

Windows Server 2016 and Intel:

# Better together



## Table of contents

Business transformation

Windows Server 2016  
+ Intel Architecture

Workload performance  
and benchmarks

Next steps



# Business transformation



The cloud is now a proven delivery model, as enterprises and service providers realize the agility and efficiency that a true cloud delivers. With continuous maturation of key technologies, the trend is for organizations to extend their cloud deployments from private to hybrid and public cloud models that offer even more ways to expand the scope of value-added business services. These models also address top priorities like big data and bring-your-own-device (BYOD) initiatives, while delivering enterprise applications as services on any platform on any device. The question has evolved from *Why do we need a cloud strategy?* to the more business-transformational question *How do we do it to get the most value?* Intel and Microsoft want to help simplify the delivery of your cloud services so that your business can realize the full benefits of cloud computing now, while also laying the groundwork to move to a more elastic hybrid model.

## Transform your datacenter

Today, with more and more business requirements, organizations are looking for resilient, flexible, and automated infrastructure resources. IT departments are building roadmaps to transform their traditional datacenters into more reliable and scalable solutions through the use of software-defined datacenter technologies as part of an overall cloud strategy.

Windows Server 2016 Datacenter Edition empowers advanced datacenter functionalities with software-defined compute, storage, and network capabilities that are elastic and cost effective. The technologies in Windows Server 2016, such as Storage Spaces Direct and Shielded Virtual Machines, provide new ways to maximize your resources and lower the risk of malicious threats to your business. Windows Server 2016 is optimized for Intel's best-in-class storage, compute, and networking technologies to deliver great performance, optimization, efficiency, and scalability to transform your datacenter.



## Energize your infrastructure for security, performance, and reliability

To align with business needs, IT infrastructure must evolve and support new initiatives and ongoing growth. To get the most out of Windows Server 2016 and the critical workloads running on it, it's necessary to upgrade your underlying hardware infrastructure. The new Intel® Xeon® processor E5-2600 v4 product family is designed for next-generation datacenters running on software-defined infrastructure with capabilities like Intel® Advanced Vector Extensions 2.0 (Intel® AVX 2.0) and Intel® Turbo Boost Technology 2.0, which are supercharged for efficiency, performance, and agility across cloud-native, virtualized, and traditional applications.

Intel® Solid State Drive (Intel® SSD) Data Center Family provides high performance and low latency, with extended write endurance, end-to-end data protection features, and the security of the 256-bit Advanced Encryption Standard (AES).

Intel® Server Boards and Chassis help customers accelerate their Windows Server 2016 deployments with preconfigured, tested, and certified systems that have been optimally designed for each workload with the required amount of CPU, memory, network, I/O controllers, and storage capacity.

# Windows Server 2016 + Intel Architecture

To optimize the features and performance of Windows Server 2016, Microsoft and Intel collaborated across four areas: **compute**, **storage**, **network**, and **security**.

## Compute



## Storage



## Network



## Security



## Compute

Windows Server 2016 includes new features for advanced virtual machine management. These capabilities improve the performance and efficiency of compute and virtualization across the datacenter with a footprint 25 times smaller, nested virtualization, Windows containers to isolate applications on a virtual machine, and hot add and remove functionality for RAM.



## Storage

Software-defined storage (SDS) in Windows Server 2016 simplifies the provisioning and management of storage resources with a scalable, flexible, and easy-to-configure solution for a wide range of Microsoft Hyper-V and private cloud workloads. Storage Spaces Direct (S2D) pools together the local storage on industry-standard Intel Xeon processor-based servers into highly scalable and available server clusters in hyper-converged or disaggregated/converged configurations, using the RDMA-capable Ethernet network as the storage fabric. Intel Xeon processors power the advanced data services of Storage Spaces Direct.

For caching in the server clusters, PCIe SSDs using the low-latency NVMe interface are recommended for higher performance. Microsoft and Intel collaborated on [three configurations](#) for Storage Spaces Direct to improve throughput and reduce latency for faster response times. To maintain performance and reliability, Microsoft recommends high-endurance SSDs for this cache tier, such as the Intel® SSD DC P3700, due to its consistent performance and reliability over a five-year period. The Intel SSD DC P3700 also provides consistently low latency for supporting larger numbers of users and virtual machines in Hyper-V environments.

## Compute optimization by Intel



Up to 1.5x more business transactions per second during peak periods when running **Intel® Xeon® Processor E5-2699 v4** with Windows Server 2016, compared to a 3-year-old server<sup>1</sup>



**Intel Advanced Vector Extensions 2** significantly improves compute performance by doubling the number of floating-point operations (FLOP) per second per clock cycle



**Intel Data Direct I/O technology** makes the processor cache the primary destination and source of I/O data rather than main memory, helping to deliver increased bandwidth, lower latency, and reduced power consumption

## Storage optimization by Intel



**NVM Express with Storage Space Direct** optimizes performance with better input/output operations (IOPS), enhanced Storage QoS, and read-write performance



High-bandwidth **Intel SSDs with NVMe**, together with Intel processors, provide faster IOPS per second to deliver more performance and significantly cut latency





## Network

Windows Server 2016 provides software-defined network (SDN) capabilities to centrally manage virtual and physical network resources, isolated network infrastructure for multiple tenants, SLB and NAT for an enhanced network throughout, and NIC teaming for reliable performance.

### Network optimization by Intel



Ease of Ethernet support through **Intel Ethernet Converged Network Adapter X710/XL710** 10 GbE and 40 GbE solutions



**Intel VT-d** speeds up data movement and reduces performance overhead by lowering the need for the virtual machine manager to monitor I/O traffic



## Security

Windows Server 2016 adds many new enhancements around security and auditing. Just Enough Administration security technology enables delegated administration for anything that can be managed with Windows PowerShell. **The new Microsoft Shielded Virtual Machines technology protects virtual machines from compromised or malicious administrators in the fabric by encrypting disks and the state of virtual machines so that only the VM or tenant administrators can access them.** This hardware-plus-software combination allows more secure boot for guarding hosts, as well as enforced hypervisor and management OS kernel code integrity.

### Security optimization by Intel



Enhanced hardware-assisted security capabilities, including Intel Secure Key to provide high-quality security keys, as well as random bits (RDSEED) for software-based key generation solutions



Intel AES-NI and new crypto acceleration help boost bulk data encryption and secure session initiation protocols, enabling encryption to be used more pervasively without slowing applications



Support-host hardware and firmware to deploy Shielded Virtual Machines with TPM 2.0 and UEFI 2.3.1 to allow secure boot for guarding hosts

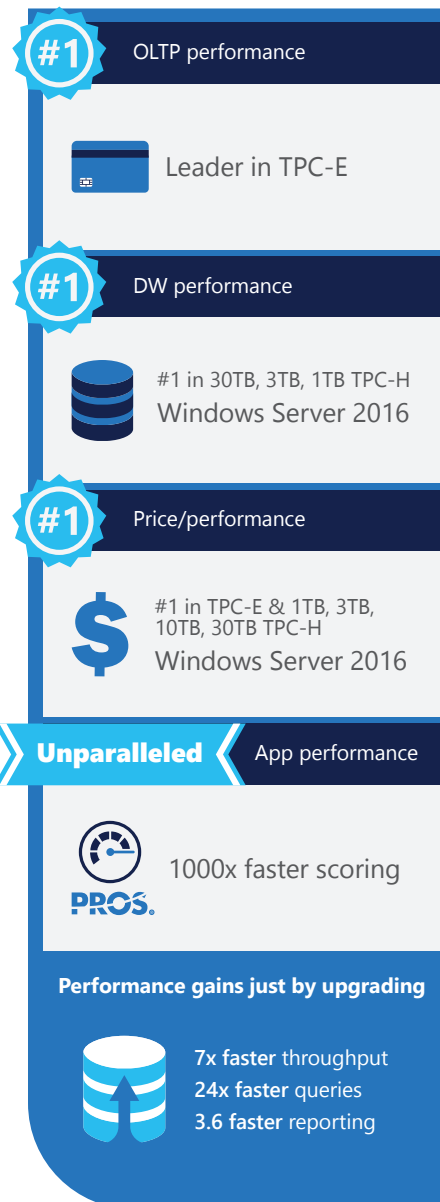
# Workload performance and benchmarks



Refreshing Windows Server 2016 with the latest Intel Xeon processors offers versatility across diverse workloads, whether deployed in traditional datacenter architecture, in the cloud, or within a hosted environment. For example, when customers pair Microsoft SQL Server 2016 and the latest Intel Xeon Processor E7-8890 v4 on-premises, they benefit from up to **2.7x more queries per hour at less than one-third the cost per query.**<sup>2</sup>

## SQL Server 2016

Running SQL Server 2016 on the latest Intel Xeon Processor E7-8890 v4 delivers unparalleled performance.<sup>3</sup>



## Consistent platform across clouds

Intel and Microsoft are enabling customers to transform their existing datacenters into private or hybrid clouds. With a single, consistent platform—on-premises, in Microsoft Azure Cloud, or within a hosted environment by any service provider running Azure Stack—Intel and Microsoft are accelerating the deployment of cloud computing.

### Public cloud



Azure Virtual Machine



Microsoft Azure



### Service providers



Windows Server

Microsoft SQL Server

Microsoft System Center



### Private cloud



Windows Server

Microsoft SQL Server

Microsoft System Center



## Next steps

Accelerate business transformation by [partnering with Intel and Microsoft](#). Benefit from solutions such as:

- ➔ Intel Xeon Processor E5 family
- ➔ Intel Xeon Processor E5-2600 v4 product family world-record benchmarks
- ➔ Windows Server 2016
- ➔ Intel Cloud Builders
- ➔ Intel Storage Builders



© 2016 Microsoft Corporation. All rights reserved. This document is provided "as-is." Information and views expressed in this document, including URLs and other Internet website references, may change without notice. You bear the risk of using it. This document does not provide you with any legal rights to any intellectual property in any Microsoft product. You may copy and use this document for your internal, reference purposes. You may modify this document for your internal, reference purposes.



Intel, the Intel logo, and Xeon are trademarks of Intel Corporation in the U.S. and other countries.

\*Other names and brands may be claimed as the property of others. Copyright 2016 Intel Corporation. All rights reserved.

## Footnotes

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.

1. Up to 1.5x more transactions per second comparing Intel® Server with two Intel® Xeon® processor E5-2697 v2, 256GB memory (Source: Intel® Technical Report #3049) to an Intel® Server with two Intel® Xeon® processor E5-2699 v4, 512GB memory (Source: Intel® Internal Testing).
2. Up to 2.7x performance improvement and up to 1/3 lower cost claim based on TPC-H workload comparing baseline HP™ ProLiant™ DL580 Gen8 server with four Intel® Xeon® processor E7-4890 v2 scoring 404,005 QphH, costing \$941,800, \$2.34/QphH (Source: <http://tpc.org/3298>) to Lenovo™ x3850 X6 server with four Intel® Xeon® processor E7-8890 v4 scoring 1,106,832.6 QphH, costing \$870,459, \$0.79/QphH (Source: <http://www.tpc.org/3325>).
3. Lenovo announced the [number one TPC-H 10TB benchmark world record](#) using SQL Server 2016 and Windows Server 2016 on Lenovo System x3850 X6 using the latest Intel Xeon E7 processor technology. In May 2016, Lenovo also published a [new number one TPC-H 30TB world record](#) using SQL Server 2016 and Windows Server 2016 on Lenovo System x3950 X6. These results, in addition to recent benchmarks by software and hardware partners, as well as key applications, show that SQL Server 2016 is the fastest in-memory database on the planet for your applications. (Source: <https://blogs.technet.microsoft.com/dataplatforminsider/2016/07/18/sql-server-2016-posts-world-record-tpc-h-10-tb-benchmark/>).

For more information, visit [intel.com/performance](http://intel.com/performance).