

# Data Center Workload Buyers Guide

Running a More Efficient Data Center for Your Most Demanding Workloads  
With HPE BladeSystem

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HPE creates new possibilities for technology to have a meaningful impact on people, businesses, governments and society. With the broadest technology portfolio spanning, software, services, and IT infrastructure, HPE delivers solutions for customers' most complex challenges in every region of the world. More information about HPE (NYSE: HPE) is available at <https://www.hpe.com/us/en/integrated-systems/bladesystem.html>.

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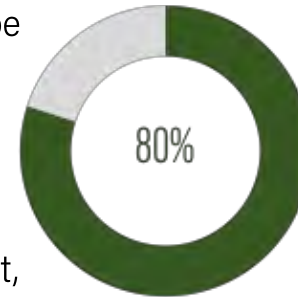
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## Introduction

Building the data center has always been about ensuring that data center resources are capable of matching the needs of the workloads supported by that environment. However, as time goes on, making sure that data center resources match workload needs is simply one part of the equation. IT decision makers also need to be on the lookout for ways to make the entire data center environment more efficient and more available.

In addition to resource support, organizations seek solutions that can help them break the "80/20 rule." The 80/20 rule is a phenomenon which seems to prevail in IT approaches and describes a scenario under which IT expends 80% of its staff time or budget dollars on activities that simply maintain operational currency, while only 20% of its resources go to those activities that can actively accelerate the business. As time goes on, and the business demands more from IT, IT leaders

and practitioners must find ways to shift the IT resource expenditure balance much further toward the side of business innovation and less toward simply treading water. This will force IT to adopt solutions that enable organizational agility and flexibility and that are exceedingly cost effective.



In order to achieve this goal while also meeting the needs for business critical workloads, IT will need to consider different methods for supporting those key workloads. In this paper, you will be introduced to four common workloads and the challenges surrounding those workloads. You will learn how the combination of HPE's BladeSystem and OneView 2.0 can help IT meet these workload challenges while also meeting the broader organizational goal of making IT more agile and flexible while reducing costs.

# 2

## Understanding Workloads

Business workloads supported by the data center are the lifeblood of most businesses today. IT is no longer separate from the business; for many companies, IT *is* the business. Even though the market continues to virtualize more and bigger workloads and applications, the fact is that different workloads — whether those workloads are physical or virtual — each have unique requirements that must be satisfied. The primary reasons to virtualize more are to reduce CAPEX, hardware acquisition costs, and optimize hardware usage and efficiency. Four common and often mission-critical workloads, as well as some of the challenges associated with each, are described in the following sections.

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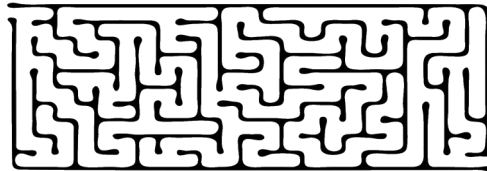
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# Server Virtualization

No longer relegated to supporting niche workloads, server virtualization has broken through many of its earliest limitations to become the *de facto* standard method by which new server workloads are deployed in the enterprise. Although much better understood than the very first server virtualization implementations, even modern server virtualization environments have a number of challenges.

## Complexity



Traditional approaches to infrastructure deployments are complex. Server virtualization environments carry with them significant levels of complexity. Consider what must happen as you deploy new server virtualization environments. You must install servers, storage, and networking equipment (both LAN and SAN communications fabric equipment) into racks and get all of that cabling and underlying switch and storage configuration done before you begin to add the virtualization layer to the mix.



At the host level, you need to keep track of which network ports go where, you must manage SAN connections to a variety of storage devices, and you must repeat the physical installation, cabling and configuration processes for each server. In legacy traditional environments, you may also have to perform proof-of-concept testing to make sure that all of the components you've selected can adequately interoperate with one another.



From there, ongoing management is often accomplished through a variety of administrative interfaces, each with a vastly different operational paradigm.

When trouble hits, a multi-vendor hardware environment reveals more interoperability and complexity issues which means that troubleshooting takes more time, and can increase costs as downtime is extended. Firmware updates (a regular need in IT) start to take more time as the number of systems increases.

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# Server Virtualization

## Resource Challenges

Server virtualization deployments have a number of challenges around individual resources such as compute, RAM, networking, and storage. When considering storage, there are often challenges in two dimensions: capacity and overall performance. Challenges reveal themselves in multiple ways.



### Poor resource utilization

For years, administrators have tended to overprovision servers, whether they're physical or virtual. This results in wasted resources. There are a lot of reasons why this happens, but part of it falls back to a lack of truly comprehensive monitoring tools to aid in server sizing and difficulty making on-the-fly changes to configurations after they've been deployed.

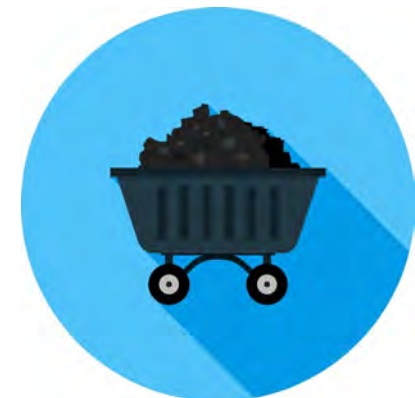


### I/O bottlenecks

The more workloads that are deployed to servers, the higher the likelihood that there will be a bottleneck somewhere in the design as well as during peak periods of operation.

## Energy Efficiency

Traditional systems are often not as energy efficient as other options that are on the market. Each individual resource consumes power, creating heat, which increases both the electricity bill as well as the cooling bill. With options that can reduce the amount of hardware that you have to deploy into the data center, you may be able to reduce these expenses.

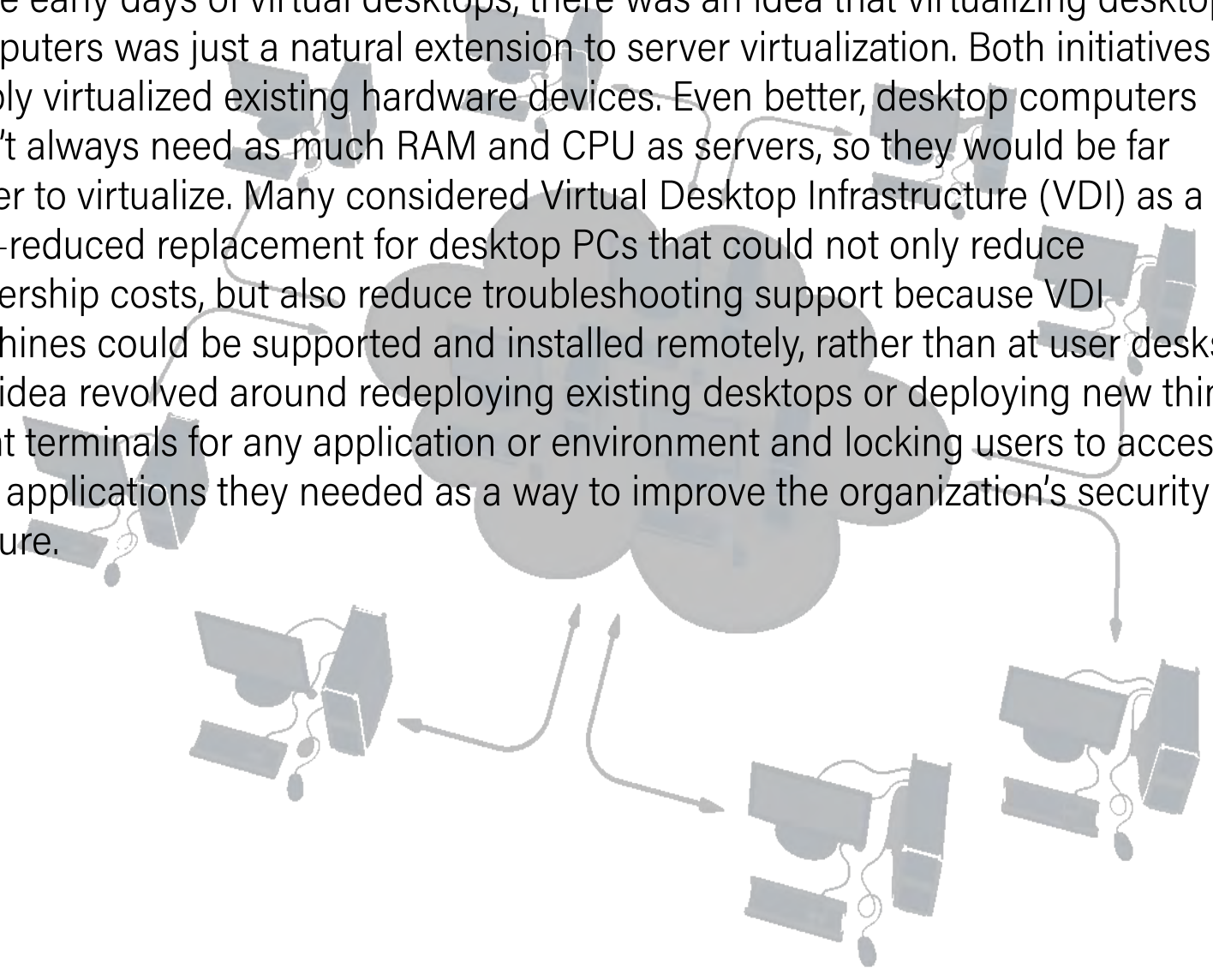


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# Virtual Desktop Infrastructure

In the early days of virtual desktops, there was an idea that virtualizing desktop computers was just a natural extension to server virtualization. Both initiatives simply virtualized existing hardware devices. Even better, desktop computers didn't always need as much RAM and CPU as servers, so they would be far easier to virtualize. Many considered Virtual Desktop Infrastructure (VDI) as a cost-reduced replacement for desktop PCs that could not only reduce ownership costs, but also reduce troubleshooting support because VDI machines could be supported and installed remotely, rather than at user desks. The idea revolved around redeploying existing desktops or deploying new thin client terminals for any application or environment and locking users to access only applications they needed as a way to improve the organization's security posture.



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# Virtual Desktop Infrastructure

## Things didn't work out the way that people expected.

They quickly discovered that VDI was a lot harder than it first appeared. Administrators learned that the overall resource I/O patterns that they learned about as a part of their server virtualization projects did not hold true for their VDI projects. Storage-imposed resource constraints proved to be the undoing for many early VDI implementations. Even worse, just making it all work could be a chore. They ended up being hard to install and hard to manage. Administrators realized very quickly that server virtualization and desktop virtualization were very different services.

As desktops were centralized to servers, the sheer storage I/O that barraged arrays resulted in situations in which users were subjected to extremely poor levels of performance.

These periods of heavy I/O were eventually termed "storms" and most often impacted the speed by which a user's individual desktop virtual machine could boot and log in to the network. Whereas server virtualization performance problems might be somewhat hidden from user view, there is no hiding when a user has to wait 10 minutes for his computer to be ready in the morning. The poor user experience resulted in reduced user productivity.

Another challenge with virtual desktop computers revolves around graphics performance required to support not

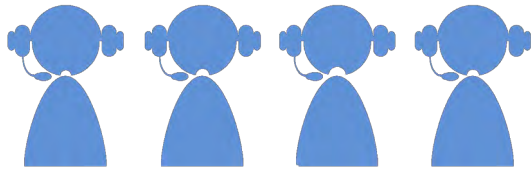
only demanding 3D applications but also the general increase in media streaming, web-based programs, internet surfing and 2D/image manipulation software suites for photo and video. With a regular desktop, you can simply and easily add a powerful graphics adapter to handle graphics processing needs as they arise. With many virtual desktop systems, however, graphics can be a real challenge. Poor graphics performance can mean that users simply can't get their work done, delaying the speed of business operations.



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Every desktop user in an organization has different needs, and these needs break down into four general categories



### Task Worker

Task workers often use just a single program and may work in call center scenarios. While their computing needs may be minimal, they still require reasonable levels of performance.



### Power User

Power users are knowledge workers that have deep experience in their domain and have good understanding for how to use technology to accomplish their goals. Some of these programs include specialized graphics suites for photo and video processing and production, media streaming and more graphics intensive software environments. These workers will often have significant CPU and RAM demands and will expect high levels of performance.



### Knowledge Worker

Knowledge workers generally run multiple programs, such as Microsoft Office, ERP, and more. These applications may be used simultaneously, and users must have consistent level of performance and may have somewhat demanding resource requirements.



### Designer

Designers have the most demanding compute, RAM, and graphics needs and rely on workstations that can keep up with pushing the boundaries.

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# Database Consolidation

Business intelligence and analytics activities are growing in criticality for organizational decision-making needs. However, over the years, many businesses have created database systems that are or have become islands unto themselves, adding significant expense and complexity to what needs to be a fast, nimble service. To combat this, many organizations are undertaking projects to consolidate these disparate databases into fewer or a single database workload silo.

There are a number of challenges associated with database sprawl, and this leads companies to seek solutions to consolidate these systems:

- **Increased database server licensing costs.** Each time a new database system is deployed, there can be significant licensing and support costs incurred by the organization.
- **Staff burden.** Every new database server has the potential to add burden to already harried IT staff members.
- **Planning.** Database systems vary wildly in their resource utilization needs, making planning sometimes difficult.

*“There are a number of challenges associated with database sprawl, and this leads companies to seek solutions to consolidate these systems.”*

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# Unified Communications and Collaboration (UCC) Systems

Modern businesses absolutely rely on their UCC systems in order to get work done. With teams spread across the country and across the globe, today's businesses rely heavily on such tools as Skype for Business (formerly Lync), Exchange, and SharePoint to exchange text, audio/video assets, and documents between employees, contractors, partners, and customers. UCC systems have become essential elements in workflows, and without them productivity and the business both suffer.

At the same time, however, these systems have become very difficult to manage. Each service is often deployed as part of a multi-server deployment and, for those organizations deploying these tools to legacy environments, there may be multiple management tools in place to keep the underlying infrastructure running well. This results in decreased reliability and increased costs.

With UCC systems, user demand directly correlates to how much infrastructure is needed to support the environment. For IT departments that are already under stress, deploying additional traditional physical servers to meet new UCC demand can be a challenging task. This can make scaling the environment difficult and expensive.

In short, while communications and collaboration continue to become more easily accessible to end users, the IT infrastructure behind these systems has become increasingly challenging to support.

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## HPE BladeSystem

Data center complexity is becoming a critical risk in the data center. Besides directly increasing costs, data center complexity results in an IT organization that cannot be as flexible and agile. This, in turn, results in an IT staff that has to stay more focused on technical operations rather than focusing on the business. This is true even with flat or decreasing IT budgets, and with increasing demands from the business.

HPE BladeSystem is a modular infrastructure platform that converges servers, storage, and networking fabrics. Convergence of these resources provides the ability to bring simplicity to complex data center architectures, improve workload performance, and significantly reduce costs.

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# Enclosure

Efficiency and flexibility are key drivers for IT moving forward. Each time a new system is deployed, there are physical installation tasks that must be performed, followed by a series of steps to configure the new hardware for use. With the HPE BladeSystem enclosure, the physical deployment requirements around new implementations are streamlined. Rather than physically cabling separate systems, you simply slide blade servers into the HPE BladeSystem enclosure, accommodating both half- and full-height blades with many processor (and core count) and memory options.

The enclosure is responsible for providing the data center environment with a place to house server blades, networking interconnection fabrics, power, and more. When connecting to the network, the current enclosure generation provides support for 56Gb FDR InfiniBand, 40Gb Ethernet, and 16 Gb Fibre Channel. In addition, the enclosure's energy efficient thermal logic service optimizes power utilization without impacting performance, accommodating both half- and full-height blades with many processor (and core count) and memory options.

From a business impact perspective, the enclosure itself helps to reduce costs via reduced power consumption, streamlined infrastructure deployment, and investment protection through backward compatibility with previous generation components. The modular environment can be outfitted to support new technologies as they are introduced as well.

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# Enclosure

Two HPE BladeSystem enclosures are available. The c7000 supports up to 16 server blades. The c3000 supports up to 8 server blades and is targeted at small and remote office/branch office (ROBO) environments.



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# Gen 9 Blade Servers

The HPE BladeSystem enclosure provides a home for a wide variety of server and workstation blades, each intended to address specific workload needs. Although the enclosure will support Gen7, Gen8, and Gen9 servers, the document focuses on Gen9 server and workstation blades.

HPE's ProLiant Gen9 server and workstation blades can help organizations significantly drive down costs, improve service delivery, and increase business performance. Gen9 servers achieve these goals by:



Tripling compute capacity by **3X** per watt, achieving up to **62%** total cost of ownership (TCO) savings over three years.



Improving service delivery speed by up to **66x** by enabling simple automation<sup>1</sup>.



Enabling up to **4X** read and write workload acceleration with HPE SmartCache, which accelerates workload performance.

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Source: <http://h20195.www2.hp.com/V2/getpdf.aspx/4AA5->



# Gen 9 Blade Servers

HPE ProLiant Gen9 server blades are intended to help organizations solve even the most serious workload challenges. The HPE BladeSystem blades include the latest HPE ProLiant BL460c, WS460c and BL660c.



Designed for a wide range of configuration and deployment options, the **HPE ProLiant BL460c** Gen9 Server Blade provides the flexibility to enhance your core IT applications with right-sized storage for the right workload—resulting in lower total cost of ownership (TCO). This performance workhorse adapts to any demanding workload need, including virtualization, IT and Web infrastructure, collaborative systems, cloud, and high-performance computing. The HPE ProLiant BL460c Gen9 Server Blade delivers performance with the Intel® Xeon® E5-2600 v3 processors (up to two sockets per blade) and the enhanced HPE DDR4 SmartMemory at speeds up to 2,133 MHz (up to 1TB), as well as more flexibility with new storage, networking and other options. The BL460c Gen9 blade is a half-height server available in a variety of processor, memory, and option configurations to enable a number of applications and workloads.



When you need to increase performance with limited data center space and aggressive return on investment (ROI) targets, server blades offer scalable compute resources with processing power for today's demanding workloads—and power to spare for tomorrow's applications.

The **HPE ProLiant BL660c** Gen9 Server Blade features the latest innovations to deliver the right performance, scalability, economics, and manageability—through HPE OneView—for the converged data center, at the lowest cost and fastest time-to-value. That makes it an ideal match for workloads that require a fine-tuned balance between space, price, and performance—such as virtualization, databases, business processing, analytics, high-performance computing (HPC), and other data-intensive applications. With the BL660c, you can transform your data center to respond with agility to the business challenges of today and tomorrow as the HPE ProLiant BL660c Gen9 Server Blades give you performance with the Intel® Xeon® E5-4600 v3 series processors in a 4-Socket computing in a single-wide, full-height form factor. It supports up to four Intel Xeon E5-4600 v3 processors with up to 18 cores each and 32 DDR4 DIMM sockets for up to 2.0 TB of HPE SmartMemory and a maximum memory speed of up to 2,133 MHz.

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# Gen 9 Blade Servers

Blade servers can be outfitted with storage controllers that feature **HPE SmartCache**. This process dynamically accelerates application workloads. SmartCache consists of firmware that provides the caching feature within the Smart Array controllers

Gen9 server blades are well-suited for solving the challenges presented by common workloads:

- They make eminently **capable** and **flexible** server virtualization hosts by enabling server **resource sizing** from relatively little resource density to very high per-blade density.
- With high density resource blades, organizations can easily **consolidate database workloads** to far fewer servers, potentially erasing massive database licensing costs as hosts are eliminated.
- UCC environments are able to be **scaled very easily** and **without cabling and management hassle**. As user demand increases, IT can scale these environments by simply adding additional blades to an enclosure.

For all of these workloads, BladeSystem enables IT to scale compute, storage, and networking through a common management platform that makes it possible to deploy and scale services with ease.

## Definition

HPE SmartCache is a controller-based caching solution that caches the most frequently accessed data onto lower latency high performing solid state disks (SSDs)

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# Gen 9 Blade Servers

## Workstation Blade

VDI is emerging as a critical workload in many organizations. As mentioned previously, when not architected appropriately, VDI can suffer from storage I/O performance challenges as well as graphics acceleration challenges. Both situations result in end user dissatisfaction and can impact their individual workload delivery, impacting the bottom line. As a result of these challenges, many organizations abandoned their early VDI plans.

Today, however, HPE's ProLiant Graphics Server Blades can help these organizations deploy VDI environments without risk and without complexity. The **HPE ProLiant WS460c** Gen9 server blade is optimized for high end workloads and virtualized desktops and can support professional 3D graphics needs and high density VDI environments.

With regard to workloads, these workstations can easily support the needs of task and knowledge workers.



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# Gen 9 Blade Servers

WS460c workstations can support up to **512GB of DDR4 RAM per blade, dual Intel Xeon E5-2600 v3 series processors**, and can use a combination of local storage backed by various storage/RAID controllers and shared storage systems.

The robust nature of the WS460c makes it a perfect fit for addressing the needs of power users, thanks to a unique architecture, flexible-to-operate industry-standard PCIe adapters or individual MXM-style daughtercards.



To enable **high-end graphics**, the WS460c supports NVIDIA M5000, N6000, K5200, and K6000 professional graphics adapters. Additionally, the workstation blade supports NVIDIA GRID M6, M60, K1, and K2 options via an expansion module that optionally accompanies the WS460c blade. The NVIDIA Tesla M6 vGPU supports vGPU profiles for up to **16 users per GPU**, thus enabling up to **512 graphics accelerated users per enclosure**. NVIDIA vGPU technology (branded as NVIDIA GRID) is the first to virtualize a graphics GPU to multiple users. With these options, HPE BladeSystem can easily support the workload requirements for the most demanding designers as well as power users.

Regardless of which kind of users you need to support, the WS460c supports multiple users per blade. The exact number of users supported is dependent on the types of demand that they will place on the device, but the user density often enables better initial acquisition price and the reduced amount of hardware in the organization can save significantly on operational expenses.

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# Gen 9 Blade Servers

## Mezzanine Slots

The addition of multiple mezzanine and FlexLOM slots enables each blade with a variety of configuration options for flexibility and future-proofing for additional functionality.

Beyond RAM and compute, each blade offers a variety of configuration options through the inclusion of multiple mezzanine slots. With blade servers, it's important to understand the role of the mezzanine slots. Unlike traditional tower and rack mounted servers, blade servers don't generally have full PCIe slots for expansion cards. The mezzanine slots on blade servers fill the gap and can be populated with the interconnection options necessary to enable communication with other systems. Mezzanine cards enable connections to 1Gb/10Gb/20Gb Ethernet switches, SAS-based storage devices, 2Gb/4Gb/8Gb/16Gb Fibre Channel switches, and InfiniBand systems.

What can be confusing to first-time blade system buyers is learning how these server-mounted mezzanine cards actually connect to other systems. Electrically, the mezzanine slots on each server blade are actually connected to just the backplane of the HPE BladeSystem enclosure. In order to actually connect, for example, a 10Gb Ethernet port from one of the mezzanine cards, you must also install a 10GbE fabric I/O interconnect or switch inside HPE BladeSystem.



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# Storage

Optimizing storage for today's applications and workload demands has become one of the primary challenges in the data center, particularly for highly virtualized environments dealing with massive content explosion. If not done right, storage can become one of the costliest and most complex resource in the data center and still not deliver everything that the organization needs to succeed. If done right, shared storage can transform your infrastructure and your business—for example by accelerating critical business decisions, improving workplace productivity, and protecting your digital enterprise.

Every workload discussed earlier relies on storage in order to operate, but each carries with it different storage needs.

## Server Virtualization

Requires robust and reliable storage, often with a good balance between capacity and performance, with this balance being determined by the kinds of virtualized applications in use in the organization.

## Virtual Desktops

Demands very consistent levels of performance with the ability to spike IOPS during certain times of the day. However, capacity demands aren't necessarily as critical in VDI thanks to the ability of data reduction technologies — both within the storage device and within the VDI software — to deduplicate and compress the desktop environment.

## Database Consolidation

Production databases can require storage systems designed to deliver consistent performance level with the ability to handle spikes in read and write capability when necessary.

## Unified Communications and Collaboration

Such systems often need storage that provides reasonable levels of performance, but a great deal of capacity.

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# Storage

## Adding Storage Within the BladeSystem Enclosure

Simplicity is a key driver for many organizations and HPE BladeSystem brings that to the forefront of the data center. Perhaps one of the simplest ways to deploy storage in HPE BladeSystem is to deploy it in the form of storage blades that slide right into available slots in the enclosure. This is especially useful in mid-sized businesses and ROBO environments in which there may be HPE BladeSystems deployed to many sites. The entire infrastructure at those sites can live within the walls of the enclosure, making administration of the system simple.

Specifically, you can add the **HPE D2220sb G2** storage blade to a BladeSystem to add **24 TB** of enterprise grade storage to your enclosure. The latest generation of this blade features a **50% performance increase** and **two times the bandwidth** over previous generations, making it suitable for supporting even more demanding workloads than was possible in the past.



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HPE StoreVirtual VSA, used in conjunction with server blades, creates shared storage volumes that are presented out to the environment as iSCSI targets



to the hosts. With this approach, you can add storage resources in quantities and configurations that make sense for your business. Storage access stays within the enclosure, creating a storage environment that doesn't require any cabling to operate.

In virtualized environments where scalability and cost optimization are paramount, HPE StoreVirtual VSA software running on an enclosure of blade servers provides advanced data services through a **cost-optimized** approach of pairing **software-defined storage (SDS)** and **industry-standard hardware**. This approach provides internal storage for server virtualization, VDI deployments, unified communication and collaboration services, and database consolidation projects to give you the benefits and **resiliency** of shared storage within the enclosure **without purchasing additional hardware**.

HPE StoreVirtual is a scale-out, software-defined storage platform that provides data mobility across tiers and locations and between physical and virtual storage. It enables linear scaling of capacity and performance as it creates a virtual array within your application server and scales as storage needs evolve and its built-in high availability and disaster recovery features ensure business continuity for the entire virtual environment.

Optimized for virtualized VMware, Microsoft Hyper-V, and Linux KVM environments, HPE StoreVirtual VSA transforms your server's internal or direct-attached storage into a scalable, shared storage array which achieving cost-optimization, allows you to utilize existing hardware, and provides application-integrated management via plug-ins. The convergence of HPE StoreVirtual VSA software and BladeSystem servers provides a great value to any type or size of business by focusing on cost optimization and maximum flexibility within the data center. The agility and flexibility of virtualized data services provide the functionality needed to allow applications to directly automate provisioning as workloads change over time.

Common management and federated data services give you simplicity and flexibility in your virtual data centers. Use StoreVirtual VSA with solid-state drives (SSDs) to provide a high-performance storage solution or all-flash tier or use a mixture of SSD and hard drives along with the StoreVirtual Adaptive Optimization feature to create an auto-tiered solution for your environment.

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# Storage

## HPE 3PAR StoreServ — Enterprise Flash Storage

There will come a time when an organization simply outgrows in-enclosure storage options and needs to **physically separate storage** from the compute layer—for example, to enable application acceleration, support multiple tenants, and support mission-critical applications. HPE 3PAR StoreServ Storage is a flash-optimized storage array that spans from entry-level to service provider-class systems and is particularly well suited as storage for the cloud and for delivering IT-as-a-Service. Its unmatched versatility and Tier-1 resiliency make HPE 3PAR well suited for even the largest and most mission-critical UCC, database, and VDI deployments.

With HPE 3PAR, organizations can affordably accelerate all workloads, bring down latency to microseconds, scale to multi-petabyte capacity levels, securely consolidate data from multiple tenants, and keep applications online even during failure conditions. By providing data services such as thin provisioning and deduplication, 3PAR helps companies reduce costs and complexity in the data center, enabling IT staff to focus more on the business and less on managing separate technology resource silos.

3PAR Thin Deduplication is an ASIC-based accelerated deduplication service provided in arrays that enables organizations significant capacity benefits even when using an all-flash array (AFA) configuration. 3PAR arrays feature high-capacity solid state disks (SSDs) to lower the cost of application acceleration. In short, storage becomes far simpler to manage and maintain while costs are reduced.



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# Storage

## HPE 3PAR StoreServ — Enterprise Flash Storage

When HPE 3PAR StoreServ is combined with HPE Virtual Connect, you can eliminate dedicated Fibre Channel switches entirely. Instead of switches, servers communicate with HP 3PAR StoreServ systems through direct-attach Fibre Channel. With this approach, you can build a storage solution with just a pair of Virtual Connect FlexFabric modules and the HPE 3PAR StoreServ storage system.

A direct-attach configuration offers two key benefits:

- You gain the performance of full-speed Fibre Channel without having to procure and configure Fibre Channel switches, which reduces the overall cost and complexity in the storage environment
- You reduce the number of Fibre Channel ports that you need to license, further reducing overall storage infrastructure costs

Available in all-flash configurations and featuring Thin Deduplication, 3PAR has the capability to provide great levels of capacity and performance while driving down latency. Even better, 3PAR storage arrays can be connected to BladeSystem-based servers without having to worry about separate storage communications infrastructure.



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# Virtual Connect

Traditional networking approaches with separate cables for all kinds of different networking needs result in a mass of cables in a rack, which leads to troubleshooting difficulty, and increases the amount of time that it takes to provision new systems. More hardware equates to more expense, more complexity and higher costs to manage and operate it. Further, as you build traditional redundant networking environments, you need to bear in mind that networking components may fail. To mitigate against potential failure, most companies build fully redundant networking environments, effectively doubling the amount of hardware and cabling present in the infrastructure. More hardware equates to more expense and more complexity. There are expenses associated with buying the hardware, but also with managing and operating it.

For SAN installations and storage services, even with HPE BladeSystem, you need to have the ability to connect server blades to storage devices and to the outside world. In a traditional server and storage environment, networking might require running dozens of cables between switches (both Fibre Channel and Ethernet switches) and servers. Further, you need to run everything twice in order to be able to survive an outage.

HPE Virtual Connect for HPE BladeSystem aims to massively simplify storage networking in particular, but can also help to simplify traditional networking. These advantages of using Virtual Connect are:

- **Wire-once server connectivity.** By simplifying and converging your server edge connections, HPE Virtual Connect makes server changes transparent to storage and networks, and delivers four times the number of connections per physical network link. Virtual Connect enables you to dynamically optimize and control bandwidth using fewer physical ports for the same performance, while also reducing server edge infrastructure — switches, host bus adapters (HBAs), network interface cards (NICs), and cables — up to 95%, lowering hardware costs up to 65%, and consuming up to 40% less power. HPE Virtual Connect FlexFabric Ethernet and Fibre Channel Modules connects servers and virtual machines to data and storage networks over Ethernet, Fibre Channel, and iSCSI protocols.
- **Simplified infrastructure.** Virtual Connect has the potential to eliminate up to 95% of network sprawl by converging and collapsing various fabrics. This is discussed in the next session.
- **Optimal performance.** The Virtual Connect FlexFabric 20/40Gb F8 Module and the Virtual Connect 16Gb Fibre Channel module deliver optimal performance for network and SANs.

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In addition to Virtual Connect, HPE BladeSystem also provides other I/O options to enable customers with their own infrastructures. Customers who have an extensive I/O fabric infrastructure such as Ethernet or InfiniBand, often require a flexible fabric solution and HPE BladeSystem enables them with dedicated Ethernet, Fibre Channel and InfiniBand switch interconnect modules, as well as pass-through Ethernet modules enabling direct access to server blades. The HPN 6127XLG and 6125XLG Ethernet Switching modules enable 10Gb and 40Gb support, while Brocade enables Fibre Channel switch solutions up to 16Gb and Mellanox enables InfiniBand solutions up to 40Gb. The HPE Options portfolio also includes Ethernet and InfiniBand network adapters and Fibre Channel Host Bus Adapters to complement these modules.



Furthermore, HPE BladeSystem also delivers a Fabric-Extender (FEX) interconnect to simplify interfacing to customers with Cisco infrastructures.

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# Virtual Connect

## LAN and SAN Communications



The original use of the word convergence in IT pertained to networking way back in the late 1990s and early 2000s. Today, we are seeing communications convergence taken to its logical conclusion in Virtual Connect. Now, using a single pair of cables, you can effectively collapse your physical LAN and SAN infrastructure and then use HPE FlexFabric technology to virtually provision the hardware into logical networks that you need to operate your data center environment. Virtual Connect's FlexFabric networking modules slide into the back of your BladeSystem enclosure and enable you to run a variety of different services using common ports, including:

- 1 & 10Gb Ethernet
- 20/40Gb Ethernet
- 8 & 16Gb Fibre Channel
- Single/dual-hop FCoE and Converged FC gateway
- iSCSI
- Direct-attach FlatSAN technology
- Infiniband
- SAS

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Different workloads require different hardware components at times. HPE BladeSystem networking options exist to support virtualized and traditional workloads, cloud and scale-out environments, and database consolidation and big data requirements. HPE Virtual Connect delivers bandwidth to support demanding workloads from 1Gb to 40Gb Ethernet, enabling enterprises to benefit from the highest performance technology today. Additionally, HPE's native 20Gb technology doubles the bandwidth between servers and I/O fabrics while reducing components and management.

Another key innovation within Virtual Connect is Direct attach FlatSAN technology, enabling customers to directly interface HPE BladeSystem servers to a SAN fabric, such as HPE 3PAR 7x00/8x00 storage arrays, without dedicated SAN switches. This solution is ideal for small-size server-to-SAN implementations with simplified management needs, while reducing costs for additional fabric. HPE OneView supports FlatSAN and enables configuration of Virtual Connect to the 3PAR arrays quickly and easily.

For organizations that want or need dedicated Fibre Channel networking capabilities, the HPE Virtual Connect Fibre Channel modules provide 24 ports or a 4 Gb, 8 Gb, or 16Gb Fibre Channel, enabling the implementation of native Fibre Channel SAN environments.



## FlatSAN

- VC FlexFabric Modules
- **86% fewer components**
- **50% lower cost**

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In cases in which you want to use more traditional Ethernet networking approaches, HPE also makes available Gen9 networking blades that slot into the back of the HPE BladeSystem enclosure.

As is the case with all of the other HPE BladeSystem components, Virtual Connect and networking blades offer investment protection through backward compatibility. Further, as you add more server blades to the enclosure, there is no need to individually and separately wire those servers. The new servers are automatically connected to the backplane networking modules and the blade servers ship with a converged network adapter installed right on the motherboard, so there is truly zero touch beyond sliding the server into an enclosure slot. The best part: there is no impact to your LAN or SAN when you make changes to the server.

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# Virtual Connect

## LAN and SAN Communications

One breakthrough HPE innovation with Virtual Connect is FlexFabric technology. FlexFabric technology is built into HPE server NIC adapters, fabric modules and servers providing delivery of converged network protocols (such as iSCSI and FCoE) and enable the ability to maximize utilization of high-speed 10Gb or 20Gb links. This reduces the need for multiple individual network adapters to deliver the speed and/or necessary offload functions from different adapter types. These FlexFabric NICs can be populated into your server blades as Flexible LOM and Mezzanine cards. When connected to Virtual Connect modules, the architecture enables seamless operation and redundancy. HPE FlexFabric can help you reduce costs and improve workload performance by making it easier to more specifically configure networking resources to match workload needs, and are also manageable by HPE OneView.

As discussed previously, there are a number of different modules that can be installed in a HPE BladeSystem enclosure. These include a variety of Ethernet modules, Fibre Channel and InfiniBand switching modules as well as fabric extenders to support SAS connectivity for storage. With all of these options available, customers are able to meet all of their connectivity needs and can ensure seamless integration to existing network infrastructure.

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## 4

# Converged Management with HPE OneView 2.0

Management is often an overlooked data center component. Many organizations have become accustomed to being forced to use a variety of administrative interfaces to accomplish their data center management tasks. However, besides being incredibly inefficient, maintaining a data center using a variety of unrelated tools carries with it other challenges as well:

- **Need to enhance staff skills.** In a recent survey conducted by ActualTech Media on behalf of HPE, 45% of respondents indicate that one of their biggest IT challenges is maintaining staff skillsets. The more variety that there is in the management environment, the more difficult it becomes to maintain skills.
- **No true integration.** When you're using tools from multiple vendors to manage your data center environment, there is no true integration between those tools, making it more difficult to make sure that handoffs from one area to another are taking place without issue. This also complicates overall troubleshooting and makes it extremely difficult, if not impossible, to automate routine tasks.
- **Expense.** The need to maintain a variety of staff skills and spend additional time on troubleshooting efforts leads to an increase in overall operational expenses. This is particularly challenging in times when businesses seek to reduce their IT spend.

Up until this point, you have learned about all of the various hardware elements that comprise the HPE BladeSystem solution. However, the hardware is just a part of the workload support story. The management solution behind the hardware provides a big part of the value, and this is especially true for HPE OneView.

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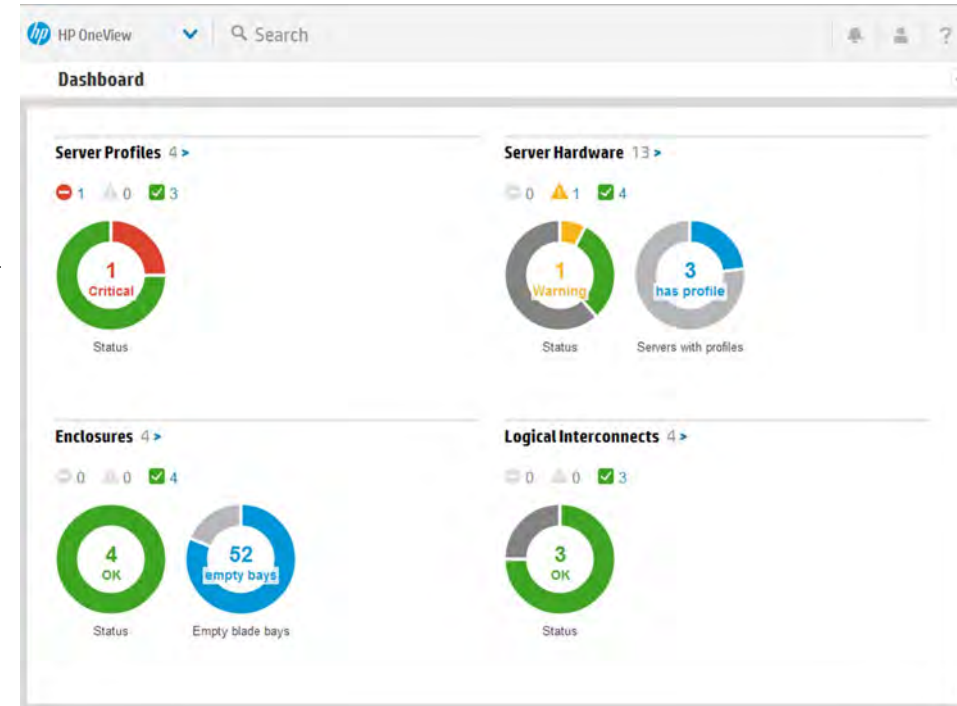
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# Converged Management with HPE OneView 2.0

HPE OneView is a software defined management solution that automates time consuming tasks of lifecycle management with open standards based, easy-to-use, repeatable templates that capture the best-practice configuration of your virtualized infrastructure across compute, storage and fabric, so you can make error-free changes once, then replicate them across your infrastructure fast and easily.

Using such templates, you can define firmware baselines, BIOS configurations, infrastructure network and storage once and then provision the configuration many times – consistently and reliably with no manual repetitive tasks.

You can then manage your infrastructure as pools of resources optimized to the workloads you are running. Streamline and automate your administrative and operational tasks to significantly increase productivity. Roll out new technologies and applications faster, and lower the costs associated with downtime and regulatory risks.



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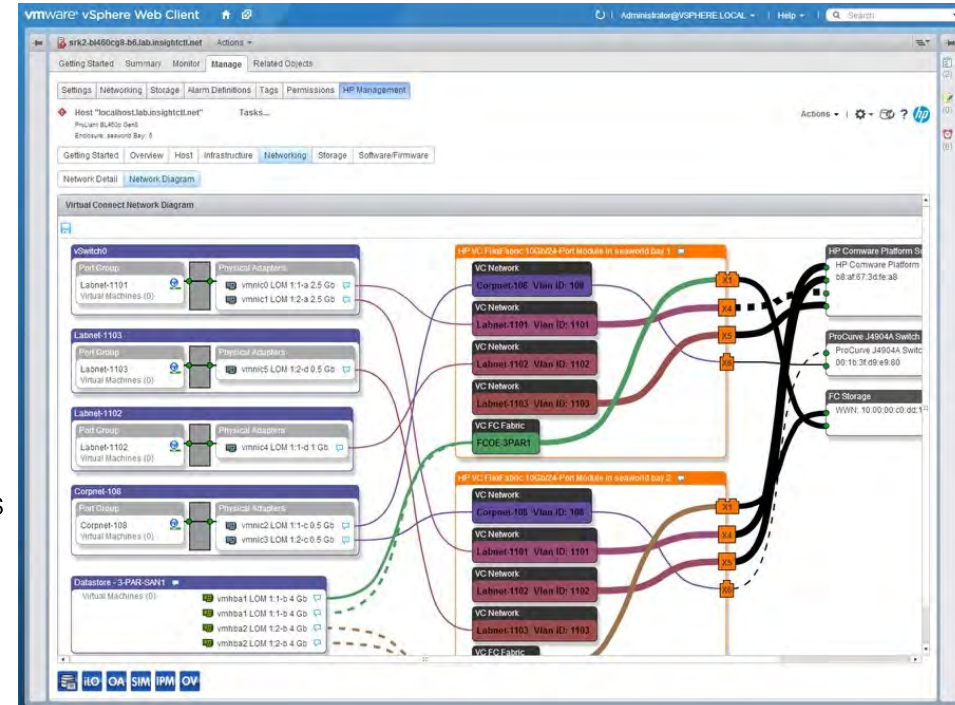
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# Converged Management with HPE OneView 2.0

Using the open standards based RESTful API enables easy integration of 3rd party tools like VMware® vCenter, Microsoft® System Center, Chef, Docker, Puppet, Ansible, OpenStack, HPE CloudSystem and HPE Business Service Management solutions.

HPE OneView brings together hardware resources and enables them to be managed and consumed as software-based elements of the data center. In short, HPE OneView becomes your single point of administration for your entire HPE BladeSystem environment and results in the individual parts providing value beyond the sum of those parts.

HPE OneView provides organizations with investment protection by supporting the management and administration of earlier generation of servers and other components and whilst not every single feature is applicable to earlier generations of servers, HPE continues to add platform support and functionality as our strategic converged management platform.

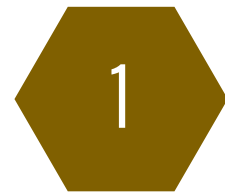


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# Converged Management with HPE OneView 2.0

HPE has designed HPE OneView with the following goals in mind:



Provide fast time-to-value and intuitively easy to use

Inherently software-defined and automated



Unify previously isolated silos of compute, storage, and networking

Scale must be achieved without additional layers of management complexity



Enable a broad API ecosystem with open APIs and SDK

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# Converged Management with HPE OneView 2.0

## Workload Templates Enable Automation

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HPE OneView enables the use of workload-specific templates to streamline deployment and administrative activities. Besides accelerating activities, the use of templates has the potential to eliminate human error, which is one of the largest causes of data center downtime. With software-defined templates, organizations gain access to push-button provisioning and precision to eliminate errors and manual steps. Administrators can correctly and consistently deploy server, storage, and connectivity configurations the first time, every time.

For example, with HPE OneView, you can create templates for:

- Role-based access control
- OS build plan
- Storage volumes
- Network connections

All of the workloads described early in this paper will eventually require some kind of expansion or maintenance. As you need to scale your environment, HPE OneView enables you to leverage templates to do so. Rather than having to manually build and configure your new systems and risk introducing human error into the equation you can use a template to handle the initial deployment tasks, ensuring consistency and accuracy as you grow the business environment. Moreover, you will save a lot of time by avoiding mundane tasks, which ultimately saves the business money.



# Converged Management with HPE OneView 2.0

## Automation

Automation is the key to gaining efficiency and reducing data center costs as it effectively eliminates infrastructure complexity. HPE OneView provides users with a simplified and consistent infrastructure management experience and includes unified API hub that allows other management tools to connect to and to be managed as one.

The fully API-driven HPE OneView enables interoperability and integration enabling IT to manage their infrastructure in a programmatic way, building a consistent infrastructure management experience managed as one.

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