Introduction to Microsoft Core licensing models

This brief applies to all Microsoft Licensing programs.

Contents

Summary

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

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.

Figure 1: Assigning a license.

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.
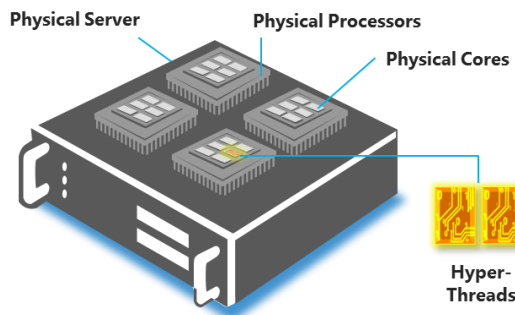

Figure 2: Physical server showing physical processors, physical cores, and hardware threads.

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.
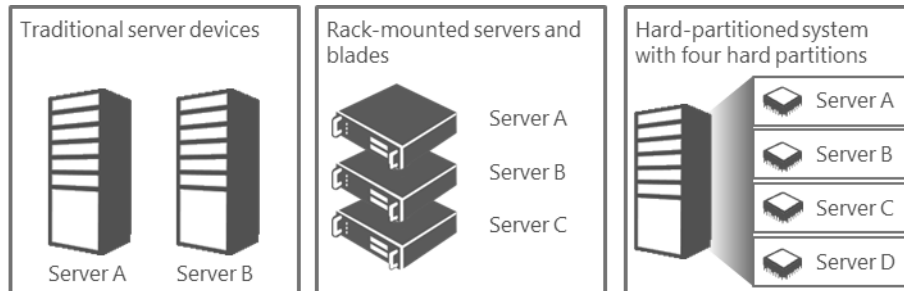

Figure 3: Different types of servers.

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 eight cores, some 16 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: 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.

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.
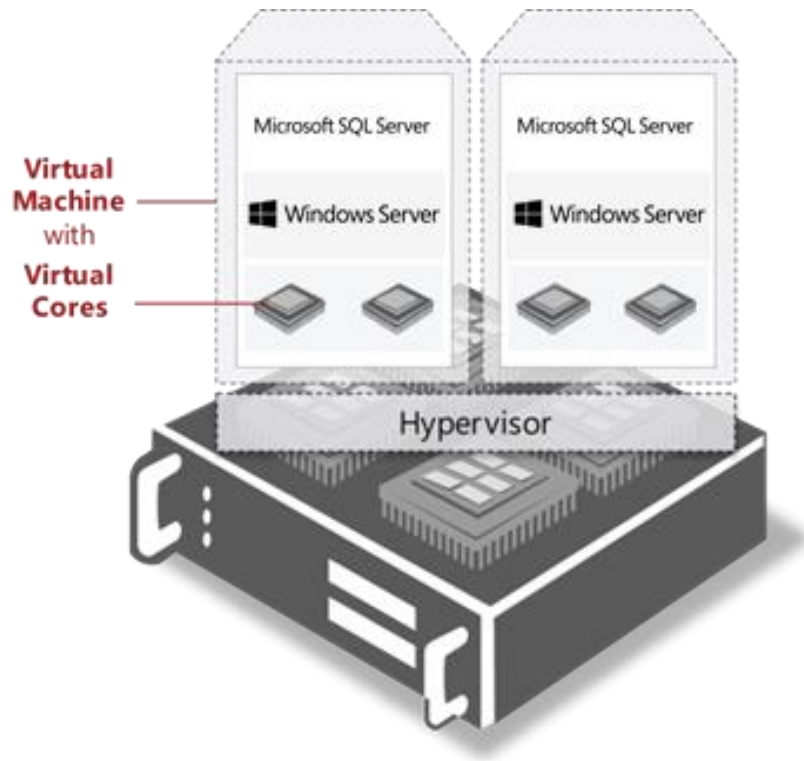
Figure 4: Virtual Machine (VM) using virtual cores.

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

Introduction to Per Core Licensing

Core-based licensing provides a more precise measure of computing power and a more consistent licensing metric than prior licensing models such as processor-based, 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 licensing model used by SQL Server and BizTalk Server.

2) The Per Core/CAL licensing model used by Windows Server (Standard and Datacenter).

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

Per Core licensing model

There are two ways to license under the Per Core licensing model:

- Licensing based on Physical Cores on a Server
- Licensing by Individual Virtual Machine

The number of core licenses needed depends on whether customers are licensing based on Physical Cores on a Server or by virtual machine.

We refer to the use of software in virtual machines or VMs in this brief. In our license terms, these are virtual operating system environments or virtual OSEs.

Licensing based on Physical Cores on a Server

When running an instance of the software in a physical OSE, all physical cores on the server must be licensed. Software partitioning or custom system bios control does not reduce the number of core licenses required, except when licensing individual virtual machines (VMs). A minimum of four core licenses is required for each physical processor on the server.

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 Server software.

Enterprise editions: 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 OSEs and/or virtual machines 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 (e.g., VM) on that licensed server.

Standard and other editions: 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. The only way to license Standard for use in a virtual machine is to license by virtual machine.

Licensing by Virtual Machine

Similar to the Per Core licensing model in physical OSEs, all virtual cores (v-cores) supporting virtual machines that are running instances of SQL Server core edition software must be licensed accordingly. To license individual virtual machines using the Per Core model, customers must purchase a core license for each virtual core (or virtual CPU, virtual thread) allocated to the virtual machine, subject to a four-core license minimum per virtual machine. For licensing purposes, a virtual core maps to a hardware thread. Customers with subscription licenses or licenses with active Software Assurance coverage on SQL Server 2022 will have the option to license by virtual machine. For earlier versions, customers with perpetual licenses also have this option.

Enterprise editions: For each server to which a customer assigns the required number of licenses, they may run any number of instances of the server software in a virtual machine. The licenses are assigned to the physical server and allocated to a virtual machine to allow running instances of the software. The licenses are not assigned to the virtual machine.

Standard and other editions: For each server to which a customer assigns the required number of licenses, they may run any number of instances of the server software in a virtual machine. The licenses are assigned to the physical server and allocated to a virtual machine to allow running instances of the software. The licenses are not assigned to the virtual machine.

Per Core/CAL licensing model

Beginning October 2022, there are two ways to license the Per Core/CAL licensing model:

- Licensing based on Physical Cores on a Server
- Licensing by Virtual Machine

The number of core licenses needed depends on whether customers are licensing based on Physical Cores on a Server or by virtual machine. The option to license by virtual machine is available only to customers with subscription licenses or licenses with active Software Assurance.

Licensing based on Physical Cores on a Server

When licensing based on physical cores, the Per Core/CAL license model requires the customer to license all the physical cores on the server they run the software on. The licensed server must be assigned a minimum of 16 core licenses subject to a minimum of eight core licenses per physical processor. The greater of these two minimum requirements would equal the minimum number of licenses any server running the software must have.

Datacenter edition: For each server to which a customer assigns the required number of licenses, they may run the software in the physical OSE and any number of virtual machines on the licensed server.

Standard edition: For each server to which a customer assigns the required number of licenses, they may run the software in up to two OSEs (physical or virtual) on the licensed server. If a customer runs the software in two virtual machines, they may also run the software in the physical OSE if the physical OSE is used solely to host and manage the virtual machines.

Customers may use Windows Server Containers with either edition. Windows Server Datacenter terms permit use of any number of Windows Server Containers with or without Hyper-V isolation on servers licensed based on physical cores. Windows Server Standard terms permit use of two Windows Server containers with Hyper-V isolation and unlimited Windows Server containers without Hyper-V isolation on servers licensed based on physical cores.

Once a server is licensed for Windows Server Standard, customers may wish to use additional virtual machines or Windows Server Containers with Hyper-V isolation. Fully relicensing the server based on physical cores permits use of two additional virtual machines or Windows Server Containers with Hyper-V isolation. This practice is often referred to as "stacking.. Alternatively, if the customer has active Software Assurance on their Standard licenses, they may choose to purchase Step Up licenses to Datacenter edition or explore licensing by virtual machine.

Licensing by Individual Virtual Machine

When licensing either edition of Windows Server by virtual machine, the Per Core/CAL license model requires the customer to license all the virtual cores in the virtual machine. The licensed server must be assigned a minimum of 8 core licenses per virtual machine. Additionally, a minimum of 16 core subscription licenses or licenses with active Software Assurance per customer applies to any customer choosing to allocate Windows Server licenses by virtual machine.

Access Licenses

In addition to licensing the server with core licenses under either option (based on physical cores or by virtual machine), access to the server also requires a Client Access License (CAL). CALs are available as device CALs or user CALs and each device or user is required to be licensed to directly or indirectly (e.g. multiplexing) access the server.

CALs are not required to access the server by another licensed server, a server running a Web Workload or HPC Workload, or to access a physical OSE that is being used solely for hosting and managing Virtual OSEs.

Management Servers licensing model

Beginning October 2022, there are two ways to license the Management Servers licensing model:

- Licensing based on Physical Cores on a Server

- Licensing by Virtual Machine The number of core licenses needed depends on whether customers are licensing based on Physical Cores on a Server or by virtual machine. The option to license by virtual machine is available only to customers with subscription licenses or licenses with active Software Assurance.

Licensing based on Physical Cores on a Server

When licensing based on Physical Cores, the Management Server license model is similar to the Per Core/CAL model and requires the customer to license all the physical cores on the server in order to manage OSEs on that server. The licensed server must be assigned a minimum of 16 core licenses subject to a minimum of eight core licenses per physical processor. The greater of these two minimum requirements would equal the minimum number of licenses any server with managed OSEs must have.

Datacenter edition: For each server to which a customer assigns the required number of licenses, they may manage the Physical OSE and any number of virtual machines on the licensed server.

Standard edition: For each server to which a customer assigns the required number of licenses, they may manage up to two OSEs (physical or virtual) on the licensed server. If a customer manages two virtual machines, they may also manage the physical OSE if the physical OSE is used solely to host and manage the virtual machines.

If a customer needs to manage more than two OSEs on server licensed for Standard, they may fully relicense the server based on physical cores. This is often referred to as "stacking" licenses. Alternatively, if the customer has active Software Assurance on their Standard edition licenses, they may choose to purchase Step Up licenses to Datacenter edition or explore licensing by virtual machine.

Licensing by Individual Virtual Machine

When licensing either edition of System Center by virtual machine, the Management Server license model requires the customer to license all the virtual cores in the virtual machine they are managing. The managed server must be assigned a minimum of 8 core licenses per virtual machine. Additionally, a minimum of 16 core licenses per customer applies. The greater of these two minimum requirements would equal the minimum number of licenses any server running a managed virtual machine must have.

Licensing for the management of client OSEs is subject to different terms. See the Microsoft Product Terms.

Server software products that apply Per Core licensing

SQL Server

Under the Per Core licensing model, each server running SQL Server software or any of its components (such as Reporting Services or Integration Services) that are not included as Additional Software must be assigned an appropriate number of SQL Server core licenses that are the same version as the software being run or newer versions.

- When to use Per Core licensing model. Deploying the SQL Server Enterprise Core edition (including using the SQL Server Parallel Data Warehouse deployment option), SQL Server Standard Core edition, or SQL Server Web Core edition (available through service provider hosting only) software, and SQL Server Big Data Node Core licenses.

- 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 Core editions 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.

Licensing based on Physical Cores on a Server: To determine and acquire the correct number of core licenses needed, customers must:

1) Count the total number of physical cores per physical processor in the server.

2) Purchase the appropriate number of core licenses required for the server. SQL Server Core licenses are sold in packs of two (each licensing SKU includes two core licenses), so customers must divide the number of licenses required by two to determine the actual number of line items (licensing SKUs) to order.

	4-Processor Server with 4 physical cores per processor		4-Processor Server with 6 physical cores per processor		4-Processor Server with 10 physical cores per processor	
	Required # Cores Licenses	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses	Required # 2-Pack SKUs
SQL Enterprise Core edition	16	8	24	12	40	10
SQL Server Standard Core edition	16	8	24	12	40	10

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

1) Count the number of virtual cores allocated to the virtual machine an instance of the software will run in.

2) Purchase the appropriate number of core licenses required for the server (subject to a minimum of four licenses per virtual machine). SQL Server Core licenses are sold in packs of two (each licensing SKU includes two core licenses), so customers must divide the number of licenses required by two to determine the actual number of line items (licensing SKUs) to order.

Note: Licensing individual VMs is the only licensing option available for SQL Server Standard Core edition customers who are running the software in a virtualized environment under the Per Core model. The option to license SQL Server 2022 by individual virtual OSE will apply only to customers with subscription licenses or licenses with active Software Assurance.

	1 Virtual OSE: 8 virtual cores		1 Virtual OSE: 10 virtual cores		2 Virtual OSEs: VM 1 = 8 virtual cores, VM 2 = 12 virtual cores	
	Required # Cores Licenses	Required # 2-Pack SKUs	Required # Cores Licenses[1]	Required # 2-Pack SKUs	Required # Cores Licenses	Required # 2-Pack SKUs

	1 Virtual OSE: 8 virtual cores		1 Virtual OSE: 10 virtual cores		2 Virtual OSEs: VM 1 = 8 virtual cores, VM 2 = 12 virtual cores	
SQL Enterprise Core edition	8	4	10	5	20	10
SQL Server Standard Core edition	8	4	10	5	20	10

SQL Server licensing options for highly virtualized environments

Customer that need to deploy large numbers of virtual machines running SQL Server on one server or across many servers may benefit from greater flexibility provided with Software Assurance (SA) or subscription licenses. Allocating SQL Server Enterprise Core subscription licenses or licenses with SA based on physical cores provide customers with Unlimited Virtualization rights on the licensed server. Both SQL Server Enterprise Core and Standard Core subscription licenses or licenses with SA also provide customers with License Mobility Across Server Farms.

SQL Server Enterprise Core Unlimited Virtualization

Customers that fully license a server (based on physical cores) with SQL Server Enterprise Core edition with subscription licenses or licenses with active SA may run any number of instances of the software in the physical OSE and any number of virtual machines on the licensed server.

License Mobility Across Server Farms

For customers with highly virtualized environments who want to move VMs dynamically across servers to reallocate resources as needed, Microsoft permits License Mobility Across Server Farms as an SA benefit available for all SQL Server editions. Under this option, licenses may be reassigned to another server in the same Server Farm at any time as needed. License Mobility Across Server Farms rights are also conveyed under subscription licenses..

BizTalk Server

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).

Per Core license model

Licensing based on Physical Cores on a Server: To determine and acquire the correct number of core licenses needed, customers must:

1) Count the total number of physical cores per physical processor in the server.

2) Purchase the appropriate number of core licenses required for the server. BTS Core licenses are sold in packs of two (each licensing SKU includes two core licenses), so customers must divide the number of licenses required by two to determine the actual number of line items (licensing SKUs) to order.

Licensing by Individual Virtual Machine: To determine and acquire the correct number of core licenses needed, customers must:

1) Count the number of virtual cores allocated to the virtual machine the software will run in.

2) Purchase the appropriate number of core licenses required for the server (minimum of four per virtual machine). SQL Server Core licenses are sold in packs of two (each licensing SKU includes two core licenses), so customers must divide the number of licenses required by two to determine the actual number of line items (licensing SKUs) to order.

Beginning with SQL Server 2022, the option to license by individual virtual OSE will apply only to subscription licenses or licenses with active Software Assurance.

BizTalk Server licensing options for highly virtualized environments

Customer that need to deploy large numbers of virtual machines running BizTalk Server on one server or across many servers may benefit from greater flexibility provided with Software Assurance (SA). BizTalk Server Enterprise Core edition with SA provides customers with Unlimited Virtualization rights on the licensed server. Both BizTalk Server Enterprise Core and Standard Core editions with SA also provide customers with License Mobility Across Server Farms.

BizTalk Server Enterprise Core Unlimited Virtualization

Customers that fully license a server with BizTalk Server Enterprise Core edition with active SA based on physical cores may run any number of instances of the software in the physical OSE and any number of virtual machines on the licensed server.

License Mobility Across Server Farms

For customers with highly virtualized environments who want to move VMs dynamically across servers to reallocate resources as needed, Microsoft permits License Mobility Across Server Farms as an exclusive SA benefit available for all BizTalk Server editions. Under this option, licenses may be reassigned to another server in the same Server Farm at any time as needed.

Windows Server

For both Standard and Datacenter editions, Windows Server is licensed by the Per Core/CAL license model. Like products with Per Core licenses, Windows Server core licenses are sold in packs (2 core pack and 16 core pack). Each license SKU includes the 2 or 16 core licenses per pack. As an alternative to licensing Windows Server based on the physical cores on the server, customers can license by virtual machine.

	Datacenter	Standard	Either Edition
Per Core/CAL Option	Licensing based on physical cores [1]	Licensing based on physical cores /CAL[1]	Per Core/CAL by VM[2]
License Type	Core License	Core License	Core License
OSEs/Windows Server containers with Hyper-V isolation	Unlimited	Two[3]	One
Windows Server without Hyper-V isolation containers	Unlimited	Unlimited	Unlimited within one VM

[1]*When licensing by physical core, licenses for all physical cores on the server must be assigned, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server.*

[2]*When licensing by virtual machine, licenses for all of the virtual cores in the virtual machine must be assigned, subject to a minimum of 8 licenses per virtual machine and 16 licenses per customer.*

[3]*When licensing based on physical cores, 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 machines), if the physical OSE is used solely to host and manage the virtual machines.*

Minimum core license requirements for Standard and Datacenter Editions

Licensing Based on Physical Cores

The table below provides examples for various server configurations, and the minimum number of core licenses required when licensing based on the physical cores on the server.

Server Licensing	1-Processor Server		2-Processor Server		4-Processor Server	
Windows Server Standard & Datacenter	Required # Cores Licenses[1]	Required # 2 core - Pack SKUs	Required # Cores Licenses[1]	Required # 2 core - Pack SKUs	Required # Cores Licenses[1]	Required # 2 core - 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 by virtual machine

For licensing by virtual machine, the minimums are 8 per virtual machine and 16 per customer. In other words, four 2 core packs and eight 2 core packs, respectively. The number of processors on the server does not affect the minimums.

Licensing requirements for adding virtual machines for Standard Edition when licensing by physical core

The table below provides examples of "stacking" scenarios for various server configurations, the minimum number of licenses required, and the resulting number of virtual machines or Windows Server Containers with Hyper-V isolation provided. As a rule, for each additional set of two VMs or two Windows Server containers with Hyper-V isolation the customer wishes to use, the server must be fully relicensed based on the physical cores. Note that Datacenter edition has rights to unlimited virtualization so "stacking" therefore is not required. As an alternative to relicensing the full server for stacking using Windows Server, customers with subscription licenses or licenses with active Software Assurance can license additional virtual machines based on virtual cores and subject to license minimums.

"Stacking" Standard	1-Proc Server with 16 cores		2-Proc Server with 16 cores		4-Proc Server with 32 cores	
OSEs or Hyper-V Containers	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

For both Datacenter and Standard editions, System Center Server Management Licenses (Server MLs) are licensed under the Management Servers license model. System Center Datacenter and Standard have core-based licensing, in alignment with Windows Server. Like Windows Server Per Core licenses, System Center Server core licenses (Server MLs) are sold in packs (2 core pack).

	Datacenter	Standard	Either edition
Management Server Option	Licensing based on physical cores[1]	Licensing based on physical cores[1]	Licensing by VM[2]
License Type	Core License	Core License	Core License
OSEs/Windows Server containers with Hyper-V isolation	Unlimited	Two[3]	One
Windows Server containers without Hyper-V isolation	Unlimited	Unlimited	Unlimited within one VM

[1]*When licensing based on physical cores, licenses for all physical cores on the server must be assigned, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server.*

[2]*When licensing by virtual OSE, licenses for all of the virtual cores in the managed virtual OSE must assigned, subject to a minimum of 8 licenses per virtual machine and 16 licenses per customer.*

[3]*When licensing based on physical cores, System Center Standard edition permits management of the physical OSE on the managed server (in addition to two virtual OSEs), if the physical OSE is used solely to host and manage virtual OSEs.*

Minimum core license requirements for Standard and Datacenter Editions

Licensing based on physical cores

The table below provides examples for various server configurations, and the minimum number of core licenses required when licensing based on the physical cores on the server.

Server Licensing	1-Processor Server, 2 Cores per processor		2-Processor Server, 6 Cores per processor		4-Processor Server, 10 cores per processor	
Edition - OSEs required	Required # Cores Licenses[1]	Required # 2 core - Pack SKUs	Required # Cores Licenses[1]	Required # 2 core - Pack SKUs	Required # Cores Licenses[1]	Required # 2 core - Pack SKUs
Standard edition – 2 OSEs	16	8	16	8	40	10
Standard edition – 4 OSEs required	16	8	32	16	80	40
Datacenter edition – 10 OSEs required	16	8	16	8	40	10

Licensing by virtual machine

For licensing by virtual OSE, the minimums are 8 per virtual OSE and 16 per customer. In other words, four 2 core packs and eight 2 core packs, respectively. The number of processors on the server does not affect the minimums.

Additional resources

- SQL Server Licensing Resources and Documents.
- Windows Server Licensing Resources and Documents.
- Infrastructure and Other Servers Licensing Resources and Documents.
- Licensing Guides
- Licensing Briefs