Benchmarking your Infrastructure

HP Converged Systems and New Gen9 Update

Jim Westover
Enterprise Solutions Architect
Nth Generation Computing
HP Blueprint for Client Virtualization

Today’s Deskside

User Types

- Task Oriented
- Productivity/Knowledge
- Desktop Power User
- Performance User

Client Devices

- Traditional PC
- Workstation
- High-end PC

Strategic Partnerships

- VMware
- Citrix
- Microsoft

Integrated Cost/Performance Optimized Datacenter

- Session Virtualization
- Virtual Desktop Interface (VDI)
- Graphics Accelerated VDI
- Dedicated PC (HDI)

HP Client & Insight Control Management Tools

HP Client Infrastructure Services
Converged Infrastructure for CV Solutions
Alignment to PC User Segmentation

- Session/Application Virtualization
- Virtual Desktops (VDI)
- Hosted Desktops (HDI)
- Graphics Accelerated VDI

Density

Performance, Cost/Seat

Knowledge Workers

Productivity Workers

Power Users

Task Workers

Graphics Users

Thin Clients
Traditional Rich Clients
Windows-To-Go

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# Modes of Graphics Acceleration

**(GPU available to VMs)**

<table>
<thead>
<tr>
<th>Direct map</th>
<th>SW graphics (RFX2012, VMware)</th>
<th>Shared (Microsoft, VMware)</th>
<th>Pass-thru (Citrix, VMware)</th>
<th>HW Virtualized GPU (Citrix &amp; NVIDIA GRID)</th>
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<tbody>
<tr>
<td>Bare metal</td>
<td>Virtual Desktops</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- **App** ... **App**

- **Win 7 OS**

- **GPU**

- **VRAM**

- **NVIDIA Graphics driver**

- **VDI vendor’s shared graphics framework**

- **NVIDIA Graphics driver**

**Performance**

- ●●●●

- ●

- ●●

- ●●●●

- ●●●
Break-Through User Consolidation & Per User Costs

Industry’s leading GPU density
- Eight Q1000m per blade, 64 per 10U enclosure
- Six Q3000m per blade, 48 per 10U enclosure
- Gen9 DL380 2U allows 4 Full-Height GPU options
- Citrix XenDesktop support via GPU Pass Thru
- VMware View support via vDGA

Technical White Paper:
HP Hardware Accelerated Graphics for VDI & Client Virtualization, 4AA4-1701ENW

Best matching of graphics to user different user needs and cost requirements

<table>
<thead>
<tr>
<th>Entry</th>
<th>Mid-range</th>
<th>High-end</th>
<th>Ultra High-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Q500m</td>
<td>Eight Q1000m&lt;br&gt;One K1 (4 GPUs)</td>
<td>Six Q3000m&lt;br&gt;Two K4000&lt;br&gt;One K2 (2 K5000)&lt;br&gt;One Quadro 5000&lt;br&gt;One K5000</td>
<td>One Quadro 6000</td>
</tr>
</tbody>
</table>
HP ProLiant WS460c Graphics Server Blade

Two form factors to support a the broadest range of graphics

- Major production deployments since 2004
- Two PCIe Gen3 x16 slots mezzanine slots
- Intel Xeon E5-2600v2 Dual Socket
- Up to 384GB of low cost memory via 24GB DIMMs
- 512GB max w/ 32GB DIMMs
- Gen8 BladeSystem designed for Converged Infrastructure
- FCoE and in-enclosure storage solutions

WS460c Gen8
Workstation Server blade
16 per 10U enclosure

WS460c Gen8 Graphics Expansion
Workstation Server blade
8 per 10U enclosure
HP WS460c GPUs & VDI Solution Stacks

- Broadest range of GPU virtualization, leading density
  - Q500m, Q1000m, Q3000
  - 8xQ1000m, 6xQ3000m, Quadro 5000, 6000
  - Grid K1, K2, K4000, K5000
- Broadest OS and VDI solution stack
  - Bare metal Windows 7 64-bit and RHEL 5.8+, 6.0
  - Citrix HDX 3D Pro, XenDesktop, XenServer 6.0
  - VMware PCoIP, View, vSphere 5.2
  - Windows 2012 HyperV, RemoteFX
  - Leostream Broker

Up to 2 GPUs
32 GPUs per 10U enclosure

Up to 8 GPUs
64 GPUs per 10U enclosure
<table>
<thead>
<tr>
<th>HP Thin Client Portfolio</th>
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</thead>
<tbody>
<tr>
<td><strong>Flexible Clients</strong></td>
</tr>
<tr>
<td>t820</td>
</tr>
<tr>
<td>t620</td>
</tr>
<tr>
<td>t510</td>
</tr>
</tbody>
</table>
| • Multiple Operating Systems  
  • Multiple Environments  
  • Multiple Displays  
  • Robust Management  
  • HP Velocity |
| **Smart Clients**        |
| t410 AIO                 |
| t410                     |
| • SmartZero Operating System  
  • Multiple Environments  
  • Multiple Displays |
| **Zero Clients**         |
| t310                     |
| • No Operating System  
  • Single Environment  
  • Zero Configuration, Zero management  
  • Lock-tight security |
| **Mobile Clients**       |
| mt41                     |
| • Secure Mobility  
  • Common Docking with HP Notebooks  
  • HP Velocity |
Benchmarking your Infrastructure

HP Converged Systems Family

Jim Westover
Enterprise Solutions Architect
Nth Generation Computing
The HP ConvergedSystem portfolio
Delivering a breakthrough total systems experience

Virtualization
• HP ConvergedSystem for Virtualization
• HP ConvergedSystem for Hosted Desktops

Cloud
• HP CloudSystem

Big Data
• HP ConvergedSystem for Vertica
• HP ConvergedSystem for SAP HANA

Built on the industry’s best converged infrastructure with leading ISVs
HP ConvergedSystem family: FAST, SIMPLE, EFFICIENT

OPTIMIZED for
- Virtualization
- Bus Intelligence / Analytics
- Hosted Desktop “HDI”

ConvergedSystem 100
ConvergedSystem 200
ConvergedSystem 300
ConvergedSystem 500
ConvergedSystem 700
ConvergedSystem 700x (custom)

Integrated Management & Support

http://hp.com/go/convergedsystems
HP Moonshot System: Game-changing innovation

The world’s first software-defined server

Converged Infrastructure for breakthrough efficiency and scale

- Shared power, cooling, networking, management and fabric
- Up to 45 hot-plug server cartridges
- Workload optimized

80% Less space  77% Less cost  89% Less energy  97% Less complexity

Source: HP internal analysis based on HP ProLiant Moonshot Server Cartridge, Intel Atom S1260 Processor
HP ConvergedSystem 100 Chassis

Dual network switches

Forty-five (3 x 15) cartridge slots

www.hp.com/go/moonshot

180 users per enclosure

4 System on Chip per cartridge, so each user has:

- 4 core AMD 1.5GHz integrated GPU
- 8GB RAM
- 32GB iSSD (caching for vhd)
- 2x1Gb Nic


http://hp.com/go/C5100

HP ConvergedSystem 100 deployment

1260 Desktops in the rack – Simple solution for knowledge worker

HP Moonshot System
Up to 7 Chassis with 45 m700 (180 nodes)
1260 nodes per rack

(2) HP ProLiant DL385 Gen8
8x300GB SAS 1.2TB+

Dual 40Gb
4x10Gb

2x10Gb

Two HPN 5900 TOR Switches
(48XG-4QSFP)

2x10Gb

HPN 5800 Leaf Switches

Non-Persistent Desktops

HP StoreEasy
12TB – 1PB+
SAS/SATA
SFF/LFF

For more information on CS100 and Moonshot
http://hp.com/go/CS100

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Purpose-built for your virtualization sweet-spot

### HP ConvergedSystem 300 for Virtualization
- Simple, standardized configuration
- Optimized for 50–300 VMs
- Fully featured software-defined storage

### HP ConvergedSystem 700 and 700x for Virtualization
- Standardized and flexible configurations
- Optimized for 100–1,000+ VMs
- Integrated converged scale-out storage, FlexNetwork connectivity

2X faster deployment¹
2X performance²
More integrated support
All from one vendor

25% lower entry price²

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¹. Comparison between the entry HP ConvergedSystem 300 Standard and the Vblock 100DX-3P – three server configuration for both offerings. May vary by deployment.
HP ConvergedSystem 300 for Virtualization

CS300 - Easy to upgrade and grow

Modular upgrades improve time to business value and ensure ongoing sales

Expansions in <2 weeks

CS300 Base

Expansion Kit
1 X node
12 or 16 X drives

Upgraded CS300 (up to 8 nodes)
HP ConvergedSystem 300 for Virtualization

Remote Offices or Acquisition (local LAN migration)

- Existing IT Infrastructure
- VMWare (converted Hyper-V VMs, or physical servers which could be Virtualized)
- VMhost 1 .... VMhost N

Centralized Data Center

- VMWare
- VMhost 1 .... VMhost N
- WAN
- Low cost Async VM replication leveraging StoreVirtual technology
- with upper end option for VMware SRM (if vMotion desired)

- Existing VMWare or Hyper-V cluster connected to HP StoreVirtual iSCSI Storage
- OR
- HP VSA with DL or Storage Blade
- OR
- another CS300
- Efficient Async Replication or Synchronous "multi-site" if < 25km
ConvergedSystem 700 for Virtualization - When to position

When you want more > than 128 VM’s
When you need growth >500 VMs and SAN features & modular
Specialized, or alternate hypervisor

HP ConvergedSystem 700 is likely the best fit unless need...

Capex sensitive and wants to start small with rack server
Support for configure to order options like SSD, memory and processor
Support Microsoft or other virtualization

HP CS300 for Virtualization
HP CS700 X solutions
HP CS700 X solutions
New **App Maps** for HP ConvergedSystem for Virtualization

Making it simple to deploy common applications in a virtualized environment

- **Fully tested and validated** for specific workloads and applications
- Leverages **HP IP** (infrastructure, software and best practices) with ISV software
- Provides workload-specific configuration and **deployment guidance**
HP ConvergedSystem 700 for Virtualization

- **Base configuration**
  - 42U rack
  - 2 ProLiant management servers
  - 4 Blade workload servers
  - 10.8 TB storage
  - C7000 blade enclosure
  - Virtual Connect
  - TOR switches
  - Direct Attach SAN Fabric

- **Expansion Kit**
  - 4 blade workload servers
  - 10.8TB storage

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**Switching Technology**
- HP 5920 and 5120 switches (2x)

**Management servers**
- HP ProLiant DL360 Gen8

**Management Software**
- Insight Control LTU for 16 servers
- Insight Control for vCenter
- vCenter/vSphere

**Storage**
- 3PAR StoreServ 7200 series
  - Service Processor
    - 36-144 drives

**Compute**
- BL460c Gen8 E5-v2 blades – 256GB Memory
  - Intel E5-2650v2 or 2697 v2 Processors (Ivy Bridge)
  - HP Virtual Connect FlexFabric Modules
Converged Systems – Custom and CS700x Solution Sizing

SAN Topology

Single Rack Flat SAN

Multi Rack FC SAN
Converged Systems – Custom and CS700x Solution Sizing

Network Topology
HP ConvergedSystem200 – Hyper Converged

Dan Molina
Chief Technology Officer
Nth Generation Computing
October 16, 2014
Introducing the new HP CS200-HC StoreVirtual System

Best-in-class hyper-convergence

HP Converged System 200-HC StoreVirtual System

www.hp.com/go/hyper-converge
HP Converged System 200-HC StoreVirtual Models

Combines compute, capacity, hypervisor, software-defined storage and management

**CS 242-HC StoreVirtual System**
- 4 nodes
- 20 CPU cores @ 2.8GHz, 256GB RAM
- 2x 10GbE + 2x 1GbE
- 4x 1.2TB SAS SFF drives
- 2x 400GB SFF SSDs
- VMware vSphere 5.5
- StoreVirtual VSA
- OneView for VMware vSphere
- OneView InstantON
- Factory software installation

**CS 240-HC StoreVirtual System**
- 4 nodes
- 16 CPU cores @ 2.0GHz, 128GB RAM
- 2x 10GbE + 2x 1GbE
- 6x 1.2TB SAS SFF drives
- VMware vSphere 5.5
- StoreVirtual VSA
- OneView for VMware vSphere
- OneView InstantON
- Factory software installation
Rethinking storage and server virtualization

Delivers converged infrastructure with simplicity and accelerated time to value

Management Simplified
- 15 minutes from power-on to provisioning
- vCenter integration for a single UI experience
- All-inclusive data services

Optimized for Virtualization
- 99.999% high availability for business continuity
- Inherent disaster recovery capabilities
- Platform integration with vSphere

Hyper-converged
- Serves both applications and data services
- 4 times the compute in 75% less space than traditional rack servers
- Provides straightforward linear scale out architecture to handle changing workloads
HP CS 200-HC all-inclusive enterprise features

- Network RAID synchronous replication
- Federated scale-out storage
- Peer Motion data mobility
- Automated sub-volume tiering
- Unconditional thin provisioning
- Multi-site stretch cluster
- Integrated disaster recovery
- Application integration
- Linear scaling performance & capacity
- High availability
Leading in the Compute era with HP ProLiant Gen9

Delivering the right compute for the right workload at the right economics every time

October 16 2014

Jim Westover, Solutions Architect
Jim Beck, Server Specialist
HP delivers the right compute for the right workload

**Intelligence to increase productivity**
- HP MicroServer
- HP ProLiant ML
- HP ProLiant DL

**Availability for continuous business**
- HP ProLiant scale-up
- “DragonHawk”
- HP Integrity blades & Superdome
- HP Integrity NonStop

**Density and efficiency to scale rapidly**
- HP ProLiant SL
- HP Moonshot
- HP Apollo Family

**Convergence to accelerate service delivery**
- HP BladeSystem
- HP OneView

**Common modular compute architecture**

<table>
<thead>
<tr>
<th>Cost of service</th>
<th>Time to service</th>
<th>Value of service</th>
</tr>
</thead>
</table>
HP Management strategy includes value integration with the Partner platform ecosystems and “cloud” enablement

Microsoft System Center, VMware vCenter server and Linux platforms

Best managed platform
Seamless integration of unique HP manageability features

- Bare metal OS deployment
- Heterogeneous server support (Windows, ESX & Linux SDR enablement)
- Automated firmware/driver updates
- Comprehensive health monitoring & remote control
- VM rebalancing remediates hardware faults
- Agentless monitoring with Gen8 hardware
- Commonality of HP user experience
- Storage provisioning, utilization, & monitoring
- Virtual Connect network monitoring
- Online firmware updates
- Linux SDR, KVM, OpenStack, Cloud OS
HP Integration with native VMware platforms

VMware vSphere, vCenter Server and Operations Manager as a foundation

Delivers a balanced virtualized environment with the day-to-day administrative tools required to manage virtual machines (VMs) and workloads, as well as provides an end-to-end view into the operations of the virtualized infrastructure environment

**HP OneView for VMware vCenter integration**

Adds detailed dashboards to understand the relationship between the physical and virtual and provides provisioning of an entire cluster compute and storage in 5 easy clicks

**HP OneView for VMware vCenter Operations Manager integration**  [Discover 2014 Announcement]

Provides key health, utilization and performance metrics in context of the HP Server/BladeSystem and Virtual Connect hierarchy for trend analysis and delivers root cause/impact analyses via custom dashboards
VMware vCOPs – HP 3PAR Storage integration

vCenter Operations Management + HP StoreFront Analytics Pack

What does it deliver?
• Integrated and highly automated performance, capacity, configuration, compliance and costing management for HP 3PAR StoreServ Storage
• Operations management console integrated with HP 3PAR StoreServ Storage Array

Why is it unique?
• Patented analytics self-learn “normal” in a dynamic environment extended to HP 3PAR StoreServ
• Converges disciplines (Fusion / Integration)
• Designed for vSphere and HP 3PAR StoreServ
• Leverages IT monitoring investment
• First HP 3PAR solution for vCOPS in the market
VMware vCOps and HP OneView – Unbeatable Combination

Capabilities

• Proactively manage performance and improve availability for VMware vSphere environments
• Understand performance trends across virtual machines (VMs), clusters, and farms
• Optimize capacity by reclaiming unused VMs, and rightsizing under-provisioned VMs
• Reduce false alerts through patented analytics

Capabilities

• Guarantee SLA – Quick root cause identification and resolution
• Improve CapEx/OpEx savings – 30% higher resource utilization by rightsizing VMs and harnessing unused resources
• Simplify management – Dashboard view of environment for easy performance and capacity management and troubleshooting
HP Virtual Connect FlexFabric-20/40 F8 Module

Performance today with investment protection for future

- Industry’s first and only 20Gb solution with 2x server downlink bandwidth
- 86% fewer components and 50% lower costs using Flat SAN with HP 3PAR
- 4x increase in uplink bandwidth and 2.5x increase in aggregate bandwidth
- 1st Virtual Connect module to deliver 40Gb Ethernet connectivity
HP Virtual Connect FlexFabric-20/40 F8 Module

Performance today with investment protection for future – Shipped May 2014

- 4x40 Ports Q1-Q4
- QSFP+ LR, SR, DAC and AOC options
- QSFP+ Splitter DAC cable (AOC and Fibre splitter cables coming)
- 40Gb FIP Snooping (coming)
- Stacking and LACP supported
- HPN 40GB and Splitter 4x10Gb DAC supported

- 8xFlexport X1-X8 (10GbE or 2/4/8 FC (NPIV))
- SFP+ LR, SR, LRM and copper DAC
- Flat SAN supported
- 10Gb FIP Snooping (FCoE) supported

HP Virtual Connect FlexFabric-20/40 F8 Module Quickspec PDF

HTML
HP Next Gen VC and Flex Adapter Hardware

2X more bandwidth to every server with 20Gb FlexLOM and Mezz cards

New 20Gb FlexibleLOMs for Gen8/Gen9 servers
- Immediate availability on new servers
- Easy upgrade for installed systems
- Can carve out 8Gb Fibre Channel Bandwidth and with 12Gb bandwidth for other FlexNICs

New VC FlexFabric-20/40Gb F8 module
- 20 Gb to each server and 40/10Gb uplinks

* This technology has been shipping since May 2014, G7 Mezz backward compatible (prior 10Gb CNA), then Gen8 20Gb options in May, now Gen9 20Gb embedded or Mezzanine option (Broadcom 630 and Emulex 650)

2Port 1x20Gb adapter = 1x10Gb adapter +1x8Gb FC hba + extra 2Gb with dynamic bandwidth for each
New 20Gb CNA “Emulex” FlexibleLOM and Mezz Option for Gen8/Gen9 servers

2x20GbE 650 FLB (FlexibleLOM) Quickspecs
http://h18004.www1.hp.com/products/quickspecs/15049_no/15049_no.PDF

HP FlexFabric 20Gb 2-port 650FLB Adapter 700763-B21
HP FlexFabric 20Gb 2-port 650FLB FIO Adapter 700764-B21

NOTE: HP 650FLB on each server blade connects to a 20Gb interconnect in bays 1-2 (HP c7000 Enclosure) or bay 1 (HP BladeSystem c3000 Enclosure).
NOTE: The HP 650FLB requires a minimum of 2 GB of server memory, and it supports linking at 10Gbps when not connected to a Flex-20 device.

2x20GbE 650 M (Mezzanine) Quickspecs

HP FlexFabric 20Gb 2-port 650M Adapter 700767-B21
Mezz1 in a half-height BL460c Gen9 maps to bays 3-4  Mezz2 (dual-port) BL460c Gen9 maps to bays 5-6

NOTE: The HP 650M requires a minimum of 2 GB of server memory, and it supports linking at 10Gbps when not connected to a Flex-20 device.

Supported VC modules and Ethernet switches
- HP Virtual Connect FlexFabric-20/40 F8 Module for c-Class BladeSystem
- HP Virtual Connect FlexFabric-20/40 F8 Module for c-Class BladeSystem with TAA
- HP Virtual Connect FlexFabric 10Gb24-port Module for c-Class BladeSystem
- HP Virtual Connect FlexFabric 10/24 Enterprise Edition BLc7000 Option
- HP Virtual Connect Flex-10/100 Module for c-Class BladeSystem
- HP Virtual Connect Flex-10/100 Module Enterprise Edition for BLc7000 Option
- HP Virtual Connect Flex-10 Ethernet Module for c-Class BladeSystem
- HP Virtual Connect Flex-10 Ethernet Module Enterprise Edition for BLc7000 Option
- HP 6125XLG Ethernet Blade Switch
- HP 6125XLG Ethernet Blade Switch with TAA

<table>
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<tr>
<th>Feature</th>
<th>VC FF20/40 F8</th>
<th>VC FF 10/24</th>
<th>VC Flex-10/100</th>
<th>VC Flex-10</th>
<th>HP 6125XLG</th>
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<tr>
<td>20Gb dual-port</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10Gb dual-port</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Tunnel Offload</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>FCoE</td>
<td>X</td>
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<td>RoCE</td>
<td>--</td>
<td>--</td>
<td>X*</td>
<td>--</td>
<td>X</td>
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* Data Center Bridging (DCB) FCoE multi-hop
# VC FlexFabric-20/40 F8 Vs. VC FlexFabric 10/24-Port

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<th>Attributes</th>
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<th>VC FlexFabric 10/24-Port</th>
<th>Performance (X)</th>
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<td>MAC Table</td>
<td>128K</td>
<td>32K</td>
<td>4X</td>
</tr>
<tr>
<td>FC Latency</td>
<td>1.8 µs</td>
<td>2.0 µs</td>
<td>11%</td>
</tr>
<tr>
<td>Ethernet Latency</td>
<td>1.0 µs</td>
<td>1.5 µs</td>
<td>50%</td>
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<tr>
<td>Throughput</td>
<td>1200Gbs</td>
<td>480Gbs</td>
<td>2.5X</td>
</tr>
<tr>
<td>Power</td>
<td><a href="mailto:12V@13.75A">12V@13.75A</a> (165W)</td>
<td><a href="mailto:12V@9.17VA">12V@9.17VA</a> (110W)</td>
<td></td>
</tr>
<tr>
<td>ISL</td>
<td>2x20 Dedicated</td>
<td>2x10 Shared</td>
<td>2X</td>
</tr>
<tr>
<td>Flexports</td>
<td>8</td>
<td>4</td>
<td>2X</td>
</tr>
<tr>
<td>LAN</td>
<td>4x40</td>
<td>2x10</td>
<td>8X</td>
</tr>
<tr>
<td>Downlinks</td>
<td>1/10/20</td>
<td>1/10</td>
<td>2X</td>
</tr>
<tr>
<td>Packet Buffer</td>
<td>12MB</td>
<td>2MB</td>
<td>6X</td>
</tr>
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</table>
Converged Systems – Custom and CS700x Solution Sizing

Network Topology
HP advances compute

Project Voyager: redefine the future of computing

2012
- Increase admin productivity & system uptime
- Maximize use of space, power, and cooling
- Better performance

Lower cost

2013
- Converged management across server, storage, and networking
- Rapid, repeatable and reliable operations at a lower cost
- Intelligent hub streamlines the delivery of IT services

Faster time

2014
- More compute capacity with lower TCO
- Faster workload deployment with simple automation
- Faster workload performance delivers better business results

Lower cost
Faster time
Better value

Gen9 augments prior innovation to deliver compelling business outcomes

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Gen9 timing, naming, and platforms for the right compute
HP ProLiant Gen9 Series – At Launch

HP ProLiant servers with...

HP ProLiant DL160 Gen9
Right sized performance for space and budget constrained environments

HP ProLiant DL180 Gen9
The new standard for growing datacenter needs

HP ProLiant DL360 Gen9
Dense performance for multi-workload computes in the data center

HP ProLiant DL380 Gen9
THE no-compromise datacenter standard for multi-workload compute

HP ProLiant ML350 Gen9
Efficient, high-performance server delivers expandability, manageability and reliability

HP ProLiant BL460c Gen9
The world’s leading server blade, performance optimized for core IT workloads

HP ProLiant XL230a Server
Apollo 6000 System server, density optimized performance for scale-out workloads

HP ProLiant XL730f Server
Apollo 8000 System server for high performance computing workloads
### New/improved technologies supporting Gen9

#### Networking
- Tunnel offload
- RDMA over Converged Ethernet
- 1Gb/10Gb/40Gb Ethernet FDR InfiniBand
- 20Gb FlexFabric adapters on BL servers
- Embedded LOM on DL servers

#### Storage
- 12Gb/s Smart Array Controllers
- 12Gb/s SAS Expander Card
- 12Gb/s Smart HBA on Blades
- 12Gb/s SAS HDD/SSD
- PCIe Workload Accelerators
- HP SmartCache with SSD
- HP StoreVirtual VSA
- HP Smart Storage Battery

#### Flexible Options
- Universal Media Bay
- Embedded/Flexible LOM
- HP Flexible Smart Array
- HP Flexible Capacity
- UEFI/Legacy BIOS
- New rack and tower platforms
- Intel Haswell processors

#### Management
- HP OneView
- UEFI BIOS (default)
- HP SUM 7.1.0 and HP ILO powered by ILO Federation
- HP RESTful Interface Tool
- Location Discovery Services
- HP Insight Online

#### Security
- UEFI Secure Boot
- Serviceguard for Linux
- HP Secure Encryption

#### Memory
- HP DDR4 SmartMemory RDIMM/LRDIMM

#### Power & Cooling
- Flexible Slot Power Supplies
- ASHRAE A3/A4 support
- HP Uninterruptible Power Systems (UPS)
- HP Rack Mount PDUs
- Power Discovery Services

#### Services
- Simplified Offerings under Foundation Support services includes:
  - hardware support
  - software support
  - Support Plus24
ProLiant Gen8 → ProLiant Gen9 naming transitions

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<tr>
<th>Core Rack Servers</th>
<th>Essential</th>
<th>Performance</th>
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<tr>
<td><strong>New to Servers</strong></td>
<td>Gen8 → Gen9</td>
<td>Gen8 → Gen9</td>
</tr>
<tr>
<td><strong>New IT Growth</strong></td>
<td>Gen8 → Gen9</td>
<td>Gen8 → Gen9</td>
</tr>
<tr>
<td><strong>Traditional IT</strong></td>
<td>Gen8 → Gen9</td>
<td>Gen8 → Gen9</td>
</tr>
<tr>
<td><strong>Scale-Up</strong></td>
<td>Gen8 → Gen9</td>
<td>Gen8 → Gen9</td>
</tr>
<tr>
<td><strong>Form Factor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL580</td>
<td>DL580</td>
<td>4U/4S</td>
</tr>
<tr>
<td>DL560</td>
<td>DL560</td>
<td>2U/4S</td>
</tr>
<tr>
<td>DL80</td>
<td>DL380e</td>
<td>2U/2S</td>
</tr>
<tr>
<td>DL180</td>
<td>DL380p</td>
<td>1U/2S</td>
</tr>
<tr>
<td>DL380</td>
<td>DL360</td>
<td>1U/1S</td>
</tr>
<tr>
<td>DL60</td>
<td>DL360e</td>
<td></td>
</tr>
<tr>
<td>DL160</td>
<td>DL360p</td>
<td></td>
</tr>
<tr>
<td>DL20</td>
<td>DL320e</td>
<td></td>
</tr>
<tr>
<td>DL120</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

* Indicates platforms being added to portfolio in Gen9
Advancing the compute era with HP ProLiant Gen9

Intel  Xeon v3  Haswell
Grantley Platform with Intel® Xeon® Processor E5-2600 v3 product family (Haswell)

Cadence of Innovation delivers a new Microarchitecture on 22nm Process Technology based on Haswell Xeon v3
## Intel® Virtualization Technology Roadmap

Table indicates the platforms where the feature is first supported

<table>
<thead>
<tr>
<th>Platform</th>
<th>Tylersburg</th>
<th>Romley</th>
<th>Grantley</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Nehalem</td>
<td>Westmere</td>
<td>Sandy Bridge</td>
</tr>
<tr>
<td>VT-x</td>
<td>Extended Page Tables</td>
<td>VT-x Latency Reductions</td>
<td>APIC Virtualization</td>
</tr>
<tr>
<td></td>
<td>VPID</td>
<td>Real Mode</td>
<td>Cache QoS Monitoring</td>
</tr>
<tr>
<td></td>
<td>Pause Loop Exiting</td>
<td>VT-x Latency Reductions</td>
<td>A/D Bits for EPT</td>
</tr>
<tr>
<td>VT-d</td>
<td>DMA Remapping</td>
<td>Large VT-d pages</td>
<td>VT-x Latency Reduction</td>
</tr>
<tr>
<td></td>
<td>Interrupt Remapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Queued Invalidations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ATS and SR-IOV support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VT-c</td>
<td>VMDq</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SR-IOV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Current Features
- Future Platform Features
## New Virtualization Features
### Intel® Xeon® Processor E5 2600 v3 Product Families

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
<th>How Does it Work?</th>
</tr>
</thead>
</table>
| **VM Control Structure (VMCS) Shadowing** | • Enables efficient nested virtualization usages with reduced overhead by eliminating majority of nesting-induced VM exits/entries.  
• Useful for usages & workloads that require ultra-high isolation, e.g. in finance | • With VMCS Shadowing, the shadowing structure is setup by the Root VMM. When the guest VMM performs VMRead/Vmwrite, CPU will allow guest VMM to write to the Shadowing structure without doing VMExit |
| **Cache QoS Monitoring** | • Optimized scheduling by VMM  
• Load balancing  
• Resource monitoring | • Provide Last Level Cache Occupancy Monitoring.  
• Allows the VMM to identify the cache occupancy at an individual application/VM level  
• Exposes information for optimal scheduling and/or migration across platforms |
| **A/D bits for Extended Page Tables (EPT)** | • VM based fault tolerance  
• Efficient live migration | • Implements EPT Accessed and Dirty bits in hardware to eliminate VM exits  
• Enables VMM to track reads/writes on memory pages in hardware |
## Intel Haswell-EP processor: Generational direction

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU cores</td>
<td>8</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>CPU wattage</td>
<td>135W</td>
<td>135W</td>
<td>145W</td>
</tr>
<tr>
<td>QPI speed</td>
<td>8GT/s</td>
<td>8GT/s</td>
<td>9.6GT/s</td>
</tr>
<tr>
<td>DIMM type</td>
<td>DDR3</td>
<td>DDR3</td>
<td>DDR4</td>
</tr>
<tr>
<td>DIMM frequency</td>
<td>1600 MHz</td>
<td>1866 MHz</td>
<td>2133 MHz</td>
</tr>
<tr>
<td>PCIe</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>USB</td>
<td>2.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Storage</td>
<td>6Gb</td>
<td>12Gb¹</td>
<td>12Gb</td>
</tr>
<tr>
<td>Networking</td>
<td>10GbE</td>
<td>20GbE</td>
<td>40GbE</td>
</tr>
</tbody>
</table>

¹12Gb DAS SAS option available on external DL storage shelves
## Intel® Xeon® Processor E5-2600 v3 Product Family Relative SKU Performance

<table>
<thead>
<tr>
<th></th>
<th>Ivy Bridge v2</th>
<th>SPECint%, SPECfp%</th>
<th>Haswell v3</th>
<th>SPECint%, SPECfp%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advanced</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>828</td>
<td>10C 3.0GHz 130W</td>
<td>Up to 25%, 24%</td>
<td>12C 2.6 GHz 135W</td>
<td>771</td>
</tr>
<tr>
<td>807</td>
<td>10C 2.8GHz 115W</td>
<td>Up to 23%, 23%</td>
<td>12C 2.5 GHz 120W</td>
<td>747</td>
</tr>
<tr>
<td>786</td>
<td>10C 2.5GHz 115W</td>
<td>Up to 24%, 26%</td>
<td>12C 2.3 GHz 120W</td>
<td>0.85</td>
</tr>
<tr>
<td>698</td>
<td>10C 2.2GHz 95W</td>
<td>Up to 24%, 23%</td>
<td>10C 2.6 GHz 105W</td>
<td>686</td>
</tr>
<tr>
<td>643</td>
<td>8C 2.0GHz 95W</td>
<td>Up to 26%, 26%</td>
<td>10C 2.3 GHz 105W</td>
<td>668</td>
</tr>
<tr>
<td><strong>Standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>511</td>
<td>8C 2.0GHz 95W</td>
<td>Up to 35%, 27%</td>
<td>8C 2.6 GHz 90W</td>
<td>567</td>
</tr>
<tr>
<td>471</td>
<td>6C 2.6GHz 80W</td>
<td>Up to 39%, 29%</td>
<td>8C 2.4 GHz 85W</td>
<td>534</td>
</tr>
<tr>
<td>396</td>
<td>6C 2.1GHz 80W</td>
<td>Up to 23%, 18%</td>
<td>6C 2.4 GHz 85W</td>
<td>437</td>
</tr>
<tr>
<td><strong>Basic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>246</td>
<td>4C 2.5GHz 80W</td>
<td>Up to 24%, 33%</td>
<td>4C 1.9 GHz 50W</td>
<td>317</td>
</tr>
<tr>
<td>176</td>
<td>4C 1.8GHz 80W</td>
<td>Up to 51%, 49%</td>
<td>6C 85W 1.6 GHz 266</td>
<td>290</td>
</tr>
</tbody>
</table>

Source as of June 2014: Platform with two E5 v3; Prefetchers, HT & Turbo Enabled, NUMA & COO (8C ES) mode, 8x16GB DDR4-2133, RHEL 6.4, IC14 0-AW2, BIOS: 27 R01. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to: http://www.intel.com/performance. Other names and brands may be claimed as the property of others.
**HP DDR4 SmartMemory**

HP Qualified Memory delivers performance and capabilities to address the right workloads with the right economics

<table>
<thead>
<tr>
<th>Simplicity</th>
<th>Agility</th>
<th>Reliability</th>
</tr>
</thead>
</table>
| • HP SmartMemory based on DDR4 improves power consumption by **35%**\(^1\) vs. Gen8.  
• Deliver best price/GB with the best industry performance. | • Tested and tuned for HP ProLiant Servers which provide **14% to 33%**\(^2\) better performance  
(document 2 DPC at 2133MHz)  
• Enables future increased performance features | • Verifies HP SmartMemory is optimized and certified for HP ProLiant  
• Memory authentication protects against counterfeiting, reducing downtime |

\(^1\)35% power consumption improvement tests with DDR3 Gen8 to DDR4 Gen9 in a controlled environment. HP Memory engineers, Houston, Texas as of 9 July 2014

\(^2\)14% to 33% better performance is based on similar capacity DIMM running on HP server compared to a non-HP server with DDR4
# Haswell 2SPC: 16 DIMM Socket Design

## 16 DIMM Slot Design

<table>
<thead>
<tr>
<th>2SPC: DIMMs Per Channel (DPC)</th>
<th>RDIMM</th>
<th>LRDIMM &amp; 3DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DDR4-2133</td>
<td>DDR4-2133</td>
</tr>
<tr>
<td>2</td>
<td>DDR4-1866 (2133)</td>
<td>DDR4-2133</td>
</tr>
</tbody>
</table>

---
Haswell 3SPC: 24 DIMM Socket Design

24 DIMM Slot Design

<table>
<thead>
<tr>
<th>3SPC: DIMMs Per Channel (DPC)</th>
<th>RDIMM</th>
<th>LRDIMM &amp; 3DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DDR4-2133</td>
<td>DDR4-2133</td>
</tr>
<tr>
<td>2</td>
<td>DDR4-1866 (2133)</td>
<td>DDR4-2133</td>
</tr>
<tr>
<td>3</td>
<td>DDR4-1600</td>
<td>DDR4-1600</td>
</tr>
</tbody>
</table>
**HP Smart Storage – Adaptive ROC (aroc)**

**Flexible embedded smart array controller**

- Allows for **customer choice** of their embedded controller to right size for their specific workload
- Component upgrade and serviceability
- Does not take up a PCI slot

<table>
<thead>
<tr>
<th>Embedded Chipset</th>
<th>SAS Adaptive RoC Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B140i</strong></td>
<td><strong>H240ar</strong></td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Up to 8 SAS/SATA drives without license</td>
</tr>
<tr>
<td></td>
<td>Up to 26 drives with Expander</td>
</tr>
<tr>
<td></td>
<td>RAID 0, 1, 10, 5</td>
</tr>
<tr>
<td></td>
<td>No Cache required for RAID 5</td>
</tr>
<tr>
<td></td>
<td>System memory for read cache</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Up to 10 SATA Drives</td>
</tr>
<tr>
<td></td>
<td>RAID 0, 1, 10, 5</td>
</tr>
<tr>
<td></td>
<td>No Cache required for RAID 5</td>
</tr>
<tr>
<td></td>
<td>System memory for read cache</td>
</tr>
<tr>
<td><strong>Use Case</strong></td>
<td>SATA, SATA SSD, SAS, and SAS SDD,</td>
</tr>
<tr>
<td></td>
<td>OS Boot devices</td>
</tr>
<tr>
<td></td>
<td>No Controller needed (diskless boot)</td>
</tr>
<tr>
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</tbody>
</table>
HP Smart Storage Battery
Confidently protect your data with new HP Smart Storage Battery

Backup protection for your data
- Simple design to provide **backup power for multiple Smart Array controllers**
- **Easy upgrade** process for additional Smart Array controllers without need for cable routing
- Supports much larger cache capacities
- **Long life** (7 years) Lithium ION batteries for Gen9 and future products that will be available
- Eliminates thermal and connection issues
12Gb SAS Expander Option

Up to 24 drives across storage backplanes
HP Gen9 ProLiant Power Options

**ProLiant Performance Servers**

Focus on power density, efficiency, and flexibility

- New hot-plug Flex Slot power supplies, **25% smaller**
- Power efficiency starting at 94%, upgrade to **96% efficiency** (available early 2015)
- Smaller size allows for more configuration capabilities

**ProLiant Essential Servers**

Focus on value optimization, balancing features and price

- 100 series **cost optimized power supplies**
- Non redundant standard, RPS optional (available 1H2015)
Elevated Temperature Support

- 35°C has been the traditional maximum server inlet air temperature
- For Gen9, 40°C (ASHRAE A3) support available on most platforms with configuration limitations
- For Gen9, 45°C (ASHRAE A4) support available in select platforms with configuration limitations
- *Reduce cooling costs* by running at a higher temperature
What’s new with On System management

What’s new

- **HP iLO** with iLO Federation technology for management at scale and speed
- **HP Smart Update Manager** powered by iLO Federation for faster firmware updates
- **HP RESTful Interface Tool** simplifies server configuration using industry recognized APIs
- **UEFI** for simplified server configuration and boot experience

On System management:

- Remote management for lower opex
- Single interface for faster server updates
- Scripting capabilities for faster provisioning

Intelligence on every HP server for fast setup, monitoring, and firmware maintenance
Management at scale via iLO Federation

Before

Individual discover
- Ping sweep server by server

Rapid Discovery

iLO Built-in Discovery
- Query and Display
- Group health status
- Group configurations
- Server name registration

Group Management

Full Implementation with an iLO License
- Group Firmware Update
- Group License Activation
- Group Virtual Media
- Group Power Control
- Group Power Capping

Enablement for iLO and HP SUM
Standard architecture via HP RESTful API

**HP RESTful API** reduces complexity of connector semantics

**Before**

**With HP RESTful API**

**After**

Modern intelligent manageability interface and lightweight data model specification that is **simple, remote, secure, and extensible.**
What is Unified Extensible Firmware Interface? (UEFI)

Customer benefits of UEFI with Gen9

• UEFI standards specification has evolved with an emphasis on stability, security, and compatibility.
• Server ecosystem to support UEFI is available.
• Functionality Improvements over traditional BIOS
  − > 2.2 TB Boot Drives
  − Secure Boot
  − UEFI Shell
  − IPv6 PXE
  − PXE Multicast
  − UEFI Only Option Cards
  − Windows Unique functionality
• **Choice!** Customer can use either UEFI or traditional BIOS with Gen9 servers
Model Mapping to ProLiant Gen9 products
HP ProLiant Rack servers - 500/300 series

<table>
<thead>
<tr>
<th>Previous model</th>
<th>ProLiant Gen8</th>
<th>ProLiant Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL585G7</td>
<td>DL580 Gen8</td>
<td>DL580 Gen9</td>
</tr>
<tr>
<td>DL580 G7</td>
<td>DL560 Gen8</td>
<td>DL560 Gen9</td>
</tr>
<tr>
<td>DL380 G6/G7</td>
<td>DL385p Gen8</td>
<td>DL385 Gen9</td>
</tr>
<tr>
<td>DL385 G6/G7</td>
<td>DL360p Gen8</td>
<td>DL360 Gen9</td>
</tr>
<tr>
<td>DL380 G6/G7</td>
<td>DL380p Gen8</td>
<td>DL380 Gen9</td>
</tr>
</tbody>
</table>

Prior Gen Prod
Gen8 Products
Avail at Launch
Post SNAP 1
# HP ProLiant Rack servers – 100/10 Series

<table>
<thead>
<tr>
<th>Previous model</th>
<th>ProLiant Gen8</th>
<th>ProLiant Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL120 G7</td>
<td>DL320e Gen8 v2</td>
<td>DL20 Gen9</td>
</tr>
<tr>
<td>DL320 G6</td>
<td>DL320e Gen8</td>
<td>DL120 Gen9</td>
</tr>
<tr>
<td>DL160 G6</td>
<td>DL160 Gen8</td>
<td>DL60 Gen9</td>
</tr>
<tr>
<td>DL160 G6</td>
<td>DL360e Gen8</td>
<td>DL160 Gen9</td>
</tr>
<tr>
<td>DL180 G6</td>
<td>DL380e Gen8</td>
<td>DL180 Gen9</td>
</tr>
</tbody>
</table>

### Prior Gen Prod
- DL120 G7
- DL320 G6
- DL160 G6
- DL180 G6

### Gen8 Products
- DL320e Gen8 v2
- DL320e Gen8
- DL160 Gen8
- DL360e Gen8
- DL380e Gen8

### Avail at Launch
- DL20 Gen9
- DL120 Gen9
- DL60 Gen9
- DL160 Gen9
- DL180 Gen9

### Post SNAP 1
- DL80 Gen9
HP ProLiant Gen9 servers

Gen8 / Gen 9 – side by side look
The HP ProLiant DL380 Gen9

What’s New

- Intel® Xeon® E5-2600 V3 Processor
- DDR4 HP SmartMemory (maximum 1.5TB*)
- Flexible Networking – embedded 4 x 1G Ethernet with FlexibleLOM option
- Flexible Storage – embedded 10 x 6G SATA with Flexible Storage option
- I/O – improved GPGPU Support (1 double wide 225W GPGPU off each processor)
- New Power Supply Form Factor

<table>
<thead>
<tr>
<th>Gen8</th>
<th>Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compute</strong></td>
<td>(2) Intel® Xeon® E5-2600 V1, V2</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>(24) DDR3, up to 1866MHz (784GB max)</td>
</tr>
<tr>
<td><strong>Internal Storage Controller</strong></td>
<td>HP Smart Array P420i controller with FBWC options</td>
</tr>
<tr>
<td><strong>Drive Cage Options</strong></td>
<td>16SFF, 25SFF 8LFF, 12SFF</td>
</tr>
<tr>
<td><strong>Slots</strong></td>
<td>6 PCIe 3.0 slots</td>
</tr>
<tr>
<td><strong>Networking</strong></td>
<td>FlexibleLOM for rack servers</td>
</tr>
<tr>
<td><strong>Redundancy</strong></td>
<td>Redundant Fans Redundant Common Slot Power Supplies</td>
</tr>
</tbody>
</table>

* when 64GB LRDIMM available (8Gb technology)
The HP ProLiant DL360 Gen9

What’s New

• Intel® Xeon® E5-2600 V3 Processor
• DDR4 HP SmartMemory (maximum 1.5TB*)
• Flexible Networking – embedded 4 x 1G Ethernet with FlexibleLOM option
• Flexible Storage – embedded 10 x 6G SATA with Flexible Storage option
• Flexible I/O – PCIe Gen3 slot capability from each processor, 1 single wide 150W GPU off each processor, 3rd PCIe Slot
• New Power Supply Form Factor

<table>
<thead>
<tr>
<th>Gen8</th>
<th>Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute</td>
<td>Compute</td>
</tr>
<tr>
<td>(2) Intel® Xeon® E5-2600 V1, V2</td>
<td>(2) Intel® Xeon® E5-2600 V3</td>
</tr>
<tr>
<td>Memory</td>
<td>Memory</td>
</tr>
<tr>
<td>(24) DDR3, up to 1866MHz (784GB max)</td>
<td>(24) DDR4, up to 2133MHz (1.5TB max*)</td>
</tr>
<tr>
<td>Internal Storage Controller</td>
<td>Internal Storage Controller</td>
</tr>
<tr>
<td>HP Smart Array P420i controller with FBWC options</td>
<td>10 ports SATA (HP B140i) Internal H240 Smart HBA Internal P440 Smart Array</td>
</tr>
<tr>
<td>Drive Cage Options</td>
<td>Drive Cage Options</td>
</tr>
<tr>
<td>8SFF, 10SFF 4LFF</td>
<td>8SFF/10SFF 4LFF</td>
</tr>
<tr>
<td>Slots</td>
<td>Slots</td>
</tr>
<tr>
<td>2 PCIe 3.0 slots from CPU1</td>
<td>3 PCIe 3.0 slots (2 from CPU1, 1 from CPU2) Dual 150W GPU support (single-width cards)</td>
</tr>
<tr>
<td>No GPU support</td>
<td>Networking</td>
</tr>
<tr>
<td>FlexibleLOM for rack servers</td>
<td>FlexibleLOM for rack servers</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Redundancy</td>
</tr>
<tr>
<td>Redundant Fans</td>
<td>Redundant Fans</td>
</tr>
<tr>
<td>Redundant Common Slot Power Supplies</td>
<td>Redundant Common Slot Power Supplies</td>
</tr>
</tbody>
</table>

* when 64GB LRDIMM available (8Gb technology)
The HP ProLiant DL180 Gen9

What’s New

- Intel® Xeon® E5-2600 V3 Processor up to 105W
- DDR4 HP SmartMemory (maximum 1TB*)
- Flexible Networking – embedded 2 x 1G Ethernet with FlexibleLOM option
- Storage – embedded 10 x 6G SATA with standup controller option
- Form Factor – 24" chassis depth with 6 IO slots support
- New Power Supply Form Factor: 500W multi-output with optional 900W redundant support

<table>
<thead>
<tr>
<th>Compute</th>
<th>Gen8</th>
<th>Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Intel® Xeon® E5-2400 V1, V2 up to 95W</td>
<td>(2) Intel® Xeon® E5-2600 V3 up to 105W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Memory</th>
<th>Gen8</th>
<th>Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(12) DDR3, up to 1600MHz (384GB max)</td>
<td>(16) DDR4, up to 2133MHz (1TB max*)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Internal Storage Controller</th>
<th>Gen8</th>
<th>Gen9</th>
</tr>
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<tr>
<td>HP Dynamic Smart Array B120i Controller</td>
<td>Upgradeable to B320i</td>
<td>10 ports SATA (HP B140i) Gen9 Storage Controller in PCIe slot</td>
</tr>
</tbody>
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<tr>
<th>Drive Cage Options</th>
<th>Gen8</th>
<th>Gen9</th>
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<tbody>
<tr>
<td></td>
<td>8SFF, 16SFF, 25SFF</td>
<td>8SFF/16SFF/24SFF</td>
</tr>
<tr>
<td></td>
<td>8LFF, 12SFF</td>
<td>8LFF/12LFF</td>
</tr>
<tr>
<td></td>
<td>2SFF rear option, 2LFF rear option</td>
<td></td>
</tr>
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<tr>
<th>Slots</th>
<th>Gen8</th>
<th>Gen9</th>
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<tr>
<td></td>
<td>6 PCIe 3.0 slots</td>
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<th>Networking</th>
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<td></td>
<td>4 ports of 1Gb Ethernet</td>
<td>2 ports of 1Gb Ethernet FlexibleLOM for rack servers via PCIe slot</td>
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<th>Redundancy</th>
<th>Gen8</th>
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<td>Optional Redundant Fans</td>
</tr>
<tr>
<td>Redundant Common Slot Power Supplies</td>
<td></td>
<td>ATX power supply standard with optional 900W redundant supplies</td>
</tr>
</tbody>
</table>
The HP ProLiant DL160 Gen9

What’s New

• Intel® Xeon® E5-2600 V3 Processor up to 105W
• DDR4 HP SmartMemory (maximum 1TB*)
• Flexible Networking – embeded 2 x 1G Ethernet with FlexibleLOM option
• Storage – embeded 10 x 6G SATA with standup controller option
• Form Factor – 24” chassis depth with 3 IO slots support
• New Power Supply Form Factor: 500W multi-output with optional 900W redundant support

### Gen8 vs Gen9

<table>
<thead>
<tr>
<th></th>
<th>Gen8</th>
<th>Gen9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compute</strong></td>
<td>(2) Intel® Xeon® E5-2400 V1, V2 up to 95W</td>
<td>(2) Intel® Xeon® E5-2600 V3 up to 105W</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>(12) DDR3, up to 1600MHz (384GB max)</td>
<td>(16) DDR4, up to 2133MHz (1TB max*)</td>
</tr>
<tr>
<td><strong>Internal Storage Controller</strong></td>
<td>HP Dynamic Smart Array B120i Controller Upgradable to B320i</td>
<td>10 ports SATA (HP B140i) Gen9 Storage Controller in PCIe slot</td>
</tr>
<tr>
<td><strong>Drive Cage Options</strong></td>
<td>8SFF 4LFF</td>
<td>8SFF 4LFF</td>
</tr>
<tr>
<td><strong>Slots</strong></td>
<td>2 PCIe 3.0 slots from CPU1</td>
<td>3 PCIe 3.0 slots (2 from CPU1, 1 from CPU2)</td>
</tr>
<tr>
<td><strong>Networking</strong></td>
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* when 64GB LRDIMM available (8Gb technology)
## The HP ProLiant ML350 Gen9

### What’s New

- **Intel® Xeon® E5-2600 V3 Processor**
- **DDR4 HP SmartMemory (maximum 1.5TB*)**
- **Networking** – embedded 4 x 1G Ethernet
- **Flexible Storage** – embedded 10 x 6G SATA with Flexible Storage option
- **I/O** – improved GPGPU Support (Up to 4 double wide 300W GPGPU)
- **New Power Supply Form Factor**

### Gen8 vs. Gen9 Comparison

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Compute</strong></td>
<td>(2) Intel® Xeon® E5-2600 V1, V2</td>
<td>(2) Intel® Xeon® E5-2600 V3</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>(24) DDR3, up to 1866MHz (784GB max)</td>
<td>(24) DDR4, up to 2133MHz (1.5TB max*)</td>
</tr>
<tr>
<td><strong>Internal Storage</strong></td>
<td>HP Smart Array P420i controller with FBWC options</td>
<td>10 ports SATA (HP B140i)</td>
</tr>
<tr>
<td><strong>Controller</strong></td>
<td>HP Smart Array P420i controller with FBWC options</td>
<td>Internal H240 Smart HBA</td>
</tr>
<tr>
<td><strong>Drive Cage Options</strong></td>
<td>8SFF/16SFF/24SFF 6LFF/12LFF/18LFF</td>
<td>8SFF/16SFF/24SFF/32SFF/40SFF/48SFF 8LFF/16LFF/24LFF</td>
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<tr>
<td><strong>Slots</strong></td>
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<td>Optional Redundant Fans 4 Redundant Flex Slot Power Supplies</td>
</tr>
</tbody>
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*when 64GB LRDIMM available (8Gb technology)
The HP ProLiant BL460c Gen9

What’s New

- Intel® Xeon® E5-2600 V3 Processor
- DDR4 HP SmartMemory (maximum 1TB*)
- Flexible internal storage controller offerings
- 20Gb Virtual Connect networking for blades

<table>
<thead>
<tr>
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<td>Compute</td>
<td>(2) Intel® Xeon® E5-2600 V1, V2</td>
<td>(2) Intel® Xeon® E5-2600 V3</td>
</tr>
<tr>
<td>Memory</td>
<td>(16) DDR3, up to 1866MHz (512GB max)</td>
<td>(16) DDR4, up to 2133MHz (1TB max*)</td>
</tr>
<tr>
<td>Internal Storage Controller</td>
<td>HP Smart Array P220i/P230i</td>
<td>2 ports SATA (HP B140i) Internal H244br Smart HBA Internal P240br Smart Array</td>
</tr>
<tr>
<td>Drive Cage Options</td>
<td>2SFF</td>
<td>2SFF 2 M.2 internal drives</td>
</tr>
<tr>
<td>PCIe</td>
<td>2 Mezzanine</td>
<td>2 Mezzanine</td>
</tr>
<tr>
<td>Networking</td>
<td>FlexibleLOM for Blades</td>
<td>FlexibleLOM for Blades</td>
</tr>
</tbody>
</table>

* when 64GB LRDIMM available (8Gb technology)
BL460 Gen9

- 16 DIMM slots
  - 2133MHz DDR4;
  - 8 slots per processor socket

- Mezzanine Slots
  - X16 PCI Gen3

- Nand Flash & Micro SDHC

- Flexible LOM Adapter

- iLO Management Engine

- Smart Array P244br (indicated by blue box)
  - RAID 0/1; 1 GB FWBC

- Chipset SATA Cable
  - 1 or 2 Intel Xeon E5-2600 v3
  - Up to 14 cores, Up to 145W

- USB 3.0 & TPM

- Embedded SATA

- MegaCell Power Connector

- M.2 Slot* for 2 M.2 devices

- Two hot-plug drive bays
  - SATA/SAS/SSD
**HP ProLiant DL60 Gen9 (2S/1U)**

**Affordable compute and scalability packaged in dense design**

### Value Proposition

![Affordable compute capability](image)

Affordable compute capability

![Fits specific workload requirements of space constrained environments](image)

Fits specific workload requirements of space constrained environments

![2P 1U server optimized for basic IT needs of SMBs and scale-out needs of SPs](image)

2P 1U server optimized for basic IT needs of SMBs and scale-out needs of SPs

### Applications and Workloads

- Basic file and print, messaging and collaboration workloads for highly price sensitive customers
- Front end/ stateless apps in clustered environment

### Product Positioning

- Entry SATA starting at $1416
- Base configuration about $200 (ILP)