Licensing & Support

Windows Server 2016 Licensing Changes

Windows Server 2016 will introduce several noteworthy licensing changes, but the significance will vary widely depending on customer circumstances

By Rob Horwitz

Generally available as of Oct. 2016, Windows Server 2016 licenses servers based on cores rather than processors, uses technical features to differentiate between Datacenter and Standard editions, and introduces new Software Assurance (SA) dependencies. Over time these changes will likely increase server licensing costs, in part by shifting purchases to Datacenter edition, as well as impact hardware specifications and equipment upgrade schedules, the timing of new license purchases, and SA renewal decisions. While the significance of each change may vary by customer, most will find at least one relevant change.

Servers Licensed by Cores

Windows Server requires purchase of both client-side and server-side licenses. Client-side licenses—called Client Access Licenses (CALs)—provide the right for users or end-user devices to access servers, and server-side licenses provide the right to run the software on a physical server. With Windows Server 2016, client-side licensing (such as CAL requirements, types, and pricing) remains mostly the same, but server-side licensing changes dramatically, moving from a processor- to a core-based licensing model.

Old Rule

For Windows Server 2012 R2, a server license (Datacenter or Standard edition) is required for each pair of physical processors within the server. A server with one or two processors requires one server license, and a server with four processors requires two server licenses. The number of processor cores (independent processing units contained on a physical processor chip) is immaterial.

New Rule

With Windows Server 2016, servers require core licenses that are sold in two-packs, with each two-pack costing one eighth of the price of the current Windows Server 2012 R2 edition server license. (See the chart "Windows Server Pricing" on page 2.)

The minimum number of core licenses required for a server is the greatest of

• Eight core licenses per processor

• Sixteen cores licenses per server.

If the actual number of physical cores within a system exceeds these amounts, additional core licenses are required. (For licensing purposes, all physical cores are treated equally, regardless of processor manufacturer or technical characteristics, such as hyper-threading or clock speed.) For example, a two-processor server with six cores per processor (12 physical cores total) still requires 16 core licenses, and a four-processor server with four cores per processor (16 physical cores total) still requires a total of 32 core licenses. However, a two-processor server with 12 cores per processor surpasses the minimums, and thus the number of core licenses required equals the actual total number of physical cores in the server, in this case, 24.

The net effect of the new licensing model and pricing is to maintain or increase server licensing costs. The cost of licensing a single processor server with 16 or fewer cores does not change. The same is true for any multiprocessor server with eight or fewer cores per processor. Otherwise, costs increase. For example, a dual processor server with a total of 24 cores (12 cores on each processor) is 50% more expensive compared to Windows Server 2012 R2 (regardless of edition).

The default license grants for customers with active SA on Windows Server licenses is 16 Windows Server 2016 core licenses for each Windows Server 2012 R2 server license. However, for some customers, the default core conversion rates may be insufficient to adequately license the server hardware they already have deployed.

Microsoft gives SA customers the option to document and claim extra core licenses beyond the default grant, based on the server hardware deployed at the end of the SA coverage period active as of Oct. 2016 (when Windows Server 2016 became generally available). For example, if Windows Server SA is maintained under a three-year Enterprise Agreement (EA) started Jan. 1, 2015, the customer needs to document actual core counts prior to EA expiration in Dec. 2017. Core counts can be documented using a tool such as the Software Inventory Logging (SIL) tool.

If customers planning to claim greater than the default 1:16 license grant choose to renew SA, they must renew SA on all cores they are claiming in order to get credit going forward. For example, renewing SA for a dual processor server with 12 cores in each processor would require purchasing SA for all 24 cores (which would mean a 50% increase in annual SA costs).

Implications

The move to a core-based license model provides an incentive for many existing Windows Server SA customers to document core counts to maximize core entitlements. For SA and non-SA customers alike, the model change may impact both server hardware and software purchase decisions, especially for Datacenter-licensed systems, where each additional core can have an especially significant cost impact.

Scanning servers and documenting core counts. Customers with SA on server licenses should strongly consider scanning and documenting core counts prior to the expiration of their current SA term (which for almost all customers will expire sometime prior to Oct. 2019) and filing it in a way that is easily discoverable and accessible to internal licensing professionals in the future. Many SQL Server customers failed to capitalize on a similar opportunity a few years ago when SQL Server's license model was changed, leading to extra license expense that might have been at least partially avoidable.

If a customer is planning to renew SA, such documentation allows them to accurately assess the number of SA-only core SKUs they need and are entitled to purchase at renewal. If a customer is planning to drop SA, such a report could prove especially useful in a future license compliance review, as situations involving dropped SA tend to be subject to greater scrutiny. Absent documentation, auditors would most likely assume a 1:16 core entitlement, which might contribute to finding a license shortfall.

Though not mentioned in the Product Terms, a Windows Server 2016 Licensing Datasheet recommends sharing the inventory data with Microsoft. *Directions on Mi-*

crosoft advises customers to take this a step further by sending Microsoft the inventory report along with their calculation of the resultant core entitlement. Furthermore, each customer could also notify Microsoft that, unless they hear back by a certain date, they will proceed in good faith on the assumption that Microsoft finds the report's format and customer interpretation acceptable. This might help mitigate the risk that, years later during a future audit, the report's accuracy and interpretation is questioned.

Server hardware specifications. Before purchasing a single processor server with more than 16 cores or a multiprocessor server with processors containing more than eight cores each, customers should first exhaust other options for increasing server performance, including higher performance processors with the same core count and higher performance RAM or storage. Hardware performance benchmarking could help avoid unnecessary software licensing fees.

Hardware purchase timing. SA customers can maximize their core license grants by rolling out server hardware upgrades be-

fore the end of their current SA terms and documenting core counts. For example, a customer might be planning to upgrade a dual processor server from eight cores per processor to 14 cores per processor, a total of 28 cores. Completing the hardware upgrade before the current SA term ends entitles the customer to renew SA on 28 core licenses. If the customer has not completed the hardware upgrade when the current SA term ends, the customer may only renew SA on 16 core licenses and must later buy 12 core licenses (from scratch) when the hardware upgrade is complete.

New Windows Server license purchase timing. Many EA customers have the option to continue to purchase Windows Server 2012 R2 server licenses until their current EA contracts expire. In certain situations, it may be less expensive to purchase Windows Server 2012 R2 licenses at the end of the then-current EA enrollment to maximize core grants (under the server-to-core license conversion rules) rather than to wait until the EA contract is renewed and purchase Windows Server 2016 core licenses.

Some New Features Unique to Datacenter Edition

With Windows Server 2016, the two most important OS editions, Datacenter and Standard, have greater technical differences than they did in past versions, which could force use of Datacenter in more scenarios.

Old Rule

With Windows Server 2012 and 2012 R2, Standard and Datacenter are essentially technically identical; the only substantive difference is use rights pertaining to virtualization. A server licensed for Datacenter edition may be used by an organization to simultaneously run as many Windows Server–based virtual machines (VMs) as the server hardware can handle. This gives organizations running virtualized data centers maximum flexibility to move VMs among Datacenter edition–licensed servers for load balancing, patching, or other processes. Standard edition, in contrast, covers up to two simultaneously running VMs per server license, which constrains an organization's ability to move workloads among servers because of the fixed limit.

Windows Server Pricing

Windows Server 2016 moves to a Core + Client Access License (CAL) model for licensing, as opposed to its predecessor's Processor + CALs model. Listed are all the license types associated with Windows Server, the various suites that include them, and pricing under Windows Server 2016 and 2012 R2. All figures are Open No Level prices quoted in U.S. dollars and represent the highest price a U.S.-based customer would likely pay.

Server-side licenses for Windows Server 2016 are sold as two-core packs, with a minimum purchase of 16 cores for single or dual processor servers and 32 cores for quad-processor servers. If physical servers have the same or fewer cores than these minimums, server-side licensing fees end up being the same as under Windows Server 2012 R2; otherwise, server-side licensing costs increase.

For all Windows Server-associated licenses, the annual cost of Software Assurance (SA) is 25% of the underlying license price.

License	Version 2016 Pricing	Version 2012 R2 Pricing	Suites That Include License
Windows Server Datacenter edition	$770 per two cores	$6,156 per server (with one or two processors)	Core Infrastructure Suite (CIS) Datacenter
Windows Server Standard edition	$110 per two cores	$882 per server (with one or two processors)	CIS Standard
Windows Server CAL	$30 per device, $38 per user		Core/Enterprise CAL Suite and most Core/Enterprise CAL Suite Bridges Enterprise Mobility + Security (EMS) E3 and E5 suites Secure Productive Enterprise (SPE) E3 and E5 suites
Remote Desktop Services (RDS) CAL	$102 per device, $131 per user		(none)
Rights Management Services (RMS) CAL	$37 per device, $48 per user		Enterprise CAL Suite Some CAL Suite Bridges Azure Information Protection Premium P1 and P2 EMS E3 and E5 suites SPE E3 and E5 suites
Windows Server External Connector	$2,020 per server		(none)
RDS External Connector	$10,100 per server		(none)
RMS External Connector	$18,200 per server		(none)

New Rule

Virtualization use rights for Windows Server 2016 are similar to those for Windows Server 2012 R2. (See the "Standard Edition Somewhat Less Appealing for Virtualization" section below.) However, Standard and Datacenter differ technically. Most new Windows Server 2016 features are exclusive to Datacenter. Standard retains all of the capabilities it has in Windows Server 2012 R2, but it receives only a few Windows Server 2016 enhancements.

Windows Server 2016 features in both editions include Nano Server, a Windows Server OS installation mode designed to minimize on-disk footprint and RAM requirements, and Windows Containers, a technology that allows server-based applications to be quickly installed or upgraded without traditional installers or scripts with minimal impact on other applications. New technical features exclusive to Windows Server 2016 Datacenter edition focus on storage, administrative, and networking improvements. (See the illustration "Windows Server 2016 Edition Packaging" on this page.)

Implications

Microsoft has long promoted Windows Server Datacenter as a platform for VM workload consolidation. With the new technical features, Datacenter becomes more compelling in this regard, compared to both Windows Server Standard edition and to competitors' offerings. For example, customers already using Datacenter edition for VM consolidation can, through a feature called Storage Spaces Direct (S2D), leverage inexpensive commodity disks inside host servers for storage rather than use costly storage area network (SAN) hardware and software.

However, Microsoft's decision to require Datacenter for advanced storage features could limit the use of those features in certain scenarios, such as branch offices 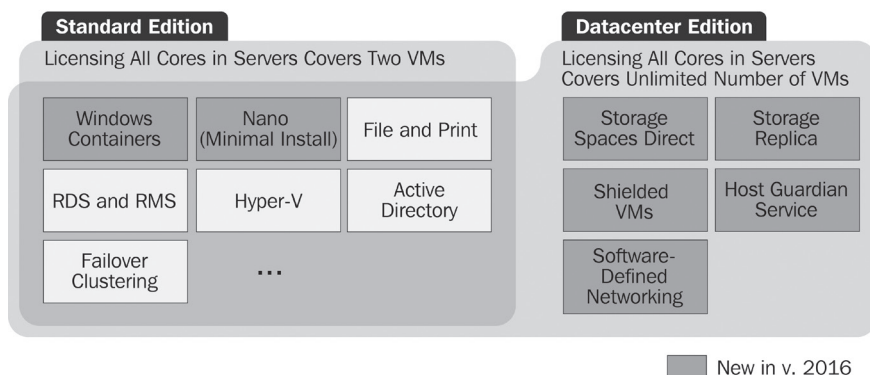or data center architectures where storage and compute roles are provided on separate hardware. In such scenarios, having to license Datacenter edition (rather than the much less expensive Windows Server 2016 Standard edition) for each storage node could make Windows Server 2016 uneconomical compared to third-party alternatives.

New Servicing Model Could Add SA Dependency

Servicing models define the frequency with which additional features and capabilities are made available for a product. They also can affect licensing requirements as well as determine what level of discretion a customer has over applying software updates, including what is required to maintain eligibility for break/fix product support and subsequent security and reliability patches. Unlike in the past, Windows Server 2016 provides two rather than one servicing model, and aspects of both models could affect customer choices for deploying and licensing the server OS.

Windows Server 2016 Edition Packaging

The Standard and Datacenter editions of Windows Server 2016 have substantial technical differences, whereas with Windows Server 2012 and 2012 R2, the editions had the same technological capabilities. While Windows Server 2016 Standard retains all the capabilities it had with Windows Server 2012 R2 and receives modest improvements, Microsoft chose to make many of Windows Server 2016's new features exclusive to Datacenter edition. The illustration compares Windows Server 2016 Standard and Datacenter capabilities, with special focus on new Datacenter-exclusive features.

Standard Edition		
Licensing All Cores in Servers Covers Two VMs		
Windows Containers	Nano (Minimal Install)	File and Print
RDS and RMS	Hyper-V	Active Directory
Failover Clustering	...	

Datacenter Edition	
Licensing All Cores in Servers Covers Unlimited Number of VMs	
Storage Spaces Direct	Storage Replica
Shielded VMs	Host Guardian Service
Software-Defined Networking	

▣ New in v. 2016

The Datacenter-exclusive features, listed below, are mainly intended to strengthen the product's role as a virtual machine (VM) hosting platform:

Storage Spaces Direct (S2D). S2D builds on the Storage Spaces feature of earlier Windows Server versions by adding the ability to use internal commodity disks, including solid state disks, rather than more expensive networked storage devices. S2D enables a Storage Space to span four to 12 servers, with up to 240 disks, and offers data mirroring and parity for resiliency. Customers can create architectures where servers using S2D are dedicated solely to storage, or where S2D servers also serve as VM hosts.

Storage Replica. Storage Replica, a new storage volume replication feature, allows for disaster recovery between servers or clusters with minimal to no data loss. While Storage Replica is not a replacement for application-specific replication technologies such as SQL Server AlwaysOn Availability Groups, it can be used for a variety of other scenarios such as replication of volumes used by file servers and Web servers.

Shielded VMs and Host Guardian Service. Shielded VMs allows for more granular control over actions administrators can perform on VMs they manage. For example, a Hyper-V administrator can start and stop a shielded VM, but cannot change the configuration, view or control it, or otherwise manipulate the contents of the VM. The Host Guardian Service feature isolates VMs from the host infrastructure in order to ensure that only authorized users or administrators can run, access, or otherwise modify or control the VMs.

Software-Defined Networking (SDN). Several features make it more practical to build networks connecting groups of VMs, whether in one data center, in multiple data centers, or externally at Azure or third-party hosting providers. These features, focused at improving flexibility, security, and performance, include Network Controller, the Software Load Balancer, and Hybrid SDN Gateways. Network Controller enables management of switches, routers, firewalls, virtual private networks (VPNs), and gateways from within Windows, whether they are software-defined or physical devices. The Software Load Balancer (SLB) offers load balancing across a collection of Hyper-V-hosted VMs without requiring deployment and management of an additional physical device. SLB is managed by, and requires, Network Controller. Hybrid SDN Gateways enable organizations to bridge virtual and physical networks, enable site-to-site VPNs, and point-to-site VPNs.

Old Rule

Historically, the way Microsoft delivered major new or enhanced features for Windows Server was to ship a new product version, with each new version supported with free security and reliability fixes for up to 10 years. Versions alternated between major releases (designated by a year, such as Windows Server 2012) and minor releases (distinguished with an "R2" for "Release Two," such as Windows Server 2012 R2). While Microsoft always issued new server-side licenses for each new version, R2 releases of Windows Server had no CALs of their own and access was licensed with CALs for the immediate preceding (non-R2) version.

New Rule

Windows Server 2016 Datacenter and Standard edition offers a choice between two models for how new features and security/reliability fixes are released and serviced: the Long-Term Servicing Branch (LTSB) and Current Branch for Business (CBB).

LTSB. From a licensing and support perspective, LTSB releases are similar in concept to "versions" as used prior to the introduction of Windows 10 and Windows Server 2016. For each LTSB release, Microsoft commits to supplying security updates, critical bug fixes, and antimalware definition updates monthly (or more frequently) for 10 years, the same support life-cycle policy that applies to earlier versions of Windows Server. Use of the LTSB is required if Windows Server 2016 is deployed in two of the three possible Windows Server 2016 installation modes: the desktop experience (as required for server-based desktops and many server applications) and the Server Core installation mode.

Organizations that want new features must deploy a subsequent LTSB release. New LTSB releases are expected every two to three years. Licenses covered with SA provide the right to deploy new LTSB releases that appear during the term that SA is active. Microsoft has not indicated an intention to distinguish between major and minor releases, in which case upgrading to a new LTSB release will probably require upgrades of CALs as well as server licenses.

CBB. Like LTSB, CBB delivers security updates, critical bug fixes, and antimalware definition updates monthly or more frequently. However, CBB also delivers feature updates two to three times a year. Microsoft will offer security updates and bug fixes only for systems running the two most recently released CBB feature updates (meaning organizations will have to deploy OS feature updates to servers on CBB roughly every eight to 12 months). Use of CBB is required if Windows Server is deployed in the Nano Server installation mode. To use CBB, customers must have active SA on Windows Server core licenses and all associated CALs.

Implications

The Windows Server 2016 servicing model changes mean customers will need to exercise greater caution for how they deploy the server OS. While customers who have both server- and client-side licenses covered by SA are not immediately affected, they need to be aware that use of Nano Server will eliminate options to drop SA in the future. To minimize the likelihood of subsequent license compliance issues, customers without SA coverage should be sure to internally communicate a policy prohibiting use of Nano Server.

Customers with CALs not covered by SA, either because they did not buy SA or because they let it lapse, might reconsider how they acquire new Windows Server client-side licenses in the future. Since Microsoft has not indicated any intention to distinguish between major and minor LTSB releases, it is likely that upgrading to a new LTSB release will require new CALs as well. This increases the value of purchasing CALs with SA. Or, organizations can purchase Windows Server CALs on subscription, in subscription license suites such as the Enterprise Mobility + Security or Secure Productive Enterprise suites. SA on CALs and subscription CALs will become even more valuable if future releases of Windows Server have additional installation modes or features that require the CBB or SA.

Standard Edition Somewhat Less Appealing for Virtualization

Regardless of software version or SA status, Windows Server Datacenter edition licenses a server to run an unlimited number of simultaneous Windows Server–based VMs. In contrast, Windows Server Standard is more limited. A minimally licensed Standard edition server provides the right to run just two simultaneous VMs. Due to the finer details of the new core-based license model, the cost of using Windows Server 2016 Standard to license servers running more than two simultaneous VMs increases dramatically in certain scenarios.

Licenses that provide the right to run Windows Server are associated with (assigned to) server hardware and cannot be reassigned frequently between physical servers. Thus, servers used to run virtualized workloads (that can move between servers for load balancing and other reasons) must be licensed to accommodate the maximum number of Windows Server–based VMs that might ever run simultaneously on the device.

Old Rule

A Windows Server 2012 R2 Standard license, which covers a one- or two-processor server, includes the right to run up to two VMs simultaneously per license. (Use of Windows Server Standard as the server's physical OS is also covered, provided the physical OS is used only to host and manage the VMs.) Windows Server 2012 R2 Standard server licenses may be stacked to accommodate more VMs. For example, if a server has two processors and the organization wants to run four VMs simultaneously on the server, the organization may assign the server two Windows Server 2012 R2 Standard licenses.

New Rule

Under the new core-based license model, a customer earns the right to simultaneously run two VMs on a server each time they acquire the minimum number of Standard edition core licenses required to cover the server. Double licensing the cores with Standard edition earns the right to run four simultaneous VMs, and triple licensing earns six. This aspect of the new core-based model will have the most immediate and dramatic effect on dual and quad processor servers.

Dual processor server. Any dual processor server with processors containing 10 or more cores becomes more expensive to license using Standard. For example, a dual processor server with 12 cores per processor requires 24 core Standard edition licenses for two VMs and 48 core licenses for four VMs. Licensing under Windows Server 2012 R2 costs the equivalent of 36 cores, meaning licensing costs in this scenario go up 50% under 2016 Standard edition.

Quad processor server. The cost of licensing a server containing four processors for more than two simultaneously running VMs using Standard edition will, at minimum, double. Under the old model, a quad processor server needs two Windows Server 2012 R2 Standard edition licenses to cover four physical processors and four simultaneous VMs. Under the new model, customers need a minimum of 32 core licenses to cover the four processors and two VMs, and then another 32 core licenses to increase the number of allowed VMs to four. Sixty-four Windows Server 2016 Standard edition core licenses costs twice as much as two Windows Server 2012 R2 Standard edition licenses.

Implications

Historically, customers who use Standard edition license stacking to license servers for modest numbers of VMs can face problems in a license compliance review, especially if they are unable to show, through hypervisor configuration, that it is impossible for more than a set number of VMs ever to run simultaneously on the device. By raising the cost of using Standard edition in certain virtualization scenarios, the Standard edition rule change provides yet another incentive to consolidate VM workloads onto Datacenter-licensed servers. Microsoft's licensing rules make Datacenter edition a more straightforward licensing approach for virtualized workloads as it relieves customers from having to monitor or limit the number of simultaneously running VMs.

Customer wanting to repurpose unused SA-covered Standard edition licenses have the option to purchase Standard-to-Datacenter Step-Up licenses, which essentially convert a Standard edition license into a Datacenter edition license at a fee equal to the difference between the higher-level edition license price and the lower-level edition license.

Open Questions Regarding Azure Stack

Azure Stack, currently in the Technical Preview phase, is on-premises software that mirrors a large portion of Azure's infrastructure and services code for private cloud hosting. Over time, Azure Stack could replace clusters of traditional Windows Servers, especially systems hosting VM-based workloads. However, Microsoft has yet to publish details for how Azure Stack will be licensed. It is unclear whether customers migrating to Azure Stack will be able to leverage their existing on-premises Windows Server licenses in any way, or if they must discard any prior investment. Concerned customers, especially those with large Windows Server SA investments near renewal, might raise this issue with Microsoft.

Resources

The *Directions on Microsoft Licensing Reference Set* provides a continuously updated

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Licensing Reference Set Entry: Azure HUB

The accompanying entry is from the *Directions on Microsoft Licensing Reference Set*, a continuously updated online reference to licensing rules and terms. Online, each highlighted word or phrase in the text below is a hyperlink to one of the hundreds of other entries in the *Reference Set*. Use the *Licensing Reference Set*, available to members at www.directionsonmicrosoft.com/licensing, to quickly zero in on answers to your Microsoft licensing questions.

Azure HUB

Azure HUB (Hybrid Use Benefit), a Software Assurance (SA) benefit specific to Windows Server server-side licenses, provides preferential pricing for Azure VMs. Within the Azure VMs, customers can, under version downgrade rights, run any version of Windows Server supported by Azure.

Discount level for Azure VMs. Eligible customers are charged the Linux virtual machine (VM) hourly rate listed in their volume licensing contract price sheet, sometimes referred to as the "compute-only" rate, rather than the Windows Server VM rate (which combines fees for use of Microsoft intellectual property with compute-related fees), resulting in approximately 25% to 45% savings.

Eligibility and benefit value. The quantity and size of Azure VMs that are eligible for Azure HUB's special pricing is based on the number of server-side licenses covered by SA, regardless of edition. The rule is that each Windows Server 2012 R2 Datacenter or Standard server license with SA, and each set of 16 Windows Server 2016 Datacenter or Standard core licenses with SA, provides preferential pricing on two Azure VMs of eight cores or less or one Azure VM of 16 cores or less. This benefit can be applied to the highest tiers of Azure VMs, and when applied to such VMs running continually, the value of the discount can be as high as thousands of dollars per year, far exceeding the annual price of SA for the underlying on-premises server license(s).

What happens to Windows Server on-premises use rights? While licenses for both editions of Windows Server provide equivalent Azure-related benefits, Windows Server Standard edition licenses applied toward Azure HUB are deemed as being reassigned to Azure and thus no longer applicable for on-premises use. For Datacenter edition licenses, the Azure HUB benefit is "in addition to" rather than "in place of" on-premises use rights, so Datacenter edition licenses can be applied to an on-premises server and Azure workload(s) simultaneously.

Redeeming the benefit. Customers must designate a VM as covered by the benefit (using a PowerShell script) when they upload their Windows Server images to Azure. (Azure HUB is not intended to be applied to VMs provisioned from the Azure Management Portal's gallery of VM images, which have the Windows Server OS preinstalled.)

Tracking use. On Azure bills, Azure VMs covered under Azure HUB are listed the same way as Linux (compute-only) instances, except that a special tag indicates they are in fact Windows Server instances operating under Azure HUB. Neither the Volume Licensing Service Center (VLSC) nor Microsoft Volume Licensing Center (MVLC) Web portals, nor any other Microsoft user interface offers a report on VMs operating under Azure HUB. However, customers can query Azure VM attributes via PowerShell to create their own reports.

Duration of benefit. The legal text in Microsoft volume licensing program contracts and the Product Terms document do not explicitly commit Microsoft to maintaining Azure HUB for any specific period of time. However, it would be unusual for Microsoft to discontinue or materially alter a SA benefit and have the changes apply to SA coverage periods already in progress.

Documentation. The SA benefit requirements and limitations are documented in the Product Terms' "Azure Services" section. The first Product Terms to include mention of Azure Hybrid Use Benefit was published Feb. 2016. The related Product Terms text documenting the quantity of the Azure HUB benefit was updated in Oct. 2016 to account for Windows Server 2016's use of a new Core/CAL License Model.

See also. Windows Server SA Benefits; Self Hosted Applications; License Mobility through SA; SA Benefits (for complete list of SA benefits across products). ❯

online reference to licensing for Windows Server 2016 and other products at www.directionsonmicrosoft.com/licensing.

The first Product Terms to include Windows Server 2016 licensing details was published Oct. 2016 and is available at https://www.microsoft.com/en-us/licensing/product-licensing/products.aspx#PT.

A Windows Server 2016 licensing datasheet and FAQ can be downloaded from https://www.microsoft.com/en-us/cloud-platform/windows-server-pricing.

Descriptions of new Windows Server 2016 features exclusive to Datacenter edition can be found in the "Storage Enhancements" and "Software-Defined Networking" chapters in the Sept. 2016 *Research Report*, "Windows Server 2016 Evaluation Guide."

Information on the Software Inventory Logging (SIL) tool can be found at https://technet.microsoft.com/library/mt572043(v=ws.11).aspx.

Windows Server 2012 R2 licensing is covered in "Windows Server 2012 R2 Pricing and Licensing" on page 16 of the Oct. 2013 *Update*.

Azure pricing for Windows Server and Linux VMs is listed on https://azure.microsoft.com/pricing/details/virtual-machines/. ❯