

Licensing
WINDOWS SERVER
2016 in a Virtual
Environment

ALTARO

CONTENTS

Disclaimers.....	3
OEM Licenses.....	3
Services provider license agreements.....	3
Who should read this book.....	4
Who should NOT read this book.....	4
What's in this book	5
The basics of Windows server licensing.....	5
Licensing terminology.....	6
The unbreakable rule for Windows server licensing.....	8
Physical instances and virtual instances.....	9
The Hyper-V server license	11
Summarizing the licensing rules.....	12
License transfers.....	13
License stacking.....	14
Core and nano.....	15
Containers	15
Core licenses.....	15
Clustering	17
Virtualization right forfeiture	17
Client access licenses.....	18
Client Hyper-V.....	18
Windows and Linux virtual machines	19
Examples.....	20
About Altaro.....	34
About Eric Siron	36

DISCLAIMERS

Software licensing is a legal matter, not a technical concern. The author of this work is not a lawyer and no lawyers were consulted when writing this work. Its contents are intended to be a guideline to aid in comprehension of the concepts of a specific licensing detail. It does not constitute legal advice or interpretation. Neither the author nor Altaro Software, Ltd. are offering legal advice and this work cannot be construed as such. We cannot be held responsible for any negative outcomes of the usage of any of the contents, whether it is through an error on our part or a misunderstanding on yours. For official answers, contact Microsoft Licensing or check with your reseller. Authorized resellers should have someone on staff that can authoritatively answer licensing questions. There are very steep fines and bounties associated with licensing violations. It is worth your time to get official answers.

The most detailed publicly-available material that Microsoft publishes on the subject is the [Product Use Rights document](#). The clearest publicly-available material that Microsoft publishes is the [Windows Server 2016 Licensing Datasheet](#). The license agreement that is included with your software is the only legally binding document. If your compliance is ever tested in court, the licensing agreement is the only applicable document.

OEM LICENSES

This work only deals with volume licenses, which are an agreement that you make with Microsoft with the assistance of a reseller. OEM licenses can be customized by an equipment manufacturer and therefore might have different rules than you find anywhere else. Do not assume that an OEM license works the same way as a standard volume license. Usually, the greatest difference is that they are not transferrable.

SERVICE PROVIDER LICENSE AGREEMENTS

Service Provider License Agreements (SPLA) govern the way that service providers make centrally-installed Microsoft software available to customers, typically in what is known as a “cloud” environment. The terms of SPLA licensing are markedly divergent from volume licensing. As the core business of such a provider involves accepting the legal burden of proper licensing, this document will not make any attempts to cover the subject of SPLA. It is expected that providers will voluntarily acquire legal counsel, work with the entities that sell licenses, and submit to audits to ensure licensing compliance.

WHO SHOULD READ THIS EBOOK

This eBook is written for small business owners, small/medium business principals and systems administrators, any technical staff involved with software licensing, and any other staff involved with software licensing compliance, all in an environment using Microsoft Windows Server software. Failure to comply with license agreements can result in legal action and large fines. If you are uncertain where to even begin on the subject licensing, this is a good place to start.

Ensure that you have read the disclaimers section and understand that this book is not intended to be the final word or a legal defense. The best time to read this book is prior to making any purchases at all.

WHO SHOULD NOT READ THIS EBOOK

As mentioned in the disclaimers section, this eBook is not intended for service providers. The importance of licensing on a service provider's business model is far too important to not have an independent verification of your environment, something that a general-purpose eBook cannot hope to match.

If you have questions about your license keys, such as which to use and where to find them, you will not find many answers in this eBook. Some of the concepts will be explained, but keys and key distribution is a subject that is only tangentially related to licensing and is beyond the scope of this eBook.

If you have questions about your OEM license, those should be taken to the manufacturer that sold you the license. This eBook focuses on volume licensing as described in the Microsoft Product Use Rights (PUR) document. OEM licenses are customized by the reseller, so there may be different rules that apply to you or the existing rules might be changed. For example, almost every OEM license restricts license portability in a way that the PUR does not.

This document also does not deal much with Windows Server Essentials. For questions on licensing that product, please talk with your reseller.

WHAT'S IN THIS EBOOK

Microsoft provides special benefits for its Windows Server operating systems when they are used in a virtual environment. The details are not complicated, but usually catch the uninitiated by surprise. To make matters worse, there is a great deal of misinformation being passed around. This eBook serves as a simple guide to the basics of Microsoft Server licensing in a virtual environment. This eBook is written for Windows Server 2016. It is applicable when this operating system is running under any hypervisor.

THE BASICS OF WINDOWS SERVER LICENSING

Before we begin exploring the specifics of Windows Server licensing in a virtual environment, let's get a good understanding of the basics of Windows Server licensing in general. A few things to understand:

- **A product's "version" refers to a unique iteration of a product.**
For Windows Server, versions include "2008 R2", "2012", "2012 R2", and "2016".
- **A product's "edition" refers to a product with a specific feature set.**
For Windows Server 2016, the editions are "Essentials", "Standard", and "Datacenter".
- **Different editions and versions have their own licensing requirements.**
There is a great deal of historical inconsistency involving Windows Server editions, so you must not assume that what was true in previous versions continues to the present. The "Advanced", "Enterprise", and "Foundation" editions of Windows Server have been phased out.
- **"Core" is a wildly overused term.** In the scope of Windows Server, the term "Core" can refer to:
 - An installation mode of Windows Server that does not include a GUI
 - Physical components of a central processing unit (CPU) to which licenses can be applied

References to "Core" in this eBook have been made with a best effort to clarify usage.

- **“Nano” is similar to “Core” in that it is an installation mode, not a distinct product.**
- **“Windows” and “Windows Server” are distinct product classes.**
“Windows” refers to desktop operating systems, such as Windows 7 and Windows 10. “Windows Server” refers to general purpose server operating systems. In this document, we will focus on Windows Server 2016.
- **Volume licenses can only be purchased for the current version of the related product.**
- **Volume licenses include “downgrade” and “down-edition” rights,** meaning that you can use any previous version or any lower edition of the purchased product in place of a licensed version/edition, provided that it is still being supported by Microsoft. For example, you can purchase a Windows Server 2016 license and install Windows Server 2012 instead. Non-volume licenses may or may not include such rights.

LICENSING TERMINOLOGY

The above information delves a bit into terminology, so ensure that you have absorbed that before proceeding. The following chart is intended to be more specific on terminology, especially on commonly misunderstood or less common terms.

TERM	DEFINITION
Physical operating system environment (pOSE)	An operating system that is installed directly to the physical computer hardware, i.e., not inside a virtual machine or container.
Virtual operating system environment (vOSE)	An operating system that is installed inside a virtual machine
License	A legally-binding agreement that is applicable to the usage of software. It is a mechanism intended to allow the author of software to retain full ownership of his/her/its intellectual property while simultaneously allowing others to use that intellectual property.

TERM	DEFINITION
Key	In the scope of Microsoft products, a key is a series of alpha-numeric characters that is entered into the product’s licensing mechanism in order to convince it that the software is properly licensed.
License transfer	<ol style="list-style-type: none"> 1. Moving a software license from one physical machine to another 2. Transferring ownership of a license (not further discussed in this eBook)

One of the most important terms shown above is “key”. Whenever licensing is the subject, it invariably attracts several questions related to the keys to use. The lack of a key does not mean that you lack legal rights.

The presence of a key does not mean that you have any legal rights. The fact that an installation of a Microsoft product accepts a key that you enter does not mean that you have any legal right to use that key or that the instance is in licensing compliance. Keys are provided by your licensing provider. For volume licenses, use the [Volume Licensing Service Center](#). Keys for OEM products must be provided by your reseller. Retail keys are typically included in the physical package, but sometimes include other redemption instructions.

THE UNBREAKABLE RULE FOR WINDOWS SERVER LICENSING

Virtualization provides several benefits, but one of its greatest is *portability*. The ease of moving an operating system installation has never been greater. There are mechanisms built right into hypervisors to pick up an installation and move it to another physical machine without even interrupting operations. Microsoft calls their implementation “Live Migration”. Even the lowest-end desktop-based type 2 hypervisors allow you to copy the files of one virtual machine and use them inside a different copy of that hypervisor on another physical computer. Regardless of the technology’s name or the hypervisor that makes it possible, such ease of portability has serious implications for operating system licensing.

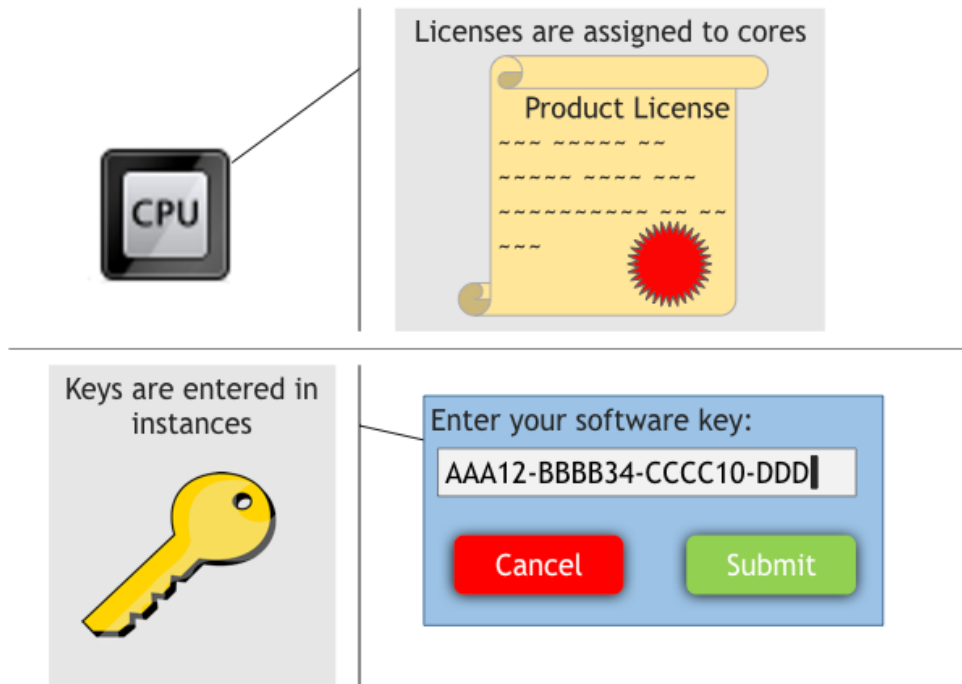
The unbreakable rule of Windows Server licensing (in fact, all Microsoft operating system licensing) is: **A Windows Server license is always bound to a specific piece of hardware.** This has always been true and has not been changed in any license. What has changed over time is what sort of hardware is targeted by a license. In older versions, licenses were often bound to a singular physical host. As multiple-processor systems came into vogue, later licenses shifted to being processor-bound. Starting with Windows Server 2016, licenses are now bound to individual cores in a processor.

The implications of this rule:

- **It is the CPU core (or, in older licenses, the CPU pair or physical box) that receives the license, not the operating system instance.**
- **A license cannot freely move from one piece of hardware to another.** There are some allowances, but even the most generous can only be used rarely.
- **Virtual machines are not licensed in any sense.** A virtual machine is just a vessel, independent of what is inside it. A virtual machine could contain a Windows instance or a Linux instance or nothing at all.
- **Operating system instances, whether physical or virtual, are not licensed.** The physical hardware is licensed to run operating system instances.
- **Keys are not licenses.** Keys are included with licenses, but they are entered into operating system instances which can move more easily than licenses.

If at any time you are uncertain of what might happen if you install or use a virtual machine, the first bullet point is by far the most important. If the core(s) that will run

that operating system instance do not have enough applied licenses to account for the instance, then you will be out of compliance from the moment that the operating system instance is started.

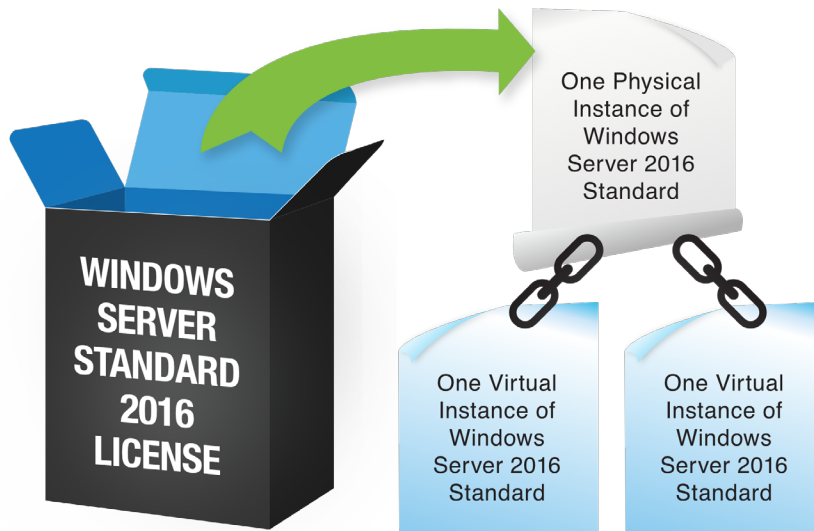


What you must always remember, at all times, is that a Microsoft operating system license is bound to specific hardware. It usually cannot be moved. Even when it can, it must be moved in its entirety. The various components and rights granted by a license cannot be split or shared across separate pieces of hardware.

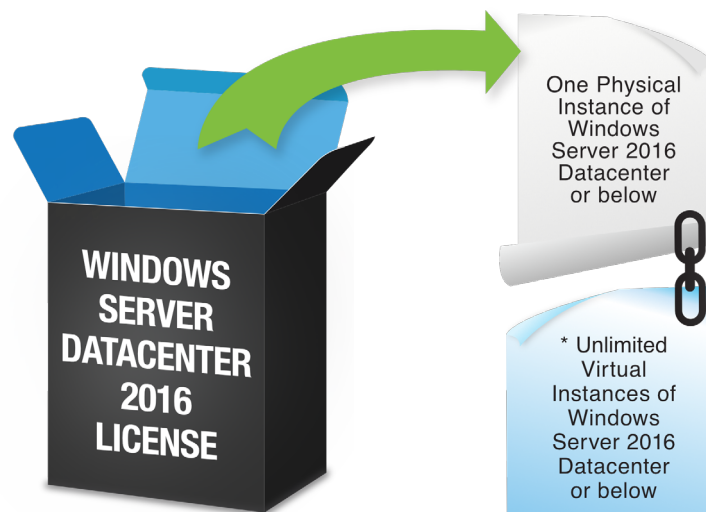
PHYSICAL INSTANCES AND VIRTUAL INSTANCES

Moving along from the basics, we now turn to the relationship between licenses and their instances. Standard and Datacenter editions of Windows include a single physical operating system installation right and two or more virtual instance installation rights. As you know from the rules outlined above, **the physical and virtual instances are inseparable!** You are not required to use the physical instance or both of the virtual instances, but **you cannot, for any reason, use any one of them on one piece of hardware and another of them on any different piece of hardware.**

A Windows Server Standard Edition license grants one physical instance and two virtual instances on licensed hardware.



A Windows Server Datacenter Edition license grants one physical instance and unlimited virtual instances on licensed hardware.



What's new in 2016 is that these licenses are bound to CPU core pairs instead of CPU pairs, as they were in 2012/2012 R2. The explanation of core licensing will be covered in an upcoming section.

THE HYPER-V SERVER LICENSE

Microsoft has an endemic problem with clearly naming products. Hyper-V is one of the most egregious examples. The confusing naming convention compounds difficulties understanding relevant licensing.

- “Hyper-V”, as a single word, refers to a particular technology. It is a type 1 hypervisor, and it ships as a component of Windows, Windows Server, and Hyper-V Server.
- “Hyper-V Server” is a product. In technical terms, it is a highly stripped-down version of Windows Server. In legal terms, it is a distinct entity with its own licensing requirements, separate from Windows and Windows Server.

The Hyper-V Server license is best understood in comparison to the Windows Server license. Standard, and Datacenter editions of Windows Server grant you the right to use one physical instance and at least one virtual instance of Windows Server. Hyper-V Server includes only a single instance right. Whether or not that single instance is physical or virtual does not really matter.

On one hand, the existence of Hyper-V Server is a positive thing. The license costs nothing, so you can download and install as many instances of Hyper-V Server as you desire. Furthermore, Hyper-V Server is more lightweight than even the emptiest installation of Windows Server (not counting Nano), so it’s an ideal environment to run Hyper-V.

On the other hand, the lack of any guest licensing rights in Hyper-V Server has led to the creation of a widespread myth that there is a licensing advantage to installing Windows Server as the physical operating system environment instead of Hyper-V Server. This is untrue. If you will be running any virtualized instances of Windows Server, the hardware that they run on must be licensed. That is a concrete, unchangeable fact, and it is in no way affected by your choice of hypervisor or physical operating system. You could be running XenServer or ESXi, and you would still need to provide sufficient licenses for the guests. Remember that **there is no requirement to use the physical operating system environment instance** granted by a license.

There are several feature-related benefits to installing Windows Server 2016 Datacenter Edition as the physical operating system environment, if you are licensed for it. These include Storage Spaces Direct and Storage Replica, which will not be discussed further

in this eBook. A feature relevant to this eBook is [Automatic Virtual Machine Activation](#). This feature allows you to enter a special key into your Windows Server 2012 R2 and Windows Server 2016 guests, and the host will automatically deal with their license activation routine. To reiterate previous points, the presence or absence of Automatic Virtual Machine Activation (because you might have chosen a different physical operating system environment) does not affect the legality of your licensing situation in any way. It is simply a convenience feature.

The fact that Hyper-V Server does not require a paid license gives it a great advantage that no Windows Server allows. You can upgrade Hyper-V Server at any time without cost. If you need to perform a license transfer from one physical hardware device to another, perhaps because you want to retire the source device without purchasing a new license, you know that you won't run into any problems with using the same licensed physical operating system environment on two systems simultaneously.

SUMMARIZING THE LICENSING RULES

There is a lot to digest up to this point, so let's take a quick moment to review the most important points:

- Rights for a physical and virtual operating system environments granted by a license are inseparable, do not move, and cannot be split. You cannot buy a single license, install its physical operating system environment on one computer, and use its virtualization rights to create and run virtual machines on other computer systems.
- Using a physical operating system environment other than what is assigned to the hardware is legally acceptable, provided that you are otherwise legally licensed to use the physical operating system environment. For example, Windows Server 2016 Standard edition as a guest of Hyper-V Server 2016 is perfectly acceptable as long as you have enough licenses for that Windows Server 2016 guest.
- The license that you purchase is assigned to particular hardware, not the operating system instances.

- If you use a technology such as Live Migration to transfer an instance of Windows Server from one physical computer to another, the license does not transfer with it; the target system must be properly licensed for that instance in advance.

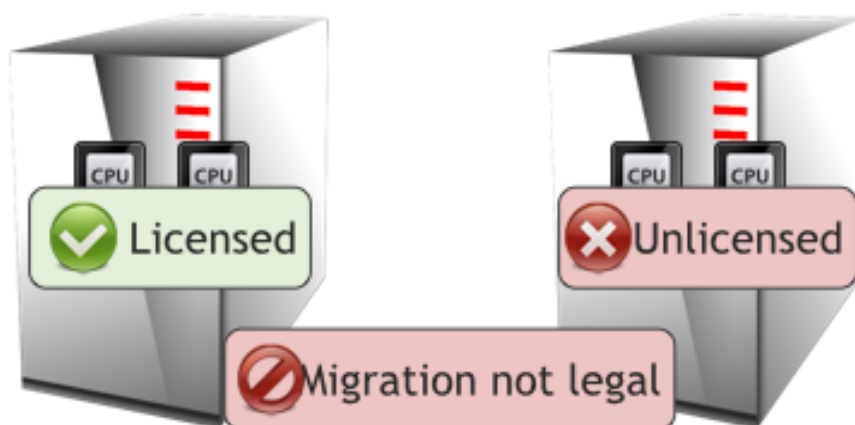
Keys cause some of the greatest conceptual issues with understanding licensing, because keys are entered into software instances. Licenses are bound to hardware. That is the core concept of importance.

LICENSE TRANSFERS

Virtual machines are highly portable, so they bring questions about license transferability into sharp focus. Your basic goal is to avoid license transfers whenever possible. A volume license can be transferred from one piece of hardware to another one time, but then not again for 90 days (unless the computer system has completely failed and cannot be repaired).

The 90-day restriction means that Live Migrations, especially within a cluster, are not a good method for license transfers. For one thing, you cannot move the physical operating system as easily as you can the guests, so a license transfer via Live Migration is inherently a violation of the license.

OEM licenses typically do not allow any transferability of any kind.



If the above does not make sense, remember that a “key” and a “license” are not the same thing. The key that you enter into the licensing box of a virtual machine’s operating system will, out of necessity, move along with it. The license stays with

the source hardware. From a legal standpoint, the license is the only thing that is important.

In order to retain a legal licensing status, the source and destination hosts involved in a virtual machine migration must be fully licensed for any and all virtual machines that they might ever operate at any given time.

LICENSE STACKING

In order to ensure that you have sufficient licenses, you may find it necessary to stack licenses. This means that you purchase more than one license for the same hardware. The Datacenter Edition allows for unlimited virtual machines on licensed hardware, but Standard Edition only allows for two. This does not mean that you must purchase a Datacenter Edition license if you wish to run three virtual machines. Instead, purchase a second Standard Edition license.



The number of licenses necessary for a particular number of instances will be fleshed out in the section on core licenses.

CORE AND NANO

In 2012/2012 R2, you could choose between installing a GUI or remaining in Core mode, and both of those options carried forward into 2016. Core mode strips away all GUI elements and left you with only character mode interfaces, although Windows Forms applications will still run. Core mode does not affecting your licensing situation in any way; you can freely switch between GUI or Core mode.

Windows Server 2016 offers a new installation method called “Nano”. Nano moves past Core and strips away everything except the bare minimum to operate Windows Server. You must piece in the components necessary to operate desired services. Unlike Core, Nano does have licensing implications. You can only use Nano if you have an active Software Assurance agreement. Otherwise, it follows the same rules as Windows Server with a GUI.

CONTAINERS

Containers are a new feature introduced in Windows Server 2016. They are offered in two types: Windows Server containers and Hyper-V containers. This is how licensing impacts containers:

- A Windows Server container does not require a new instance, therefore a Windows Server container does not count against any of your allowed licensing instances in any way
- A Hyper-V container does require a new instance, therefore the instance inside a Hyper-V container follows the same licensing pattern as if it were a virtual machine. In other words, licensing draws no distinction between a Hyper-V virtual machine and a Hyper-V container.

CORE LICENSES

Unlike earlier versions, Windows Server 2016 is licensed by physical CPU core. This has made it more difficult to easily determine what is necessary to fully license a host. Per-core licensing of Windows Server 2016 has these traits:

- **A single license is applied to two CPU cores in the same physical host**
- **Each physical processor must have sufficient licenses to cover a minimum of eight cores** (four licenses). This is true even if the physical processor does not have eight cores. More licenses might be required, depending on physical core count.
- **Each physical host must be licensed as though it has at least two physical processors**, even if it has only one. This sets a hard minimum of 16 physical cores (8 licenses) for any single system.
- **Every core in a host must be licensed.**
- Windows Server Standard licenses provide for one pOSE and two vOSEs on a licensed core pair.
- Windows Server Datacenter licenses provide for one pOSE and unlimited vOSEs on a licensed core pair.
- Windows Server Essentials is still by CPU. Consult your licensing reseller for more information.

The biggest takeaway, especially for small businesses, is that you must purchase a minimum of eight licenses per physical host. According to Microsoft's promotional material, the cost of sixteen Windows Server 2016 licenses is comparable to a 2 CPU Windows Server 2012 R2 license at the same tier.

At this point, we return to the stacking discussion that we started earlier. If you want a single physical host to run three virtualized instances of Windows Server 2016 Standard, then you do not need to purchase Datacenter licensing. However, every core in the host must be licensed to run three instances of Windows Server 2016 Standard Edition. Because each license allows for two instances, that means that you must purchase two licenses (which translates to four allowed vOSE instances) for every core.

While this seems complicated, the math is actually quite simple. First, determine the number of processor pairs in the host. A single quad core has two pairs, a dual hex core has six pairs, etc. Next, determine the number of Windows Server Standard vOSEs/ Hyper-V Containers that you'll install in virtual machines and divide that by two, rounding up. Four vOSEs is two, seven vOSEs is four, etc. If you'll be using Datacenter Edition instead of Standard, then the second number is always one. Then multiply the

first number by the second number. The final result must always be at least eight.

Standard Edition: (number of physical cores / 2 rounded up) * (Standard Edition vOSEs / 2) = licenses (at least 8)

Datacenter Edition: (number of physical cores / 2 rounded up) = licenses (at least 8)

CLUSTERING

One of the worst mistakes that administrators make is believing that combining their Hyper-V hosts into a cluster means that they can safely move virtual machines around. This belief paves a fast track to a hefty fine. The rule about a license being bound to a particular piece of hardware is unbreakable, even in a cluster. Each host must have enough licenses for the maximum number of virtual machines that it might ever run. As a general rule, you will license every node in a cluster as though it will run every virtual machine in that cluster (because most medium and large clusters will require Datacenter licensing anyway).

VIRTUALIZATION RIGHT FORFEITURE

Microsoft has very strict rules regarding Windows Server as a pOSE when it is running Hyper-V. They will not support any role or feature alongside Hyper-V that is not explicitly intended to service the pOSE or its virtual machines. Furthermore, any such roles or features, or any other applications that do not meet the same guidelines, result in forfeiture of a guest virtualization right from each licensed core.

To explain, consider a dual eight-core system. Its administrator installs Hyper-V, and believing the “chicken-and-egg” myth, also installs Active Directory Domain Services. With the minimum purchase of eight Standard Edition licenses, the administrator may operate only a single Standard Edition virtual machine. Active Directory Domain Services installed in the pOSE consumes one of the two virtualization rights for this host.

Microsoft has not published a comprehensive list of roles, features, and applications that can lead to virtualization right forfeiture. Backup and antivirus software and agents that are only responsible for the pOSE and its guests are generally considering

acceptable; almost all others should be assumed as causing forfeiture, **even if you can be reasonably certain no other systems are taking advantage**. These would include, but not be limited to:

- Active Directory Domain Services and related features and roles
- IP (ex: DHCP and IPAM) and DNS services
- File and print services
- Web servers, except those dedicated to management of host hardware (ex: OpenManage)

CLIENT ACCESS LICENSES

Hyper-V does not directly provide any user-level services to clients, therefore it is not considered in any Client Access License calculations. Unless you have installed some role, feature, or software that would cause virtualization right forfeiture (outlined in the previous section), CALs are only applicable to vOSEs.

CLIENT HYPER-V

Client Hyper-V was introduced in Windows 8 and has appeared in every version of Windows since then, including Windows 10. It provides the same fundamental technology that you'll find in Hyper-V, but with several server-class features missing, such as Live Migration. Just as Hyper-V ships as a built-in role for Windows Server and requires no licensing on its, Client Hyper-V does not require licensing.

However, the operating systems within any virtual machines hosted by Client Hyper-V must follow the same licensing discussed above. Hopefully, this is not surprising. The licensing requirements for a virtualized instance are not dependent upon the hypervisor in any way; they are the same under Hyper-V, ESXi, Client Hyper-V, XenServer, VirtualBox, and all others.

WINDOWS AND LINUX VIRTUAL MACHINES

When virtualized in the datacenter, Windows (desktop products, such as Windows 10) falls under an extremely complicated licensing scheme. If included in a proper virtual desktop infrastructure (VDI), you can work with your reseller to determine your licensing requirements. Typically, it will all fall under a virtual desktop access (VDA) agreement.

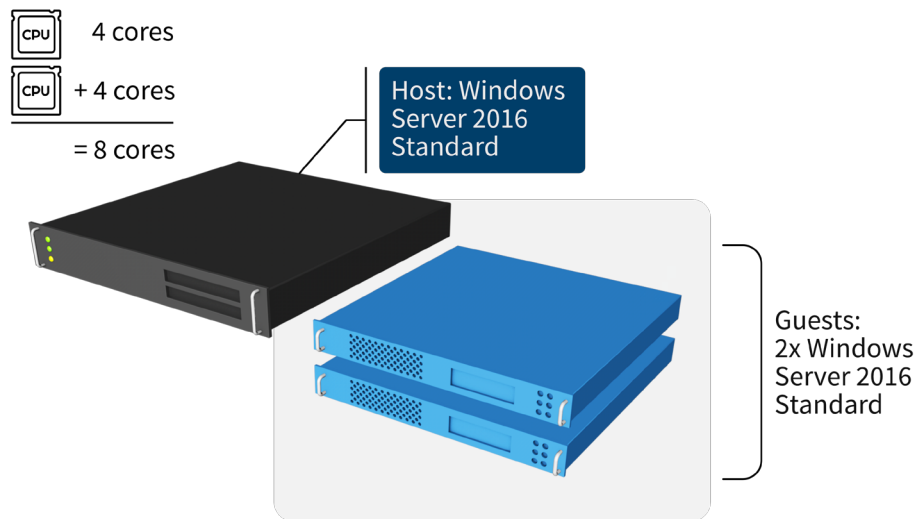
If you virtualize a desktop instance that isn't included in VDI, licensing becomes even less clear. Simply operating it would fall under the typical licensing requirements for Windows, but accessing it from a remote system in any fashion would fall in the purview of VDA. Windows licensing in a virtual environment is tricky and best handled by credentialed experts familiar with your environment and goals.

Because Microsoft does not require any licensing for virtual machines themselves, Linux instances do not require any licensing fees to be paid to Microsoft. The Linux distribution that you select may have its own licensing rules, so direct any questions to those responsible for the distribution.

EXAMPLES

You have been presented with a mountain of detail up to this point, and parsing it all out to determine how it applies to your situation might be difficult. To help, let's look at a few example situations and how they would be licensed.

EXAMPLE 1

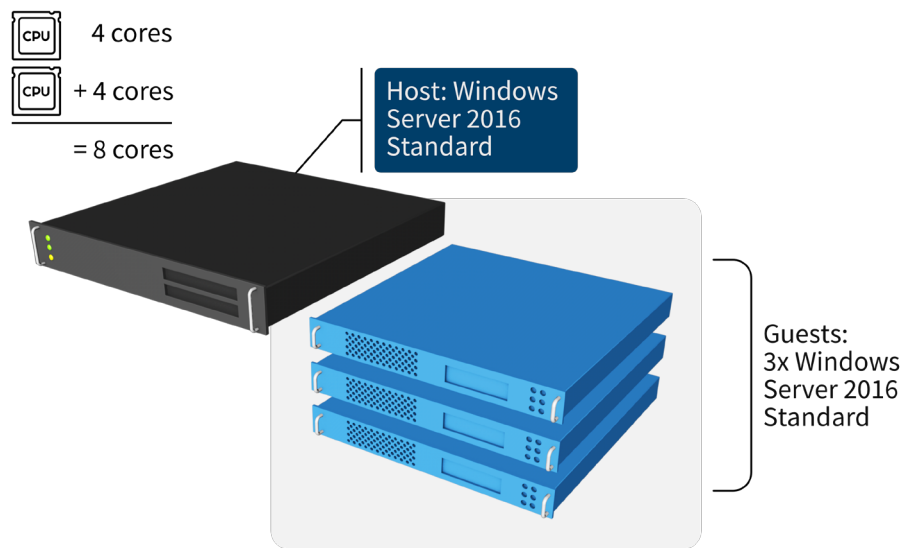


- One physical host, dual quad core, running Windows Server 2016 Standard Edition
- Two virtual machines running Windows Server 2016 Standard Edition

Necessary license: 8x Windows Server 2016 Standard Edition

Discussion: This is a typical small business build. On the one hand, it unfortunately requires more licenses than can be used because of the minimum requirement. On the other hand, it doesn't cost any more than licensing the same system under Windows Server 2012 R2.

EXAMPLE 2

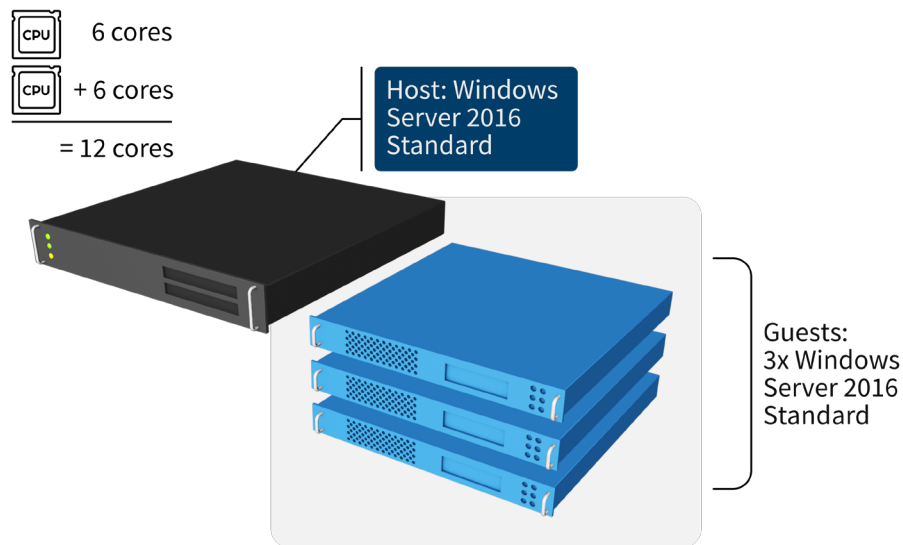


- One physical host, dual quad core, running Windows Server 2016 Standard Edition
- Three virtual machines running Windows Server 2016 Standard Edition

Necessary license: 8x Windows Server 2016 Standard Edition

Discussion: This is exactly the same scenario as the build from example 1 except a third virtual machine has been added. It might seem that more licenses would be necessary. However, because of the minimum purchase level, every core pair in this system (4) already has two licenses, which works out to two licensed Windows Server 2016 Standard Edition vOSEs per core. This host can run between two and four virtual machines for the same price.

EXAMPLE 3

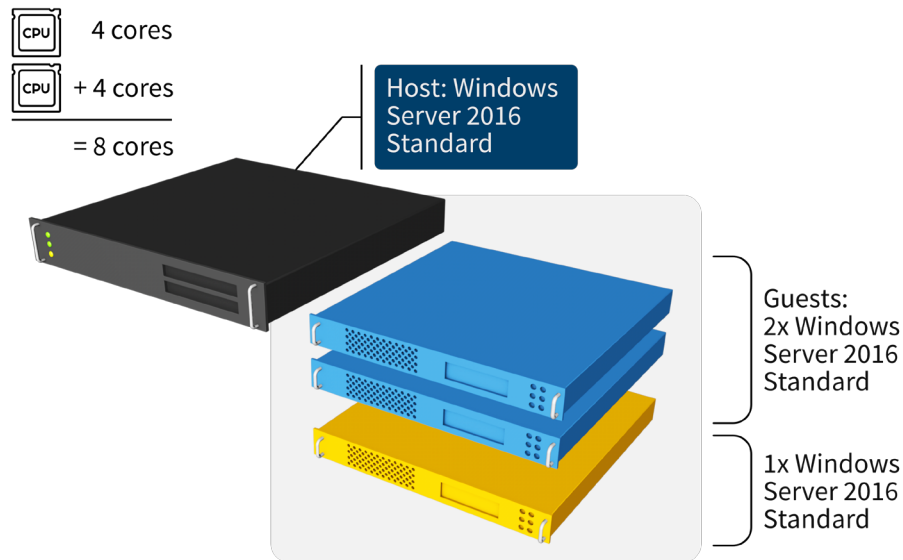


- One physical host, dual hex core, running Windows Server 2016 Standard Edition
- Three virtual machines running Windows Server 2016 Standard Edition

Necessary License: 12x Windows Server 2016 Standard Edition

Discussion: The number of virtual machines on this host is the same as from example 2, but the physical system has two more cores. The minimum of 8 licenses is not sufficient. There are six processor pairs that require two licenses apiece, therefore 6 times 2 for a total of twelve licenses.

EXAMPLE 4

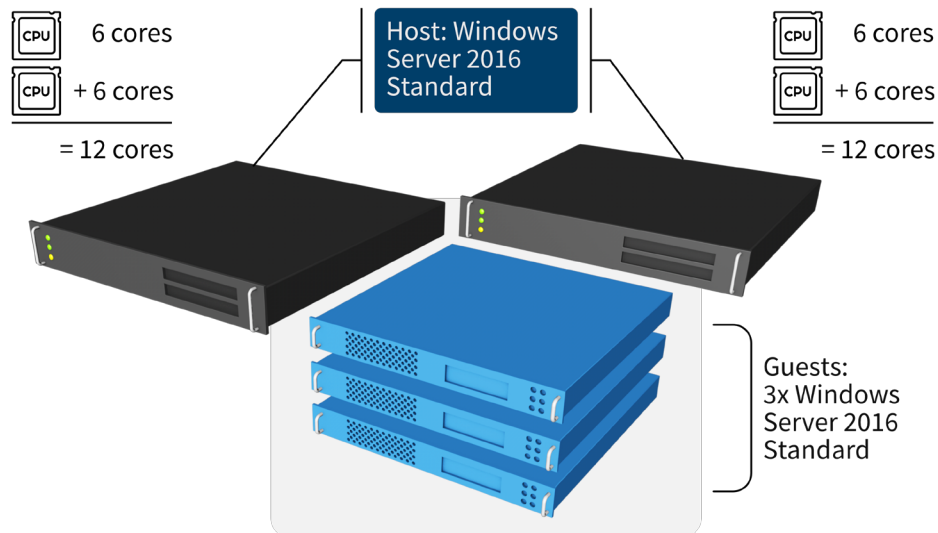


- One physical host, dual quad core, running Windows Server Standard Edition
- Two virtual machines running Windows Server 2016 Standard Edition
- One virtual machine running Windows Server 2016 Datacenter Edition

Necessary License: 8x Windows Server 2016 Datacenter Edition

Discussion: The lone Datacenter Edition guest is enough to require that every core in this system be licensed for Datacenter Edition, which will cause the cost to be very high. It is in the best interests of the administrator of this system to find a way to replace that Datacenter guest with a Standard Edition guest, in which case it would fall under the licensing for Example 2. Remember that you must always provide full licensing compliance for any and all guests running on a host.

EXAMPLE 5

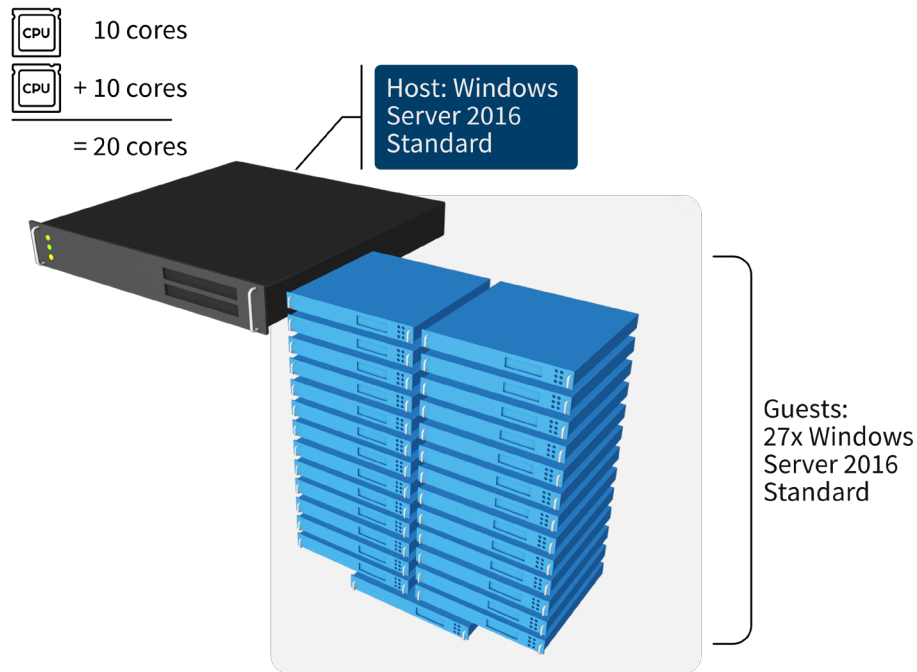


- Two physical hosts, each dual hex core, clustered, running Windows Server Standard Edition
- Three virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 24x Windows Server 2016 Standard Edition

Discussion: We've apparently increased the complexity of the situation by introducing clustering, but the truth is that the situation remains quite simple. If one node crashes or is even rebooted, all three virtual machines will be automatically shifted to the other node. Therefore, each node must have sufficient licenses for all three guests. The math for each individual node is the same as from example 3. You then simply multiple by two because you have two nodes, and you arrive at 24 necessary licenses.

EXAMPLE 6

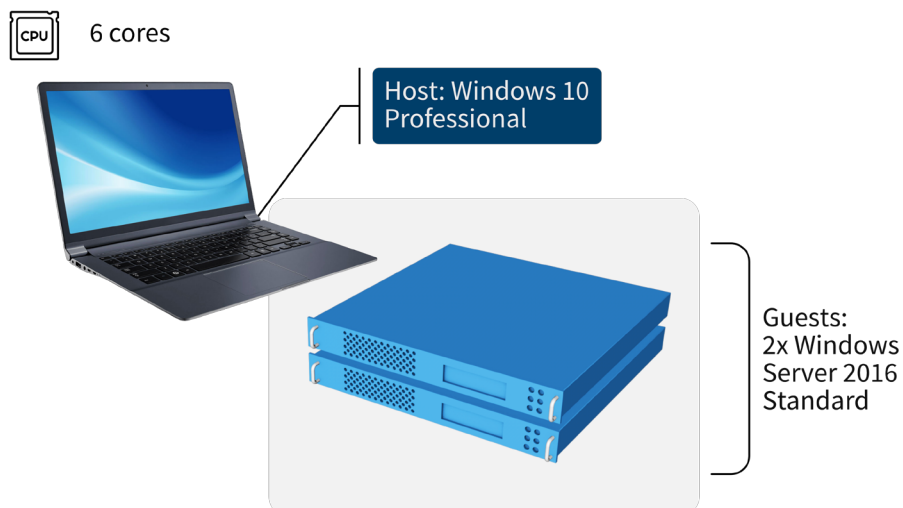


- One physical host, dual ten core, running Windows Server 2016 Standard Edition
- Twenty-seven virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 140x Standard Edition licenses OR 10x Datacenter Edition licenses

Discussion: There is a point at which you have so many virtual machines that stacking Standard Edition licenses is no longer economically feasible. The exact breakpoint will depend upon your licensing discount, but that breakpoint will certainly be reached well before twenty-seven virtual machines on a host. If you work with a reseller on volume licensing instead of purchasing retail, you can almost always get a discount.

EXAMPLE 7

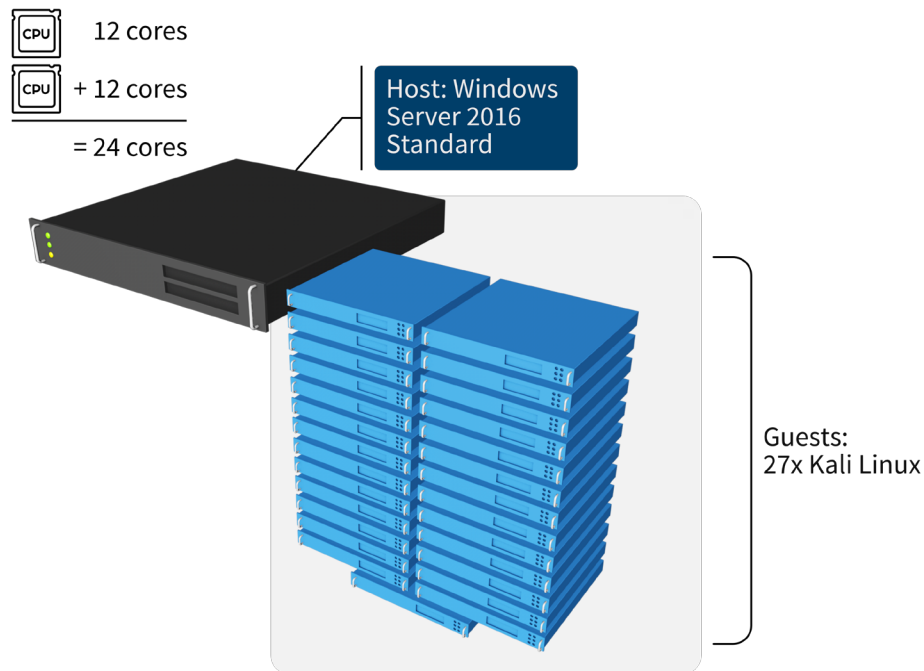


- One physical laptop, single hex core, running Windows 10 Professional
- Two virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 1x Windows 10 Professional, 8x Windows Server Standard Edition

Discussion: Using a different hypervisor changes nothing, even if it's a desktop or a laptop. You must properly license the pOSE and all vOSEs. It is possible that this system qualifies for MSDN licensing, but it is upon the system owner to be certain.

EXAMPLE 8

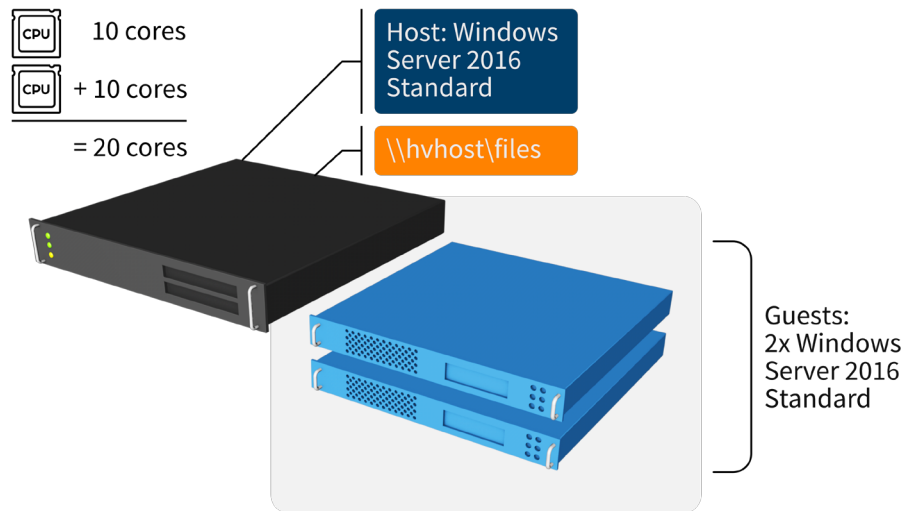


- One physical system, dual twelve-core, running Hyper-V Server 2016
- Twenty-Seven virtual machines running Kali Linux

Necessary License: None

Discussion: Microsoft will not require you to purchase any license for this system.

EXAMPLE 9

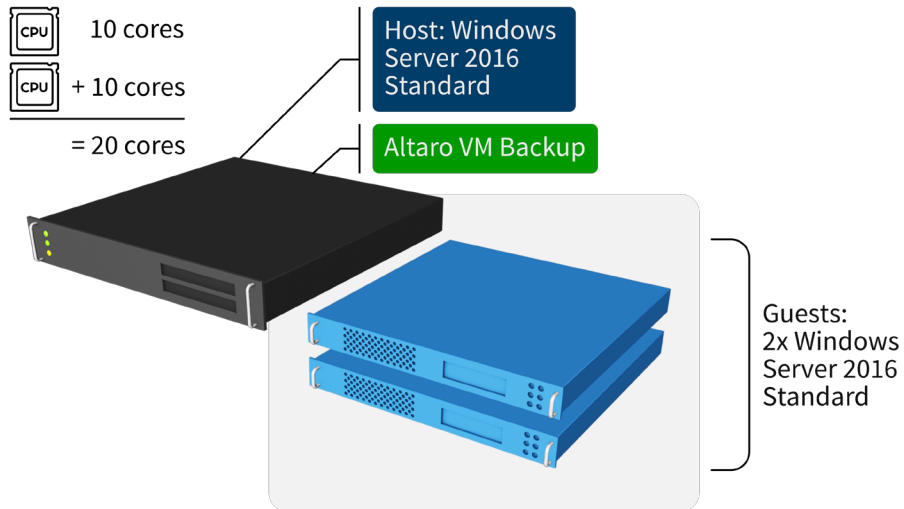


- One physical system, dual ten-core, running Windows Server 2016 Standard Edition sharing a folder
- Two virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 20x Windows Server Standard Edition, sufficient CALs

Discussion: Because the pOSE is sharing a folder, it is both a Hyper-V server and a file server. The file server causes forfeiture of a guest virtualization right and a requirement for Client Access Licenses. Because there are two virtual machines, this means that you must have sufficient licensing for three virtual machines, pushing your requirement up to a second license for each core pair. Turning off the file share will allow you to avoid purchasing the second license, dropping the licensing requirement down to 10x Standard Edition licenses and eliminating the CAL requirement.

EXAMPLE 10

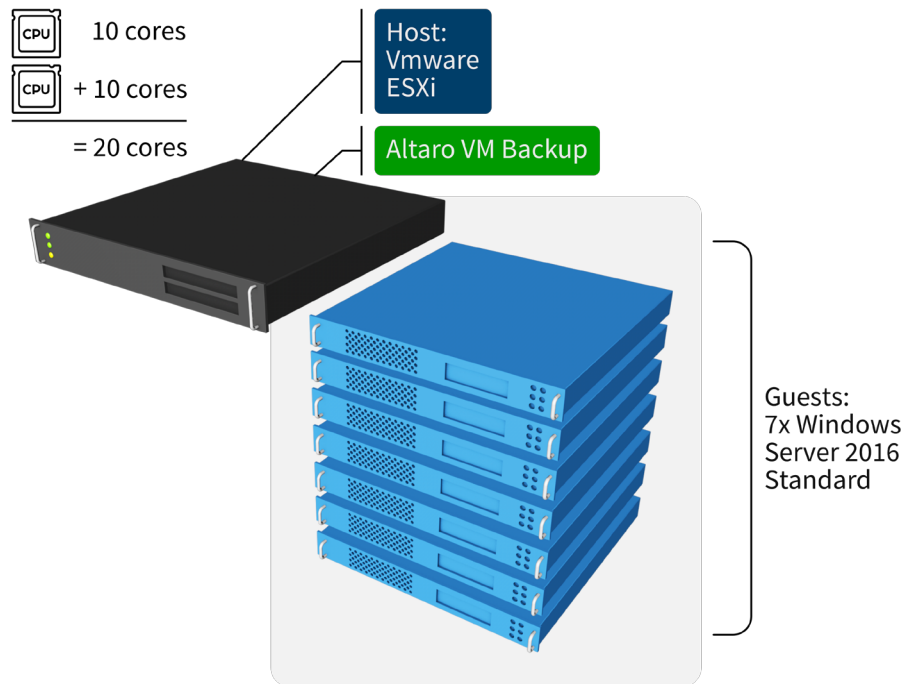


- One physical system, dual ten-core, running Windows Server 2016 Standard Edition and Altaro VM Backup
- Two virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 10x Windows Server Standard Edition, 1x Altaro VM Backup

Discussion: This system is exactly the same as example 9, but the software in this instance is a backup program that is devoted to the pOSE and its vOSEs. No license forfeiture occurs in this case.

EXAMPLE 11

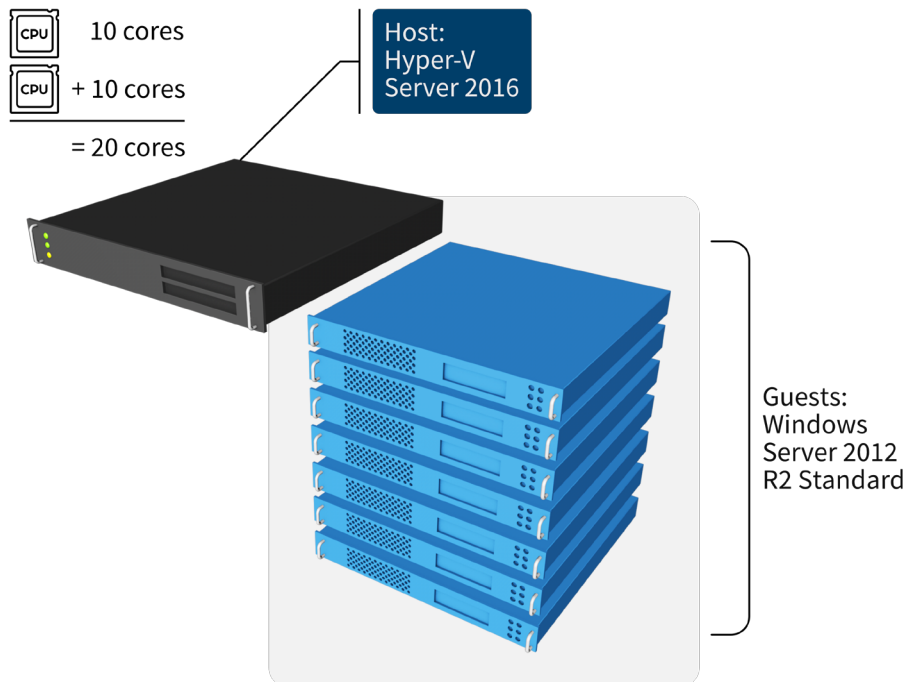


- One physical system, dual ten-core, running VMware ESXi and Altaro VM Backup
- Seven virtual machines, running Windows Server 2016 Standard Edition

Necessary License: 60x Windows Server Standard Edition licenses, 1x Altaro Unlimited Edition, current VMware requirements for 60 VMs on ESXi

Discussion: The only difference between Example 11 and Example 10 is the hypervisor choice. Notice that what you owe Microsoft does not change, even though you are not using a Microsoft pOSE. This illustrates both the stacking of licenses and the fact that you are not required to install what you are licensed to install.

EXAMPLE 12

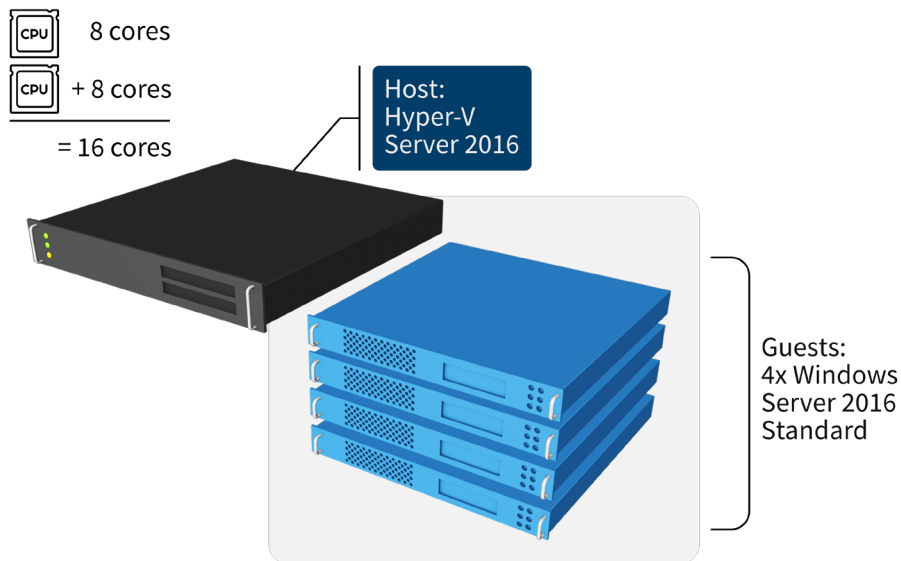


- One physical system, dual ten-core, running Hyper-V Server and Altaro VM Backup
- Seven virtual machines, running Windows Server 2012 Standard Edition

Necessary License: 60x Windows Server Standard Edition licenses, 1x Altaro Unlimited Edition

Discussion: This example follows the pattern set by examples 10 and 11 to reinforce that the licensing requirements for the guests are in no way impacted by the choice of the physical operating system environment.

EXAMPLE 13



- One physical system, dual eight-core, running Hyper-V Server 2016
- Four virtual machines running Windows Server 2016

Pre-existing Installation Necessary License: 2x Windows Server 2012 R2 Standard Edition licenses

New Installation Necessary License: 8x Windows Server 2012 R2 Standard Edition licenses

Discussion: This example illustrates two things.

1. If this system was previously built with Hyper-V Server 2012 R2 as the pOSE, the administrator has every right to immediately upgrade it to Hyper-V Server 2016 and continue running whatever virtual machines that the physical system was already licensed for without any changes.
2. If this system is being purchased new but the administrator cannot use Windows Server 2016 in guest operating systems (perhaps because software vendors do not yet support it), then the organization must purchase Windows licenses according to the current license terms and then exercise their downgrade rights to use previous versions of Windows.

This design is fairly simplistic, but closely matches reality. You will not always be able to use the most current operating system, and a virtual environment offers the flexibility

to mitigate the negative effects of running earlier operating systems. Licensing for a new system always means purchasing as though you would run the current version of the operating system in every virtual machine.

If you are retiring older physical systems, you can legally transfer their licenses to newer systems in accordance with any applicable restrictions. You cannot legally upgrade their operating systems unless you purchase the requisite licenses under current terms.

ABOUT ALTARO

Altaro Software (www.altaro.com) is a fast growing developer of easy to use backup solutions used by over 30,000 customers to back up and restore both Hyper-V and VMware-based virtual machines, built specifically for Small and mid-market business with up to 50 host servers. Altaro take pride in their software and their high level of personal customer service and support, and it shows; Founded in 2009, Altaro already service over 30,000 satisfied customers worldwide and are a Gold Microsoft Partner for Application Development and Technology Alliance VMware Partner.

ABOUT ALTARO VM BACKUP

Altaro VM Backup is an easy to use backup software solution used by over 30,000 Small and mid-market business customers to back up and restore both Hyper-V and VMware-based virtual machines. Eliminate hassle and headaches with an easy-to-use interface, straightforward setup and a backup solution that gets the job done every time.

Altaro VM Backup is intuitive, feature-rich and you get outstanding support as part of the package. Demonstrating Altaro's dedication to Hyper-V, they were the first backup provider for Hyper-V to support Windows Server 2012 and 2012 R2 and also continues support Windows Server 2008 R2.

For more information on features and pricing, please visit:

<http://www.altaro.com/vm-backup>

Don't take our word for it – Take it for a spin!

DOWNLOAD YOUR FREE COPY OF ALTARO VM BACKUP

and enjoy unlimited functionality for 30 days. After your 30-day trial expires you can continue using the product for up to 2 VMs for free, forever. No catch!

Altaro VM Backup - Trusted by over 30,000 SMBs

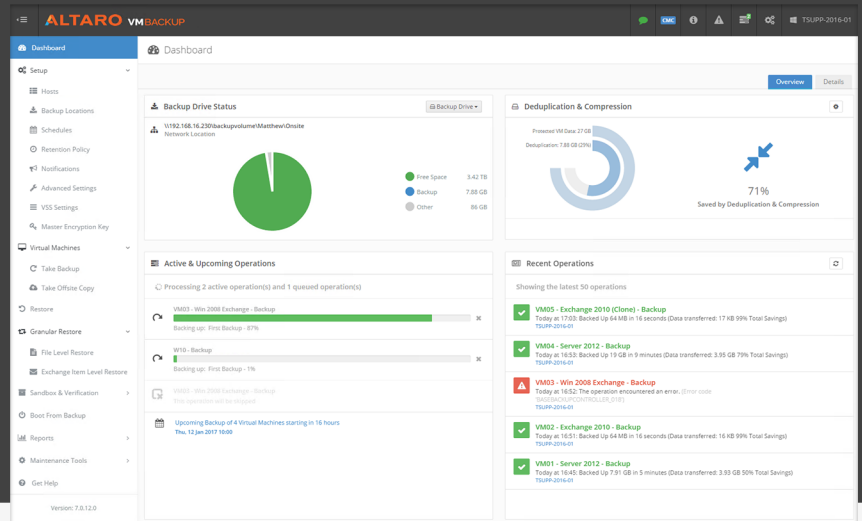
New v7! Altaro VM Backup for Hyper-V & VMware. Hassle-free and affordable VM backup software. Grab your free copy for 2 VMs now!

- ✓ Hassle-free and effective
- ✓ Unbeatable Value
- ✓ Outstanding Support

Free for 2 VMs, forever.

Back up unlimited VMs for 30 -days. After 30-days you get 2 VMs for free, forever. Download now!

Backup Now!

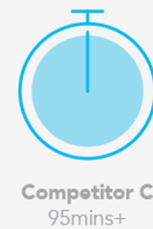
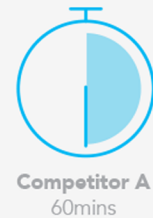


Up and running quickly, without the need for complex configurations!

With Altaro VM Backup, you can install and run your first virtual machine (VM) backup in less than 15 minutes. Get up and running quickly, without the need for complex configurations or software dependencies.

Altaro VM Backup is designed to give you the power you need, without the hassle and steep learning curve.

- **Easy to use, intuitive UI** - making it easy to implement a rock solid backup strategy
- **Managing and configuring backup/restore jobs across multiple hosts has never been simpler**
- **Full control & scalability** - Monitor and manage all your Hyper-V and VMware hosts from a single console



Virtual machine backup software packed with powerful features for Hyper-V and VMware.

[View Features](#)

ABOUT ERIC SIRON



I have worked in the information technology field since 1998. I have designed, deployed, and maintained server, desktop, network, and storage systems. I provided all levels of support for businesses ranging from single-user through enterprises with thousands of seats.

Along the way, I have achieved a number of Microsoft certifications and was a Microsoft Certified Trainer for four years. In 2010, I deployed a Hyper-V Server 2008 R2 system and began writing about my experiences. Since then, I have been writing regular blogs and contributing what I can to the Hyper-V community through forum participation and free scripts.

FOLLOW ALTARO

Like our eBook? **There's more!**

Subscribe to our Hyper-V blog <http://www.altaro.com/hyper-v> and receive best practices, tips, free Hyper-V PowerShell scripts and more here: <http://www.altaro.com/hyper-v/sign-up>

Follow Altaro at:



SHARE THIS RESOURCE!

Liked the eBook? Share it now on:

