



Scale Your Data Center—Right into the Cloud

Microsoft® Windows Server® 2012, the Intel® Xeon® processor E5 family and Dell™ PowerEdge™ 12th generation servers

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Scale Your Data Center—Right into the Cloud

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Ignoring the cloud is no longer an option. The potential benefits in agility and efficiency are simply too great. But turning your data center into a private cloud can be complex and potentially costly. As workloads, data volumes costs and application requirements grow, you have other high-priority challenges to address. Intel, Microsoft and Dell offer a game-changing solution to this challenge.

Microsoft Windows Server 2012 and Dell 12th generation PowerEdge servers based on the Intel Xeon processor E5-4600/2600/2400/1600 product families provide a scalable, dynamic and multi-tenant-aware infrastructure that allows you to unify your IT environment across multiple sites and connect securely with public cloud services. Add Microsoft System Center® 2012¹ and you can implement a complete private cloud that gives you highly automated control over workloads and service levels, with a deep insight into your applications and infrastructure.

There is no need for disruptive change. The combined platform also offers increased capability and value for existing solutions, along with a unified framework for managing and securing all your IT assets—physical, virtual and cloud. With this uniquely integrated and cost-effective solution, you can implement targeted improvements in performance, power efficiency, manageability and security throughout your existing environment, while gradually implementing cloud functionality to transform the way you deliver and manage IT services.

Start Building Your Cloud Today

With Windows Server 2012 and the Intel Xeon processor E5 family, every Dell PowerEdge 12th generation server you add to your data center provides an optimized foundation for your private cloud. Microsoft has introduced extensive new functionality based on its experience in managing some of the world's most advanced cloud environments, including Microsoft Windows Live,* Hotmail* and Bing.* Intel has integrated next-generation technologies to enable improved performance, energy efficiency, and resource utilization, dynamic workload and data movement, and improved security in dense, multi-tenant cloud environments.

The three companies have worked together to help ensure optimized performance and functionality across the entire server, network and storage infrastructure, including both physical systems and virtual resources.



- **Improve utilization at every layer with secure multi-tenancy.** Isolate workloads across servers, networks and storage systems so sensitive applications can be safely hosted on a shared infrastructure. You can configure guaranteed service level agreements (SLAs), implement chargeback based on usage and provide self-service IT for business units.
- **Optimize performance and business continuity with dynamic resource control.** Migrate virtual machines and storage within and between facilities quickly and without downtime for workload balancing and high availability. Virtual network assignments and IP addresses are automatically maintained to enable simple, secure migrations. You can also automate virtual machine replication and failover using Hyper-V replica.
- **Drive down costs and simplify management with advanced automation.** Windows PowerShell* 3.0 includes more than 2,300 new cmdlets and is integrated into all server roles. You can control almost every aspect of the operating system to automate tasks, reduce administrative overhead and reduce the likelihood of human error. Dell PowerEdge 12th generation servers extend these advantages. With Lifecycle Controller 2.0 and Integrated Dell Remote Access Controller 7 (iDRAC 7), you can gain unprecedented flexibility and capability for updating and managing systems remotely, and you don't need an agent on the system.
- **Protect your business with enhanced security and compliance.** Microsoft Dynamic Access Control* lets you centrally deploy and manage file authorization policies to protect sensitive information on shared infrastructure, both within and beyond your data center. Intel Advanced Encryption Standard New Instructions (Intel AES-NI) can enhance this protection. By accelerating AES-based encryption and reducing overhead, it lets you implement encryption pervasively for strong security and improved compliance.

Help Solve Your Toughest Data Center Challenges

The agility and efficiencies of cloud computing won't solve all your IT challenges. Workloads and data sets continue to grow rapidly and you have new applications to deploy and integrate. Microsoft Windows Server 2012 and Dell PowerEdge 12th generation servers based on the Intel Xeon processor E5 family offer extensive new capabilities for addressing fast-growing IT requirements. You can solve your toughest challenges, while simultaneously laying an optimized foundation for your private cloud.



Scale Performance and Reliability at Every Point

Enjoy major performance gains as you replace aging servers. Two-socket servers based on the Intel Xeon processor E5-2600 family boosts performance by up to 80% versus the previous-generation Intel Xeon processor 5600 series² and improve energy efficiency by up to 50% to reduce power and cooling costs.³ You can achieve high performance gains—up to 83 percent⁴—with new density-optimized four-socket servers based on the Intel Xeon processor E5-4600 product family.

You can also support mission-critical applications in your private cloud. Servers based on the Intel Xeon processor E7 family scale to support demanding enterprise workloads. Windows Server 2012 offers comparable scalability with support for up to 64 logical processors and 4 terabytes of memory per physical server. In combination with SQL Server^{*} 2012, the combined platform has demonstrated outstanding performance for online transaction processing workloads based on the TPC-E benchmark.⁵

The Intel Xeon processor E7 family offers advanced error management through Machine Check Architecture recovery, which is fully supported by Windows Server 2012 and SQL Server 2012. Errors are automatically detected, corrected and contained to enable high levels of system uptime and data integrity.

You can also increase resiliency for mainstream applications. Four-socket Dell 12th generation PowerEdge R820 servers based on the Intel Xeon processor E5 family can support a new feature called “Consumed Memory Error,” which consumes and isolates memory errors to specific virtual machines so other virtual machines can remain online.

Help Virtualize More and Heavier Workloads

Extend the benefits of virtualization throughout your data center. With Microsoft Windows Server 2012 Hyper-V, virtual machines can be configured with up to 64 virtual processors and 1 terabyte of memory^{*}, so you have the scalability you need to support demanding workloads. Intel Virtualization Technology⁶ (Intel VT) provides extensive hardware assists for core virtualization processes and Hyper-V is tuned to take full advantage of these enhancements.

Dell PowerEdge 12th generation servers add to these advantages by offering more memory and more storage capability per server or blade than previous 11th generation servers. You can run more machines (real or virtual) in less space than before on a virtualization platform that delivers near-native performance with enhanced scalability, reliability and security.



Consolidating demanding workloads onto shared infrastructure can place extreme demands on server I/O. The Intel Xeon processor E5 family is designed to keep data flowing rapidly as I/O requirements continue to increase. These processors provide PCIe 3.0 which can provide approximately twice the I/O bandwidth⁷ of previous-generation processors and, with Intel Integration I/O, help reduce I/O latency by up to 30%.⁸ Windows Server 2012 and Intel Ethernet Converged Network Adapters extend these advantages to the network connection to provide you with:

- **Fast, Low-Overhead Communications.** You can configure direct connections between virtual machines and network adapters to deliver near-native I/O performance in virtualized environments. Packet-sorting is offloaded to silicon in the network adapter to provide fast performance and to free the hypervisor for other tasks.
- **Simpler Connectivity and Improved Utilization.** You can share physical network connections among multiple virtual machines to help maximize utilization and reduce costs. Bandwidth can be flexibly allocated, and new quality of service (QoS) features allow you to provide bandwidth assurances for critical workloads.

Virtualize and Consolidate Your Network

The agility and efficiencies of cloud computing depend on your network as well as your server infrastructure. Windows Server 2012 and Intel Ethernet 10 Gigabit Converged Network Adapters offer the performance and functionality you need to support a highly dynamic cloud environment.

- **A Unified Network across Your Data Center.** You can consolidate all your server and storage traffic onto a single, high-performance 10 Gigabit Ethernet network to simplify your data center and substantially reduce hardware costs. Support for Fibre Channel over Ethernet (FCoE) and iSCSI functionality are integrated into the operating system.
- **Simple, Fast Virtual Machine Migrations.** You can move multiple virtual machines on-demand and without manual intervention. Virtual network assignments and IP addresses are preserved during migrations, not only within your data center, but into the cloud.
- **Secure Network Virtualization.** Hyper-V and Intel Ethernet Server Adapters support the PCI-SIG Single-Root I/O Virtualization (SR-IOV) specification to enable flexible network virtualization with strong isolation of communications between virtual machines and network adapters for secure multi-tenancy⁹. With Windows Server 2012, Dell 11th or 12th generation PowerEdge servers¹⁰, and the Intel® Ethernet Converged Network Adapter



X520, you can take advantage of SR-IOV designed to achieve significant increases in virtual machine network throughput, while reducing performance overhead, so you can virtualize demanding workloads, such as SQL Server. You can also take advantage of the Hyper-V Extensible Switch with third-party plug-ins to integrate additional functionality, such as traffic monitoring, firewall filters and switch forwarding.

Drive New Storage Efficiencies

Windows Server 2012 offers extensive enhancements at every layer of the storage stack to help you scale performance more cost-effectively than ever before, while simultaneously improving reliability, availability and flexibility.

Features such as virtual fibre channel and offloaded data transfers can improve flexibility and performance for existing storage area networks (SANs). You can also ramp up your storage capability without the high cost and complexity of a SAN. Windows Server 2012 includes Server Messaging Block (SMB) 3.0, which allows IT organizations to layer feature-rich, SAN-like storage functionality on top of inexpensive disk arrays. Affordable file servers become virtualized resource pools that can be provisioned on-demand to address high-end storage requirements.

- **SAN-like Performance at Low Cost.** Aggregate bandwidth across multiple Intel Ethernet adapters to dynamically scale storage performance. You can take advantage of SMB Direct in Windows Server 2012 and Remote Direct Memory Access (RDMA) in NetEffect™ Ethernet Server Cluster Adapters to enable extremely fast data transfers and live migrations. With these capabilities, you can shape storage performance to support Hyper-V, SQL Server, and other demanding applications, even as your data volumes continue to grow.
- **Continuous Data Access.** Implement transparent storage failover and network fault tolerance to help ensure high availability for critical data. You can also provision virtual storage spaces as mirrored or striped sets and physical drives as hot spares, so hardware failures can be resolved automatically and transparently.
- **Improved Utilization.** Take advantage of advanced storage features such as data deduplication, thin provisioning and trim to dramatically increase storage capacity without adding disks.¹¹



- **Simple, Automated Management.** Manage physical and virtual storage, including third-party external storage systems, from a single interface and use Windows PowerShell for advanced automation.

Take Control of Your Data Center—and Your Cloud

The goal of cloud computing is to simplify and accelerate IT service delivery, while providing an elastically scalable, highly resilient and cost-effective foundation for growth. By integrating complete cloud functionality into one of the world's most widely deployed and trusted computing platforms, Intel, Microsoft and Dell offer a uniquely smooth and cost-effective pathway to the cloud.

There's no need to deploy proprietary cloud technologies that add multiple layers of cost and complexity to your existing infrastructure. You can start where you are, scale your existing solutions, and take advantage of fully-integrated cloud functionality to gradually transform your data center into an optimized private cloud that lets you connect seamlessly with public cloud resources.

Get More Information

- Intel Xeon processor families: www.intel.com/xeon
- Microsoft Windows Server 2012: www.microsoft.com/windowsserver2012
- Dell PowerEdge 12th generation servers: www.dell.com/PowerEdge
- [Whitepaper](#): Game-Changing Capability for Your Datacenter and a Solid Foundation for Your Cloud: Microsoft Windows Server 2012 and the Intel® Xeon® processor E5 family
- For additional resources and technical guidance, visit [Intel Cloud Builders](#).

* For details about Microsoft Windows Server 2012 specs, please visit <http://download.microsoft.com/download/E/8/E/E8ECBD78-F07A-4A6F-9401-AA1760ED6985/Competitive-Advantages-of-Windows-Server-Hyper-V-over-VMware-vSphere.pdf>

¹ Since Microsoft System Center 2012 was released prior to Microsoft Windows Server 2012, it will require a service pack update to support Windows Server 2012.

² Performance comparison using best published 2-socket server results on the SPECfp*_rate_base2006 benchmark as of 6 March 2012. Baseline score of 271 published by Itautec on the Servidor Itautec MX203* and Servidor Itautec MX223* platforms based on the prior generation Intel Xeon processor X5690. New score of 492 submitted for publication by Dell on the PowerEdge T620 platform and Fujitsu on the PRIMERGY RX300 S7* platform based on the Intel Xeon processor E5-2690. For additional details, please visit www.spec.org.

³ Performance comparison using best submitted/published 2-socket single-node server results on the SPECpower_ssj*2008 benchmark as of 6 March 2012. Baseline score of 3,329 ssj*_ops/watt published by Hewlett-Packard on the ProLiant DL360 G7* platform based on the prior generation Intel Xeon processor X5675. Score of 5,093 ssj*_ops/watt submitted for publication by Fujitsu on the PRIMERGY RX300 S7* platform based on the Intel Xeon processor E5-2660. For additional details, please visit www.spec.org.



⁴ Up to 83 percent performance gain claim based on best submitted/published 2- and 4-socket server General Purpose Throughput (based on the SPECint*_rate_base2006 benchmark) results comparing the Intel Xeon processor E5-2600 product family to the Intel Xeon processor E5-4600 product family, both at a 130W TDP processor specification as of 14 May 2012. Baseline 2-socket server: 2-socket Fujitsu PRIMERGY* server using two Intel Xeon processors E5-2680 (8C, 20M Cache, 2.7GHz, 8.0GT/s Intel QPI), 128GB memory, Intel C++ Compiler XE2011 (12.1). Baseline Score: 639. Source: [SPEC® CFP2006 Result](#).

New 4-socket server: 4-socket populated Dell PowerEdge* R820 server with four Intel Xeon processors E5-4650 (8C, 20M Cache, 2.7GHz, 8.0GT/s Intel QPI), 256GB memory, Intel C++ Compiler XE2011 (12.1). Baseline Score: 1170. Source: submitted to SPEC.org.

⁵ TPC-E* world record performance claim based on top ranked result of NEC Express*5800/A1080a-E published using eight Intel Xeon processors E7-8870 (8P/80C/160T) scoring 4,614 tpsE @ \$450.18USD available 4/2/2012 compared to all other results as of May 18, 2012. TPC, TPC-E and tpsE are trademarks of the Transaction Processing Performance Council. For more information, please visit <http://www.tpc.org/tpce/default.asp>.

⁶ Intel Virtualization Technology (Intel VT) requires a computer system with an enabled Intel processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance, or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

⁷ The Intel Xeon processor E5 family supports the Peripheral Component Interconnect Express (PCIe) specification. With 8 GT/s and 128b/130b encoding, this specification enables twice the interconnect bandwidth of the PCIe* 2.0 specification. Source: [PCI-SIG Releases PCI Express 3.0 Specification](#).

⁸ Intel internal measurements of average time for an I/O device read to local system memory under idle conditions comparing Intel Xeon processor E5-2600 product family (230 ns) vs. Intel Xeon processor 5500 series (340 ns). Baseline Configuration: Green City system with two Intel Xeon processors E5520 (2.26GHz, 4C), 12GB memory @ 1333, C-States Disabled, Turbo Disabled, SMT Disabled. New Configuration: Meridian system with two Intel® Xeon processors E5-2665 (2.4GHz, 8C), 32GB memory @1600 MHz, C-States Enabled, Turbo Enabled. The measurements were taken with a LeCroy* PCIe* protocol analyzer using Intel internal Rubicon (PCIe* 2.0) and Florin (PCIe* 3.0) test cards running under Windows* 2008 R2 w/SP1.

⁹ For details about SR-IOV implementation in Windows Server 2012 environments, see the [Microsoft blog](#).

¹⁰ For a list of Dell PowerEdge servers that support SR-IOV in Windows Server 2012 environments, visit the [Dell TechCenter](#).

¹¹ Microsoft cites optimization ratios of up to 2:1 using data deduplication for general file servers and up to 20:1 for virtual libraries. Source: [Optimized Storage Efficiency with Windows Server 2012 Release Candidate](#).

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