.
		Provisions and updates all adapters quickly and consistently using the HPE Synergy template-driven server profiles.
		Orchestrates reliable adapter firmware updates with an entire HPE Synergy infrastructure from a single tool, HPE Synergy Composer.
		Multi-speed adapter operates at either 20GbE or 10GbE .
		Tunnel Offload support for VXLAN and NVGRE. Overlay networking reduces server CPU utilization and increases throughput in private/hybrid cloud networks
		RDMA over Converged Ethernet (RoCE) for greater server efficiency and lower latency (HPE Synergy 40G F8 only). RoCEv2 provides routing capability for enabling servers on separate subnets to leverage RDMA communications.
		Advanced FCoE and iSCSI offload processing frees up valuable CPU cycles
		Supports UEFI and legacy boot options.
		Mixed Storage – supports NIC + FCoE on one port, and NIC + iSCSI on the other.
		Poll Mode Driver (PMD) for DPDK provides faster small packet performance for Telco Network Function Virtualization (NFV) workloads.
		Greater bandwidth with PCIe 3.0
		Jumbo Frames support.
		Support for Preboot eXecution Environment (PXE).
		Optimized host virtualization density with SR-IOV support.

HPE Synergy 3830C 16Gb Fibre Channel Host Bus Adapter	**Type**	Dual-port 16Gb mezzanine
	Network Processor	QLogic 8324
	Data Transfer Method	x8 PCI Express 3.0
	Network Transfer Rate	Two ports, each at 16 Gbps, each direction; 64 Gbps aggregate full duplex theoretical bandwidth
	IEEE Compliance	802.3ae, 802.1Q, 802.3x, 802.1p, 802.3ad/LACP, 802.1AB(LLDP), 802.1Qbg, 802.1Qbb, 802.1Qaz, 802.3ap

Technical Specifications

Standard Features   Flexible Configuration and Connection of Pools of Compute Resources.
- Provides flexible connectivity to HPE Synergy Virtual Connect FC Modules and Brocade FC Switch Modules.

Performance Optimized:
- Capable of delivering twice the data throughput (MB/s) compared to 8Gb FC HBAs.
- High link speed combined with larger data block sizes results in improved application performance.
- Dynamic Port Utilization architecture delivers up to 600K Input Output Operations per second (IOPS) on each port or up to 1.2 million IOPS with single port operation.

Virtualization Optimized:
- Ideal for high density server virtualization environments.
- Enables more applications and Virtual Machines to run on a single HPE Synergy Compute Module and Fibre Channel port, resulting in reduced cabling and a higher return on IT investment.

Supports QLogic StorFusion(TM) technology designed to enhance diagnostic and troubleshooting capabilities, quicken SAN deployment, and improve QoS when connected to Brocade 16Gb FC fabrics.
- Accelerate SAN deployment (FA-PWWN, F-BLD).
- Improve network resiliency and Quality of Service (FEC, CS_CTL).
- Eenhance diagnostics and troubleshooting (Clearlink®, LCB, RDP, FDMI, FC Ping, FC Traceroute).

Power Optimized:
- Latest generation technology saves power.
- Reduced number of components on each FC HBA reduces overall power consumption.

RAS Optimized:
- Highest Data Integrity; Overlapping Protection Domains (OPD) extended for control and data paths.

Security Optimized:
- SAN-level authentication (FC-SP), fabric-level isolation (NPIV and end-to-end data integrity (T10).

Management Optimized:
- Provisions and updates all adapters quickly and consistently using the HPE Synergy template-driven server profiles.
- Orchestrates reliable adapter firmware updates with an entire HPE Synergy infrastructure from a single too, HPE Synergy Composer.

Fault tolerant HBA Architecture.

Two 16Gb/s Fibre Channel ports.

Multi-Path support for redundant HBAs and paths including Linux driver failover.

RoHS compliance.

QLogic Converge Console management utility for centralized. management and remote control of distributed HBAs.

Technical Specifications

Environment-friendly Products and Approach	**End-of-life Management and Recycling**	Hewlett Packard Enterprise offers end-of-life HPE product return, trade-in, and recycling programs in many geographic areas. For trade-in information, please go to: **http://www.hp.com/go/green**. To recycle your product, please go to: **http://www.hp.com/go/green** or contact your nearest Hewlett Packard Enterprise sales office. Products returned to Hewlett Packard Enterprise will be recycled, recovered or disposed of in a responsible manner. The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard Enterprise web site at: **http://www.hp.com/go/green**. These instructions may be used by recyclers and other WEEE treatment facilities as well as Hewlett Packard Enterprise OEM customers who integrate and re-sell Hewlett Packard Enterprise equipment.

Summary of Changes

Date	Version History	Action	Description of Change
1-Dec-2015	Version 1	Created	New QuickSpecs

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