Introduction to Per Core Licensing and Basic Definitions

Microsoft

This brief applies to all Commercial Licensing programs.

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Summary

The purpose of this brief is to provide definitions of key terms related to server licensing and introduce the basics of the different Per Core licensing models for key Microsoft products and software.

What's new in this brief

This brief replaces a previous version published in May 2016. It has been updated to reflect new core licensing information for SQL Server, BizTalk Server, Windows Server, and System Center.

Definitions

Assigning a license: Assigning a license means that you designate that license for one device or user. This designation avoids sharing a license across more than one device or user simultaneously. For example, after you have assigned a software license to a server, you are permitted to run the software on that server. You can use whatever manual or technical method that works for you to ensure that you have the correct number of licenses to cover your software use.

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Figure 1: Assigning a license

Core factor: A numerical value associated with a specific physical processor for purposes of determining the number of licenses required to license all of the physical cores on a server in the SQL Server core licensing model. Refer to the Core Factor Table for core factors for specific processors. (This is not applicable to SQL Server beginning with SQL Server 2016 and is not applicable to server licensing for Windows Server 2016 or System Center 2016.

Data center: A building (or multiple buildings) that houses servers and ancillary equipment typically used in a corporate computing environment connected by a local area network (LAN).

Hardware thread: A hardware thread is either a physical core or a hyper-thread in a physical processor.
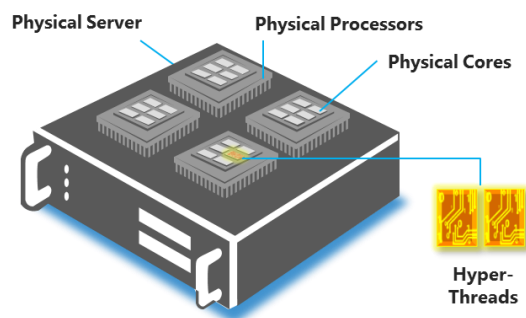

Figure 2: Physical server showing physical processors, physical cores, and hardware threads

Instance: An instance of software is the set of files that make up the software, stored in executable form, and ready to run. You create an instance of software by executing the software's setup or install procedure, or by duplicating an existing instance. Instances of software can run on physical or virtual hardware systems.

Examples:

▶ An installed copy of the Windows Server operating system on a hard disk is an instance of Windows Server.

▶ An installed copy of Microsoft Exchange Server within a virtual hard drive (VHD) (or other image format) file is an instance of Exchange Server.

▶ A VHD file with Exchange Server installed on top of Windows Server contains an instance of Windows Server and an instance of Exchange Server. Copying that VHD file creates another instance of Windows Server and another instance of Exchange Server. Deploying that VHD file to another server creates an instance of Windows Server and an instance of Exchange Server on that server.

Run an Instance: You run an instance of software by loading it into memory and executing one or more of its instructions. Once this has occurred, an instance is considered to be running (whether or not its instructions continue to execute) until it is removed from memory.

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Server: A server is a physical hardware system capable of running server software. A hardware partition or blade is considered to be a separate physical hardware system, and, therefore, a separate server.

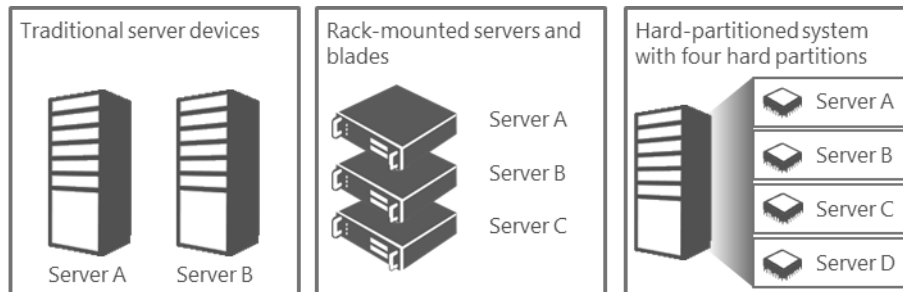| Traditional server devices	Rack-mounted servers and blades	Hard-partitioned system with four hard partitions

Figure 3: Different types of servers

Operating system environment (OSE): all or part of an operating system instance, or all or part of a virtual (or otherwise emulated) operating system instance which enables separate machine identity (primary computer name or similar unique identifier) or separate administrative rights, and instances of applications, if any, configured to run on the operating system instance or parts identified above. There are two types of OSEs, physical and virtual. A physical hardware system can have one physical OSE and/or one or more virtual OSEs.

Physical core: Each physical processor contains smaller processing units called physical cores. Some processors have two cores, some four, some six or eight, and so on.

Physical OSE: An OSE that is configured to run directly on a physical hardware system. The operating system instance used to run hardware virtualization software (for example, Microsoft Hyper-V Server or similar technologies) or to provide hardware virtualization services (for example, Microsoft virtualization technology or similar technologies) is considered part of the physical OSE.
Physical processor: A processor in a physical hardware system. Physical OSEs (see "Operating System Environment (OSE)") use physical processors.

Server farm: A server farm consists of up to two data centers each physically located in the following areas:

▸ In a time zone that is within four hours of the local time zone of the other (Coordinated Universal Time [UTC] and not Daylight Saving Time [DST]), and/or

▸ Within the European Union (EU) and/or European Free Trade Association (EFTA)

Each data center can be part of only one server farm. You can reassign a data center from one server farm to another, but not on a short-term basis (that is, not within 90 days of the last assignment).

Service provider: A service provider is an organization that provides services, such as software or hosting services, to other organizations.

Virtual core: The unit of processing power in a virtual (or otherwise emulated) hardware system. A virtual core is the virtual representation of one or more hardware threads. Virtual OSEs use one or more virtual cores.

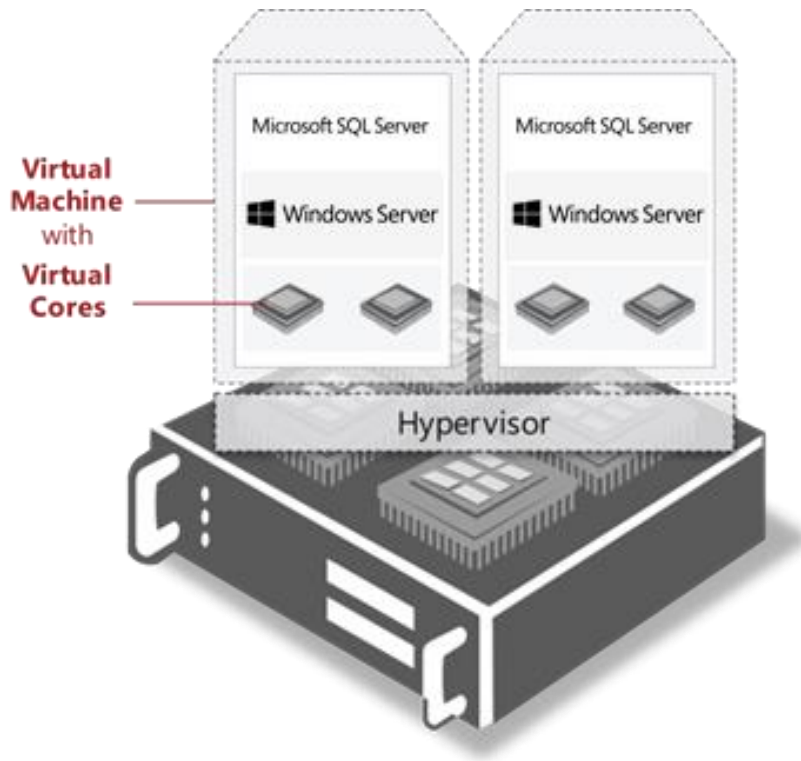# Introduction to Per Core Licensing and Basic Definitions

Figure 4: Virtual machine (VM) using virtual cores

Virtual OSE: An OSE that is configured to run on a virtual (or otherwise emulated) hardware system.

Virtual processor: A virtual processor is a processor in a virtual (or otherwise emulated) hardware system. Virtual OSEs use virtual processors. For licensing purposes, a virtual processor is considered to have the same number of threads and cores as each physical processor on the underlying physical hardware system.

Introduction to Per Core licensing

With the release of Microsoft SQL Server 2012, Microsoft server licensing shifted the measure of computing power from physical processors to cores. Core-based licensing provides a more precise measure of computing power and a more consistent licensing metric, regardless of whether solutions are deployed on physical servers on-premises, or in virtual or cloud environments. Core-based licensing enables multi-cloud environments, improving workload portability and helping remove friction across different licensing models, making it easier for customers to migrate to the cloud at their own pace.

Today, there are primarily three licensing models that apply Per Core licensing:

1. The Per Core model used by SQL Server and BizTalk Server

2. The Per Core/CAL licensing model used by Windows Server (Standard and Datacenter edition) following the release of Windows Server 2016

3. The Management Servers (core-based) licensing model used by System Center (Standard and Datacenter edition) following the release of System Center 2016.

SQL Server

Under the Per Core licensing model, each server running SQL Server 2016 software or any of its components (such as Reporting Services or Integration Services) must be assigned an appropriate number of SQL Server 2016 core licenses. The number of core licenses needed depends on whether customers are licensing the physical server or individual virtual operating system environments (OSEs).

Unlike the Server+CAL licensing model, the Per Core model allows access for an unlimited number of users or devices to connect from either inside or outside an organization's firewall. With the Per Core model, customers do not need to purchase additional client access licenses (CALs) to access the SQL Server software.

The Per Core licensing model is appropriate when:

▶ Deploying the SQL Server 2016 Enterprise Edition (including using the SQL Server Parallel Data Warehouse deployment option) or SQL Server 2016 Web Edition software.

▶ Deploying Internet or extranet workloads, systems that integrate with external-facing workloads (even if external data goes through one or more other systems), or when the number of users/devices cannot be counted easily.

▶ Implementing centralized deployments that span a large number of direct and/or indirect users/devices.

▶ The total licensing costs for licensing SQL Server 2016 Standard Edition software are lower than those incurred using the Server+CAL licensing model. **Note:** The use of hyper-threading technology does not affect the number of core licenses required when running SQL Server software in a physical OSE.

You must have the appropriate number of core licenses for the server. You have two licensing options:

1. Physical cores on a server

2. Individual virtual operating system environment

Licensing by physical cores on a server

When running SQL Server in a physical OSE, all physical cores on the server must be licensed. Software partitioning does not reduce the number of core licenses required, except when licensing individual virtual machines (VMs). A minimum of four core licenses are required for each physical processor on the server.

To determine and acquire the correct number of core licenses needed, customers must:

1	Count the total number of physical cores in the server.
2	Purchase the appropriate number of core licenses required for the server. Core licenses are sold in packs of two, so customers must divide the number of licenses required by two to determine the actual number of line items (licensing SKUs) to order.

The SQL Server Core Factor Table is no longer used to calculate the required number of core licenses needed for SQL Server 2016 and later versions. For earlier versions of SQL Server, the number of licenses required equals the number of physical cores on the server multiplied by the applicable core factor located in the SQL Server Core Factor Table (PDF, 304 KB). With the Enterprise Edition, for each server to which you have assigned the required number of licenses, you can run on the licensed server any number of instances of the server software in a number of physical and/or virtual OSEs equal to the number of licenses assigned to that server. Thereafter, for each additional license that you assign to the licensed server, you can run instances of the server software in an additional OSE on that licensed server.

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With the Standard Edition, for each server to which you have assigned the required number of licenses, you can run on the licensed server any number of instances of the server software in the physical OSE.

Physical cores per processor	1	2	4	6	8
Core licenses Required – SQL Server 2016	4	4	4	6	8

Per core—physical cores on a server. The number of licenses required equals the number of physical cores on the server subject to a minimum requirement of four licenses per processor. The SQL Server Core Factor Table is no longer used to calculate the required number of core licenses needed for SQL Server 2016 and later versions. For earlier versions of SQL Server, the number of licenses required equals the number of physical cores on the server multiplied by the applicable core factor located in the SQL Server Core Factor Table (PDF, 304 KB).

Licensing by individual virtual operating system environment

Similar to the Per Core licensing model in physical OSEs, all virtual cores (v-cores) supporting virtual OSEs that are running instances of SQL Server 2016 software must be licensed accordingly.
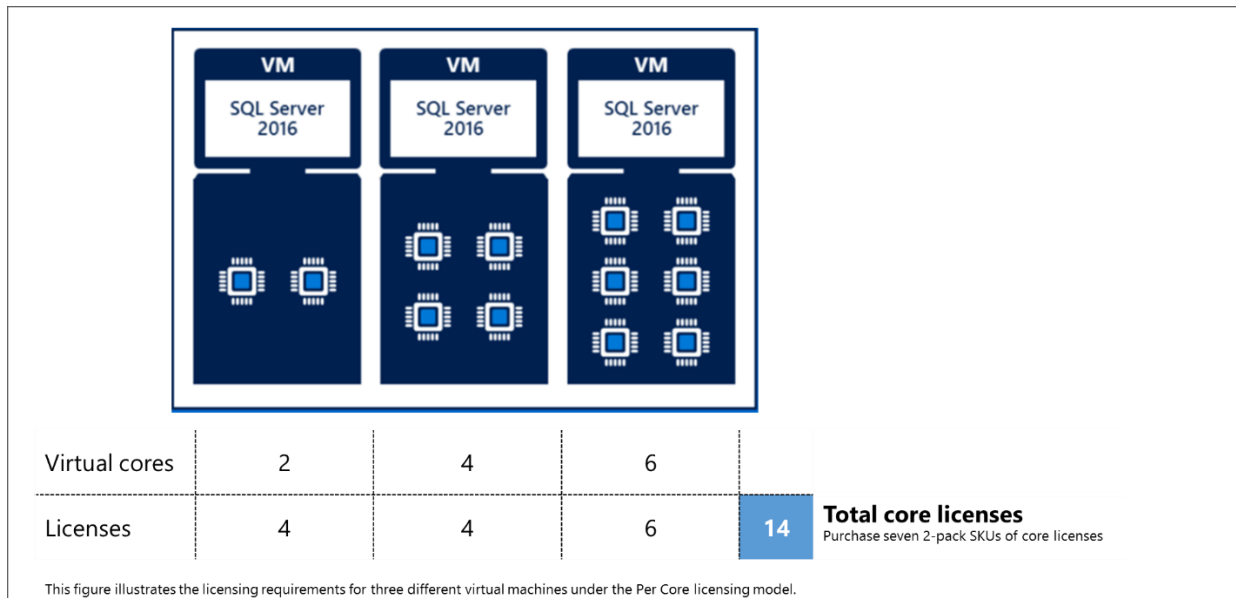
To license individual VMs using the Per Core model, customers must purchase a core license for each v-core (or virtual processor, virtual CPU, virtual thread) allocated to the VM, subject to a four core license minimum per VM. For licensing purposes, a v-core maps to a hardware thread.

Note: Licensing individual VMs is the only licensing option available for SQL Server 2016 Standard Edition customers who are running the software in a virtualized environment under the Per Core model.

For customers with highly virtualized environments who want to move VMs dynamically across servers to reallocate resources as needed, Microsoft permits License Mobility as an exclusive SA benefit available for all SQL Server editions.

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1	License the virtual cores in each virtual machine
2	There is a minimum of four core licenses required for each virtual machine

Virtual cores	2	4	6		
Licenses	4	4	6	**14**	**Total core licenses** Purchase seven 2-pack SKUs of core licenses

This figure illustrates the licensing requirements for three different virtual machines under the Per Core licensing model.

BizTalk Server

▶ Effective with the 2013 software release, BizTalk Server (BTS) is licensed under the same Per Core model as SQL Server. This model provides a precise measurement of computing power and a consistent licensing metric, regardless of whether your BTS solution is deployed across servers on-premises, virtually or physically, or cloud environments under License Mobility with Software Assurance. Under the Per Core licensing model, each server running BTS software must be assigned an appropriate number of BTS core licenses. The number of core licenses needed depends on whether you are licensing the physical server or individual virtual operating system environments (OSEs).

▶ To license a physical server, you must license all the cores in the server, with a minimum of 4 core licenses required for each physical processor in the server. BTS core licenses are sold in packs of two.

▶ With BTS 2013, the actual number of core licenses required may vary by processor type, and as such, will depend on the Core Factor assigned to your applicable processor(s).

For more information on BizTalk Server core licensing, please download the BizTalk Server 2013 R2 Licensing Datasheet and FAQ or review the Product Terms.

Windows Server

With the launch of Windows Server 2016 Datacenter edition and Windows Server 2016 Standard edition, Windows Server licensing has transitioned from being processor-based to being core-based.

For both Standard and Datacenter editions, the number of core licenses required equals the number of physical cores on the licensed server, **subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server**. Core licenses are sold in 2-packs.

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	Datacenter	Standard
Licensing model	Per Core/CAL[1]	Per Core/CAL[1]
License type	Core License	Core License
OSEs/Hyper-V containers	Unlimited	Two[2]
Windows Server containers	Unlimited	Unlimited

[1] *All physical cores on the server must be licensed, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server.*

[2] *Windows Server Standard edition permits use of one running instance of the server software in the physical OSE on the licensed server (in addition to two virtual OSEs), if the physical OSE is used solely to host and manage the virtual OSEs.*

Minimum Requirements for Standard and Datacenter Editions

The table below provides examples for various server configurations, and the minimum number of core licenses required.

▶ **Standard**: When all cores on the server are licensed (subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server), Standard has rights to use two OSEs or two Hyper-V containers and unlimited Windows Server containers.

▶ **Datacenter**: When all cores on the server are licensed (subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server), Datacenter edition has rights to use unlimited OSEs, Hyper-V containers, and Windows Server containers.

Server Licensing	1-processor server		2- processor server		4- processor server	
Windows Server Standard & Datacenter	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs
2 cores per processor	**16**	8	**16**	8	**32**	16
4 cores per processor	**16**	8	**16**	8	**32**	16
6 cores per processor	**16**	8	**16**	8	**32**	16
8 cores per processor	**16**	8	**16**	8	**32**	16
10 cores per processor	**16**	8	**20**	10	**40**	20

[1] *Core licenses are sold in 2-packs.*

Licensing requirements of additional OSEs for Standard Edition

Standard edition has rights to use two OSEs or two Hyper-V containers and unlimited Windows Server containers when all cores on the server are licensed (subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server). Once a server is licensed, customers may wish to license the server for additional OSEs or Hyper-V containers. This practice is often referred to as "stacking", and is allowed with Standard edition.

The table below provides examples of "stacking" scenarios for various server configurations, the minimum number of licenses required, and the resulting number of OSEs or Hyper-V containers provided. As a rule, for each additional set of two OSEs or two Hyper-V containers the customer wishes to use, the server must be relicensed for the same number of core licenses. Note that Datacenter edition has rights to unlimited virtualization so "stacking" therefore is not required.

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"Stacking" Standard OSEs or Hyper-V Containers	1-proc server with 16 cores		2-proc server with 16 cores		4-proc server with 32 cores	
	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs
2 per server	**16**	8	**16**	8	**32**	16
4 per server	**32**	16	**32**	16	**64**	32
6 per server	**48**	24	**48**	24	**96**	48
8 per server	**64**	32	**64**	32	**128**	64
10 per server	**80**	40	**80**	40	**160**	80

[1] Core licenses are sold in 2-packs.

System Center

Server management licensing for System Center 2016 Datacenter edition and System Center 2016 Standard edition has transitioned from being processor-based to being core-based, in alignment with Windows Server 2016. For both Standard and Datacenter editions, the number of core licenses required equals the number of physical cores on the licensed server, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server. Core licenses are sold in 2-packs. Server Management Licenses (Server MLs) are required for managed devices that run server Operating System Environments (OSEs). For complete details and information on licensing, refer to the Product Terms.

	Datacenter	Standard
Licensing Model	Management Servers[1]	Management Servers[1]
License Type	Core License	Core License
OSEs/Hyper-V containers	Unlimited	Two[2]
Windows Server containers	Unlimited	Unlimited

[1] All physical cores on the server must be licensed, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server.

[2] System Center Standard edition permits management of the physical OSE on the licensed server (in addition to two virtual OSEs), if the physical OSE is used solely to host and manage virtual OSEs.

Additional resources

- For details about licensing SQL Server , refer to the SQL Server 2016 Licensing Guide.
- For details about licensing BizTalk Server, refer to the Microsoft BizTalk Server pricing page.
- For details about licensing Windows Server, refer to the Windows Server 2016 Licensing Guide.
- For details about licensing System Center 2016, refer to the System Center 2016 MS.com licensing page.