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Microsoft Private Cloud

A comparative look at Functionality, Benefits, and Economics

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Microsoft

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Executive Summary

In this whitepaper, we compare private cloud solutions from Microsoft and VMware. We do this by defining private cloud using industry standard concepts, explain the Microsoft products needed to create a Microsoft private cloud solution and then define the technology benefits a Microsoft private cloud solution provides. We also examine how the licensing models differ between Microsoft and VMware and, in particular, how those licensing models will impact the ROI of investments you are making today and long into the future.

Microsoft private cloud solutions are licensed on a per processor basis, so customers get the cloud computing benefits of scale with unlimited virtualization and lower costs – consistently and predictably over time. VMware private cloud solutions are licensed by either the number of virtual machines or the virtual memory allocated to those virtual machines – charging you more as you grow. This difference in approach means that with Microsoft your private cloud ROI increases as your private cloud workload density increases. With VMware, your cost grows, as your workload density does.

Our analysis shows that a VMware private cloud solution can cost from five to sixteen times more than a comparable Microsoft private cloud solution over a period of one to three years.

The reason for this significant cost difference is VMware's per-VM licensing for private cloud products like VMware vCenter Operations Management Suite which charges $34,250 for 25 VMs (Enterprise Plus edition, U.S. suggested license list price) and drives this cost differential.

Economics has always been a powerful force in driving industry transformations and as more and more customers evaluate cloud computing investments that will significantly affect ROI, now is the time to provide the information they need to make informed decisions, for today and tomorrow.

What is a Private Cloud?

Private cloud is a computing model that uses resources which are dedicated to your organization. A private cloud shares many of the characteristics of public cloud computing including resource pooling, self-service, elasticity and pay-by-use delivered in a standardized manner with the additional control and customization available from dedicated resources.

Fig. 1: Private Cloud Attributes

While virtualization is an important technological component of private cloud, the key differentiator is the continued abstraction of computing resources from infrastructure and the machines (virtual or otherwise) used to deliver those resources. Only by delivering this abstraction can customers achieve the benefits of private cloud – including improved agility and responsiveness, reduced TCO, and increased business alignment and focus. Most importantly, a private cloud promises to exceed the cost effectiveness of a virtualized infrastructure through higher workload density and greater resource utilization.

Microsoft Private Cloud – Unlimited Virtualization Rights

Microsoft private cloud solutions are built using Windows Server with Hyper-V and System Center – the combination of which provides enterprise class virtualization, end-to-end service management and deep insight into applications so you can focus more attention on delivering business value. Microsoft private cloud solutions are delivered through our wide ecosystem of partners and are offered as custom, pre-configured, or hosted offerings - so, no matter your unique business need; there is a Microsoft private cloud solution for it.

Microsoft private cloud solution is licensed through the Microsoft Enrollment for Core Infrastructure[1] (ECI) licensing program. ECI is a Microsoft Enterprise Agreement (EA) enrollment, available in two editions (Datacenter and Standard), that allows a simple and flexible per processor licensing option.

ECI Datacenter is strongly recommended for customers exploring Microsoft private cloud solutions.

ECI Datacenter edition includes Windows Server Datacenter, which supports unlimited virtualization rights. This means that customers license on a per processor basis, with ability to have unlimited Windows Server based virtual machines on a particular physical processor. **Additionally, ECI Datacenter also includes System Center 2012 Datacenter edition, which provides rights to manage an unlimited number of physical or virtual operating system environments**. The components of ECI Datacenter are shown below.

Fig. 2: Microsoft ECI Datacenter Components and Value Proposition

* New Component Introduced with System Center 2012

[1] Microsoft ECI licensing program details here, more details in Appendix A

Our approach is focused on delivering the benefits of scale to you – through unlimited virtualization rights and significantly simplified licensing for Windows Server and System Center. A deeper cost analysis is provided in the Private Cloud Economics section of this whitepaper.

VMware Private Cloud – Per-VM Licensing

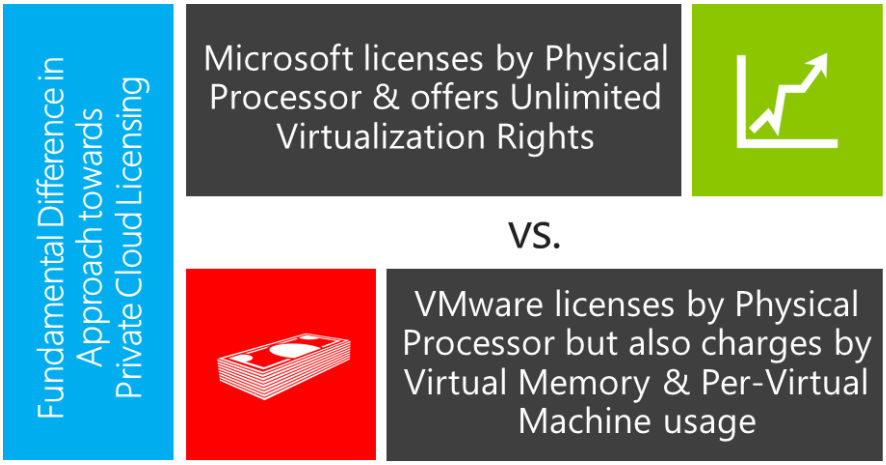
In 2011, VMware announced the latest version of its virtualization platform, vSphere 5.0, along with updated versions of surrounding technologies; vCenter Site Recovery Manager, vShield Security and vCloud Director. These products collectively are referred to as Cloud Infrastructure Suite. VMware has also released several management products like vCenter Operations Management Suite and vFabric Application Performance Manager (APM) to provide capabilities like monitoring, application performance management, and configuration management. To build a comparable private cloud solution using VMware technologies, you'll require components from VMware Cloud Infrastructure suite, vCenter Operations Management Suite and vFabric APM as a private cloud solution requires capabilities like monitoring, configuration, automation, orchestration and security in addition to the virtualization platform. We explore the product comparisons later in the whitepaper.

Unlike Microsoft ECI Datacenter, VMware Cloud Infrastructure Suite, vCenter Operations Management Suite, and vFabric APM cannot be licensed as a single SKU, but have to be licensed separately for individual products. Moreover, VMware private cloud products follow a combination of three different licensing schemes-

- **vSphere 5.0 is licensed on a per processor basis with virtual RAM entitlements**[2]
- **vCenter is licensed on a per-instance basis**[3]
- **Cloud Infrastructure products - vCloud Director, vCenter Site Recovery Manager, and vShield are licensed on a per-VM basis**[3]
- **vCenter Operations Management Suite and vFabric APM are licensed on a per-VM basis**[5]

This fundamental difference in private cloud licensing approach implies choosing VMware for your private cloud solution can cost you up to $4730 per-VM (3 year license and support cost included). We'll provide an explanation later on how this cost is calculated.

Fig. 3: Differences in approach towards private cloud licensing



[2] vSphere 5 & vCenter 5 licensing information from VMware website as of January, 2012

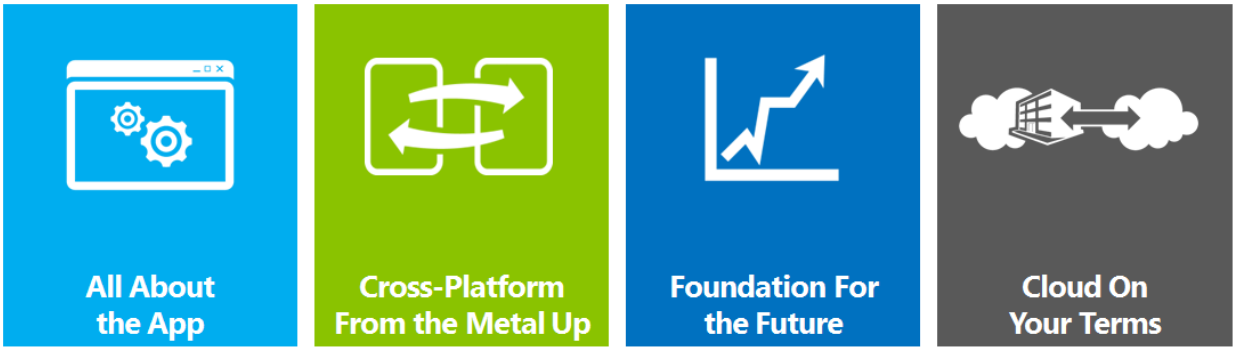
[3] vCloud Director, vCenter SRM, vShield, vCenter Operations Management Suite, vFabric APM licensing information from VMware website as of January, 2012

Before we get into a detailed immediate and long term cost analysis of each private cloud solution, we will explore the Microsoft private cloud and the business value it delivers – in greater detail.

Microsoft Private Cloud – Business Benefits

The Microsoft Private Cloud is a unique and comprehensive offering, built on four key "pillars".

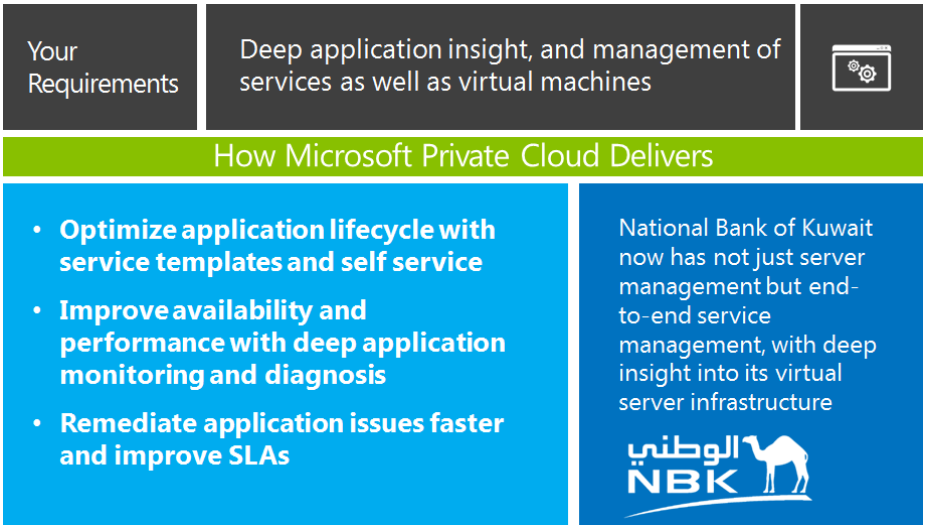
- **All About the App**: Application centric cloud platform that helps you focus on business value.
- **Cross-Platform From the Metal Up**: Cross-platform support for multi-hypervisor environments, operating systems, and application frameworks.
- **Foundation For the Future**: Microsoft Private Cloud lets you go beyond virtualization to a true cloud platform.
- **Cloud On Your Terms**: Ability to consume cloud on your terms, providing you the choice and flexibility of a hybrid cloud model through common management, virtualization, identity and developer tools.



Microsoft offers a private cloud that delivers real value today AND positions a business to take advantage of greater public cloud benefits in the future. Let's look at each of these pillars in depth.

All About the App

Applications are the lifeblood of your business. The ability to deploy new applications faster and keep them up and running more reliably is the central mission of IT as a competitive differentiator. To gain a real edge, you need to go beyond just managing infrastructure.



National Bank of Kuwait Case Study

With the Microsoft Private Cloud, you can:

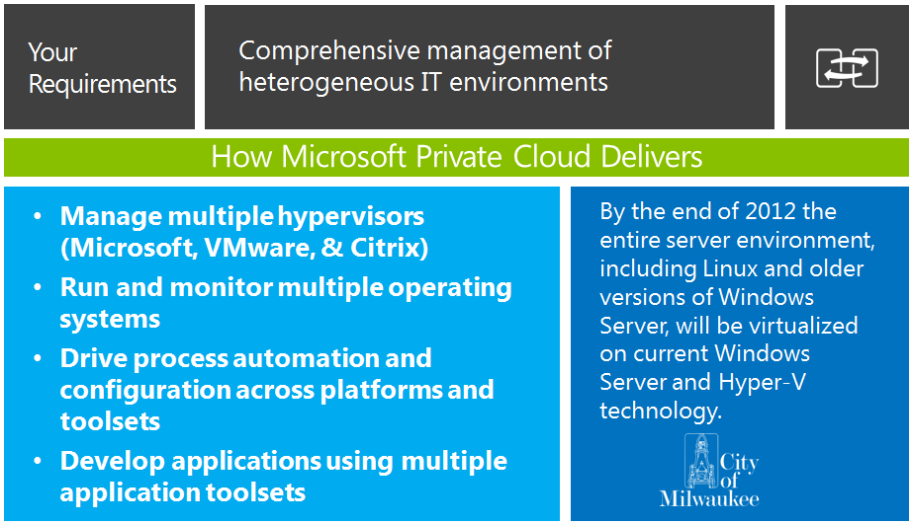
- Optimize the application lifecycle with service templates and self service
- Improve availability and performance with deep application monitoring and diagnosis
- Remediate application issues faster and improve SLAs

The Microsoft Private Cloud lets you deliver applications as a service. You can deploy both new and legacy applications on a self-service basis, and manage them across private cloud and public cloud environments. You can even virtualize server applications to simplify deployment and upgrading. And with a new way to see what's happening inside the performance of your applications, you can remediate issues faster – before they become show-stoppers. The result is better SLA's, better customer satisfaction, and a new level of agility across the board.

Microsoft Private Cloud provides you *deep application insight, and management of services as well as virtual machines.*

Cross-Platform From the Metal Up

No datacenter is an island. Odds are, you run and manage an IT environment today that is deeply heterogeneous, with a wide range of OS, hypervisor, and development tools in the mix. You want to gain the advantages of private cloud computing, but not if it means walking away from your existing IT investments or adding new layers of complexity. Microsoft takes an open and comprehensive approach that puts customers' needs ahead of any particular technology.



City of Milwaukee Case Study

With the Microsoft Private Cloud, you can:

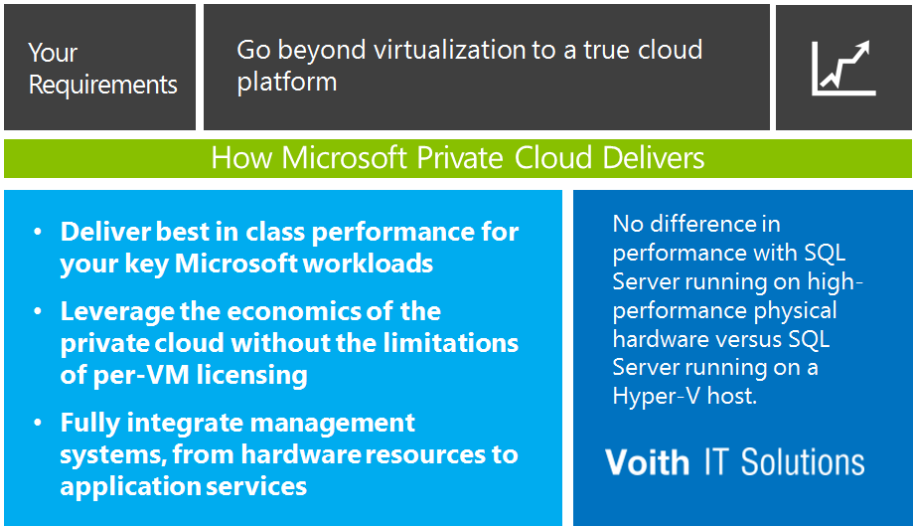
- Manage multiple hypervisors (Microsoft, VMware, & Citrix)
- Run and monitor multiple operating systems
- Drive process automation and configuration across platforms and toolsets
- Develop applications using multiple application toolsets

The Microsoft Private Cloud lets you keep what you've got and make the move now to a new kind of agility. That's because it's architected from the raw metal up to enable process automation and configuration across platforms and environments. Because the Microsoft Private Cloud provides comprehensive management of heterogeneous IT environments, you can put your business's needs ahead of the needs of any particular technology or vendor.

Microsoft Private Cloud gives you *comprehensive management of heterogeneous IT environments.*

Foundation For the Future

Cloud computing offers the promise of unlocking new innovation and transforming the role of IT in driving business success. The game is no longer about virtualization and server consolidation. A private cloud delivers fundamentally new capabilities that represent a fundamental shift in computing. The bet you make today will have long-term implications for the future of your business.



Voith IT Solutions Case Study

With the Microsoft Private Cloud, you can:

- Deliver best-in-class performance for your key Microsoft workloads
- Leverage the economics of the private cloud without the limitations of per-VM licensing
- Fully integrate management systems, from hardware resources to application services

For more than 15 years, Microsoft has operated some of the world's biggest and most advanced datacenters, and we've driven the evolution of major Internet services such as Windows Live, Hotmail, and Bing. Our experience is unmatched in the industry, and we've taken all that we've learned and put it into the DNA of our products.

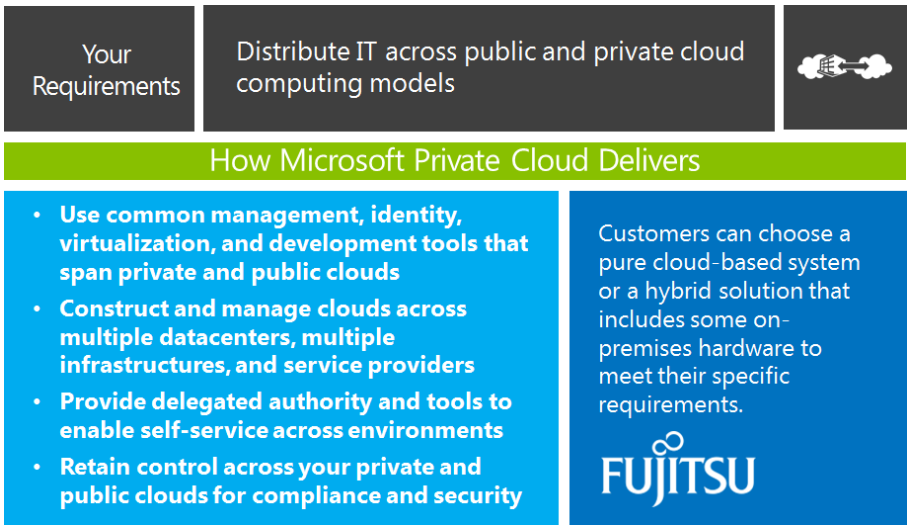
Microsoft workloads (including SharePoint, Exchange, and SQL Server) work best on the Microsoft Private Cloud. But the story is much bigger than that. We've architected our platform and our management approach to be comprehensive and deeply integrated, spanning private and public cloud scenarios. Our goal is to take our customers beyond virtualization – and unnecessary per-VM licensing – and proceed with confidence in building a secure and manageable private cloud that delivers great performance and compelling economics.

Microsoft Private Cloud lets you *go beyond virtualization to a true cloud platform.*

Cloud On Your Terms

The move to cloud computing involves more than just building a private cloud. The undeniable benefits of public

cloud computing – on-demand scalability, flexibility, and economics, as we've discussed – also promise significant competitive advantages. The challenge is to leverage your existing investments, infrastructure, and skill sets to build the right mix of private and public cloud solutions for your business – one that will work for you today and in the future.



Fujitsu Case Study

With the Microsoft Private Cloud, you can:

- Use common management, identity, virtualization, and development tools that span private and public clouds
- Construct and manage clouds across multiple datacenters, multiple infrastructures, and service providers
- Provide delegated authority and tools to enable self-service across environments
- Retain control across your private and public clouds for compliance and security

With Microsoft, you have the freedom to choose. Because Microsoft solutions share a common set of management, identity, virtualization, and development technologies, you can distribute IT across physical, virtual, and cloud computing models. Our solutions are built to give you the power to construct and manage clouds across multiple datacenters, infrastructures, and service providers – on terms that you control. That means you can keep a handle on compliance, security, and costs. And you can let your business needs drive your IT strategy, instead of having IT limit your options.

Microsoft Private Cloud lets you *distribute IT across public and private cloud computing models.*

Private Cloud Features Comparison

In this section we look at the features comparison between Microsoft and VMware private cloud products. As seen earlier, Microsoft private cloud solutions are built using Windows Server with Hyper-V and System Center and licensed through ECI, a simple and flexible per-processor licensing option. To build a comparable private cloud using VMware, you'd need components from its Cloud Infrastructure Suite, vCenter Operations Management Suite and vFabric APM.

Let's discuss the capabilities required to deliver IT as a service using a private cloud computing model.

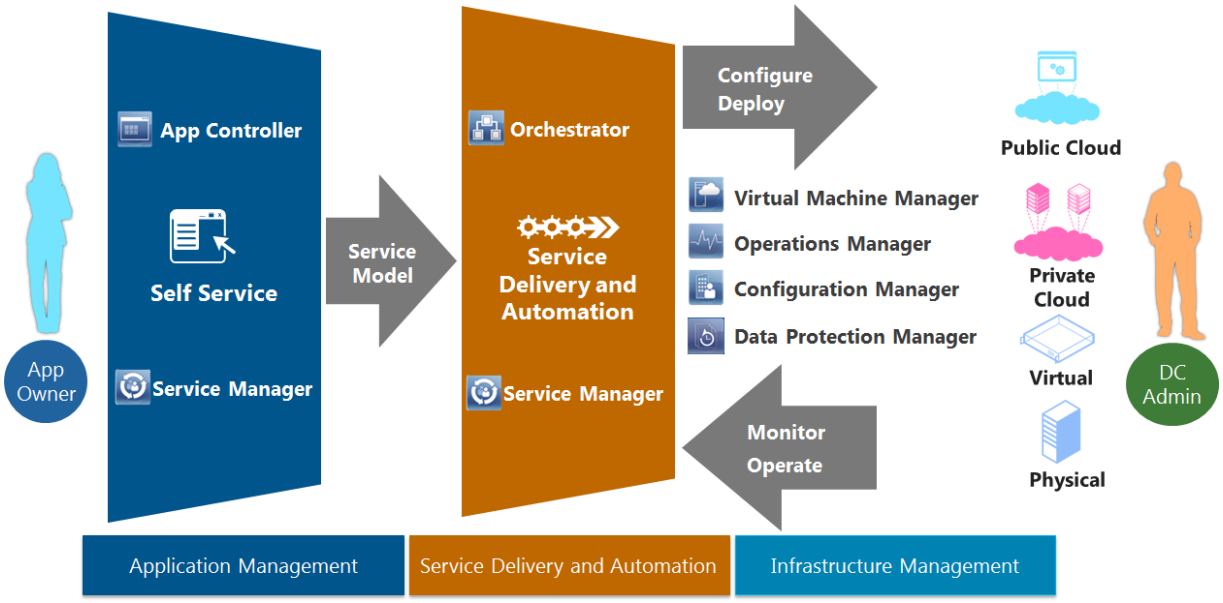
- First, you need a "simple" **self-service experience** to enable your application owners to specify their

requirements.

- Next, you need a way to understand the topology and architecture of the application service in question. An application deployed in on an abstracted, or cloud computing model is called a "service". This would necessitate a "**service model**" that accurately binds the application's architecture to the underlying resources where it will be hosted.
- You will need a set of **process automation capabilities** to break down this application provisioning request into the enterprise change requests that need to be implemented. This could include setting up the underlying infrastructure and then a set of app configuration/release requests that need to be tracked (and ideally implemented with orchestrated automation).
- Next, you need a set of provisioning tools that actually **configure and deploy** the infrastructure and application layers.
- Once the underlying infrastructure and application service are deployed, they would immediately need to be "**discovered**" and **monitored** for reporting and health tracking.

The graphic below shows how the System Center 2012 components offer these life cycle management capabilities in combination to help you deliver IT as a Service as per your organization's requirements.

Fig. 4: System Center 2012 capabilities enabling you to deliver IT as Service



If we think about all the processes involved in delivering IT as a service, they can really be categorized into three buckets:

- **Application Management**: Deploying and operating your business applications
- **Service Delivery & Automation**: Standardizing and automating service and resource provisioning, managing change and access controls, etc.
- **Infrastructure management**: Deploying and operating the entire underlying infrastructure on which your business applications and services run.

The table below shows the products required to deliver IT as service using a private cloud computing model. As you can see below, to build a comparable private cloud based on VMware, you'd need several components like Cloud Infrastructure Suite products (vSphere, vCenter, vCloud Director, vCenter Site Recovery Manager), vCenter

Operations Management Suite and vFabric among others.

Fig. 5: Microsoft and VMware Private Cloud products comparison

Customer Scenario	Industry Capability	Microsoft Private Cloud Products		VMware Private Cloud Products
Application Management	Application Self-Service	System Center 2012	App Controller, Service Manager	vCloud Director
	Application Performance Management		Operations Manager	vFabric Application Performance Manager (APM)
	Application Management Across Clouds		Virtual Machine Manager	vCloud Director, vCloud Connector
Service Delivery & Automation	IT Service Management		Service Manager	VMware Service Manager
	IT Service Reporting (Operations)		Service Manager	vCenter Operations Management Suite
	Process Automation & Orchestration		Orchestrator	vCenter Orchestrator
Infrastructure Management	Cloud Creation & Delegation		Virtual Machine Manager	vCloud Director
	Data Protection & Disaster Recovery		Data Protection Manager, Orchestrator	vCenter Site Recovery Manager
	Monitoring		Operations Manager	vCenter Operations Management Suite
	Configuration & Compliance		Configuration Manager	vCenter Operations Management Suite
Virtualization Platform	Hypervisor &VM Management	Windows Server 2008 R2 Hyper-V, Virtual Machine Manager		vSphere 5.0, vCenter 5.0

With System Center 2012, standalone products become components of integrated product management license, which means that customers can get all the private cloud components with a single license, simplifying purchasing and management.

Other than the licensing advantage, Microsoft also offers several competitive advantages over VMware for private cloud as shown below

Microsoft Private Cloud	VMware Private Cloud
Operations Manager • Provides a single pane of glass to monitor infrastructure, network, applications, transactions, and code • Provides a single pane of glass to monitor applications running on private and public cloud (Windows Azure) • Provides a single pane of glass to monitor physical and virtual infrastructure • Provides a single pane of glass to monitor Microsoft and non-Microsoft platforms, including Unix, Linux and VMware	**vCenter Operations Manager Suite (vCOPs), vFabric APM** • vCOPs is needed for monitoring infrastructure and network. vFabric APM is needed for monitoring applications and code. These products are not completely integrated. • vCOPs cannot monitor apps and vFabric APM cannot monitor apps running on VMware's PaaS platform, Cloud Foundry • vCOPs cannot monitor physical infrastructure. VMware sells another product, Hyperic that is needed for monitoring apps running on physical infrastructure, but it can only monitor a limited set of apps. Unlike Operations Manager, it cannot monitor business critical apps like SQL, Exchange, and SharePoint. • vCOPs Enterprise Plus edition can integrate with 3rd party products, but is priced at $34,250 for 25 VMs

Orchestrator	vCenter Orchestrator
• Mature product with best-in-class workflows and automation • Provides a true IT Pro authoring environment • Provides automation throughout the datacenter (Physical and Virtual) • 30+ integration packs, mostly focused on 3rd party tools	• Rebranded from Lifecycle Manager • Complicated developer focused authoring environment • Automates only the virtual environment in the datacenter • Only 13 plug-ins, mostly focused on VMware products (5 plug-ins VMware centric)
Configuration Manager	**vCenter Operations Manager Suite (vCOPs), vCenter Configuration Manager**
• Configuration Manager is the most widely-used configuration life cycle management tool in the market & has been available since 1996 • Empowers users- enables device freedom and application self-service • Helps improve user satisfaction and free up helpdesk resources though service management integration	• New product, first released to market in 2011 • No concept of application self-service • Limited integration with VMware Service Manager for service management tasks
Virtual Machine Manager	**vCenter**
• Offers multi-hypervisor support (Microsoft, VMware, Citrix) • Server App-V integration, Service Templates • Provides built-in resiliency	• Cannot manage hypervisors other than ESXi/ESX • Nothing comparable to Server App-V technology • Buy separately the expensive vCenter Heartbeat product for resiliency
Windows Server 2008 R2 Hyper-V	**vSphere 5**
• Built-in Virtualization with unlimited virtualization rights • Leverage familiarity with Windows • Hyper-V best choice for virtualizing Microsoft workloads	• Purchase as a separate product; vSphere 5 imposes memory based licensing • Learn a new technology from the ground up • Deal with complicated support models when virtualizing Microsoft workloads on vSphere

Private Cloud Economics

In this section, we first compare the private cloud licensing differences between Microsoft and VMware. Next, we illustrate the cost differences through a simple example of a private cloud with 500 VMs. Finally, we analyze the impact of licensing differences on future growth scenarios and show that as your workload density increases, your costs on VMware increases significantly.

Private Cloud Licensing Comparison

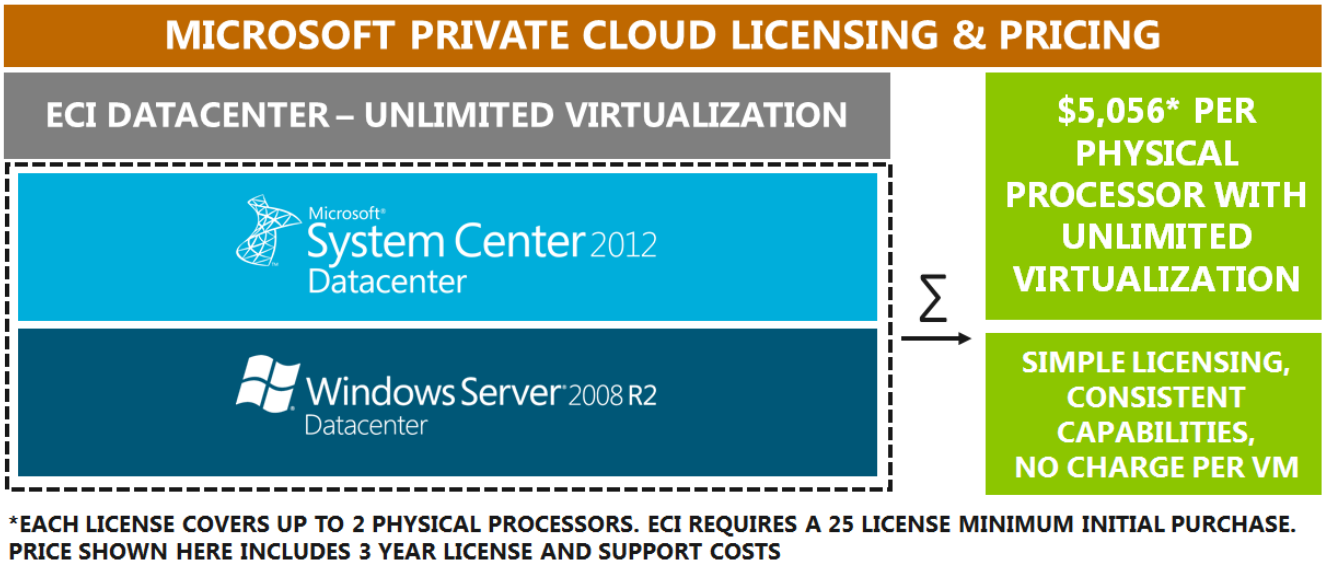
As mentioned earlier, you can use Windows Server and System Center to build Microsoft based private cloud solutions. To build a comparable private cloud solution on VMware technologies, you'll require the components from VMware Cloud Infrastructure Suite, vCenter Operations Management Suite, and vFabric APM. Unlike Microsoft ECI, these products cannot be licensed as a single SKU, but have to be licensed separately for individual products. Moreover, VMware private cloud products follow a combination of three different licensing schemes-

- **vSphere 5.0** is licensed on **a per processor** basis with virtual RAM entitlements
- **vCenter** is licensed on a **per-instance** basis
- **Cloud Infrastructure products** - vCenter Site Recovery Manager, vShield Security and vCloud Director are licensed on a **per-VM** basis

- **vCenter Operations Management Suite** and **vFabric APM** are licensed on a **per-VM** basis

The licensing & pricing comparison between Microsoft and VMware private cloud solutions are shown below. These prices include licensing and support prices for 3 years based on published U.S. suggested list prices for both VMware and Microsoft. We include Microsoft Software Assurance[4] (SA) for Microsoft ECI Datacenter[5] and VMware Production Support and Subscription[6] (SnS) for all VMware products. Appendix A provides details on Microsoft and VMware U.S. suggested list prices.

Fig. 6: Microsoft ECI Datacenter Licensing and Pricing (USD)



System Center 2012 introduces the following licensing improvements

- Standalone 'products' become components of integrated product Management Licenses
- Software Assurance is included with all licenses
- Server Management Licenses align to 'processor-based' model, each license covers 2 processors
- The right to run Management Server software and supporting SQL Runtime are now included with every Management License. Management Server Licenses are discontinued**.**

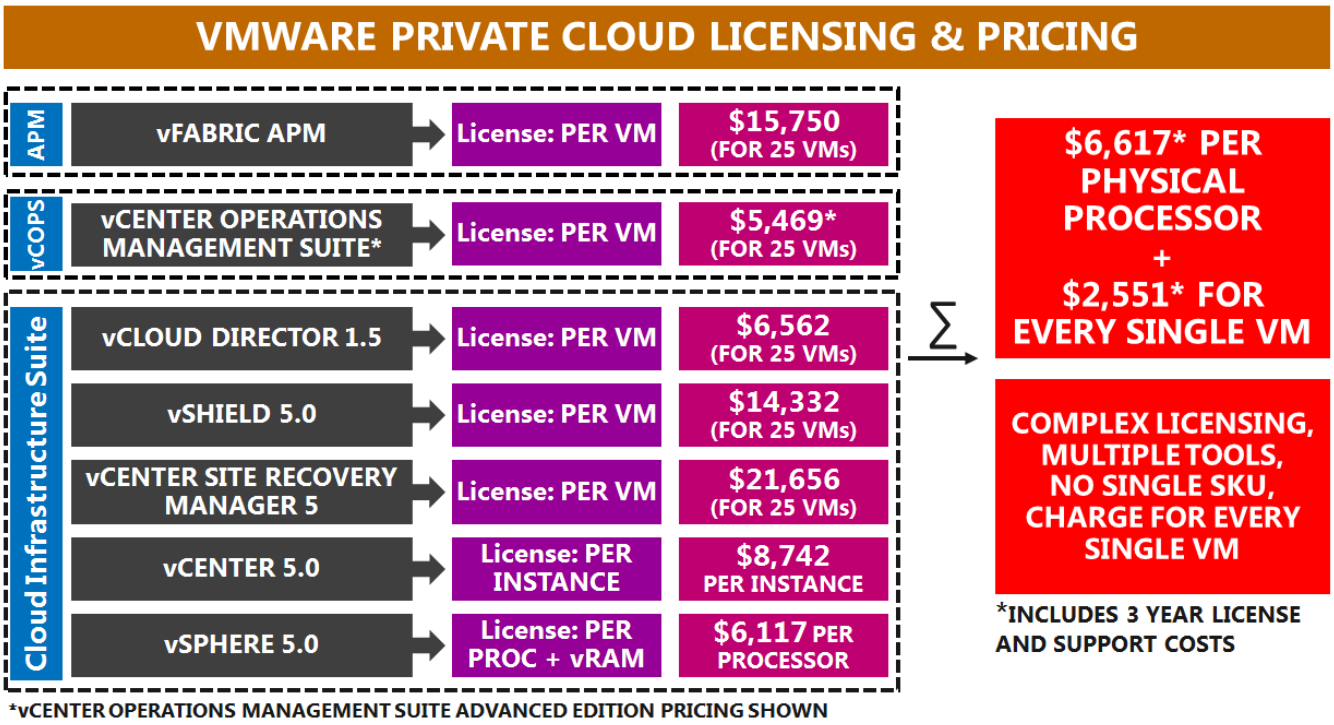
Most of the VMware private cloud products are licensed on a per-VM basis and these products are sold in packs of 25 virtual machine licenses[7]. The VMware private cloud licensing cost for a single VM is calculated as below:

VMware Private Cloud Licensing Cost Per-VM = ∑ List License Prices (Cloud Infrastructure Suite + vCenter Operations Management Suite + vFabric APM)/25

VMware Private Cloud Licensing Cost Per-VM =∑ ($21,656 + $14,332 +$6,562+ $5,469+ $15,750)/25 = $2,551 USD. This is illustrated through a simple graphic below.

[4] Microsoft Software Assurance information here
[5] Pricing for ECI Datacenter available in Appendix A, Windows Server 2008 R2 and System Center 2012 pricing available here
[6] Most of VMware products require at least 1 year of SnS. The service fee for Production SnS is 25% of the then-current list price of the product.
[7] VMware Private Cloud products such as vCloud Director, vCenter SRM, vShield, vCenter Operations Management Suite are sold in packs of 25 virtual machine licenses.

Fig. 7: VMware Private Cloud Licensing & Pricing (USD)



In the graphic above, we have included the **Advanced** edition of vCenter Operations Management Suite, which is ideal for SMB customers, but not for enterprise customers. As shown below, a viable private cloud requires configuration, compliance, and patching of guest operating systems and VMs. These capabilities are provided through the **Enterprise and Enterprise Plus**[8] editions of vCenter Operations Management Suite. We have included only the Enterprise Plus edition in our calculations for enterprise customers, as the configuration management capabilities in Enterprise edition are limited to vSphere hosts only.

Fig. 8: vCenter Operations Management Suite SKUs and components

vCENTER OPERATIONS MANAGEMENT SUITE

Edition	SMB		ENTERPRISE	
	Standard	Advanced	Enterprise	Enterprise Plus
Scope	Small vSphere environments	Large vSphere environments	Virtual & cloud infrastructure	Cloud & heterogeneous environments
vCENTER OPERATIONS MANAGER	YES (perf only)	YES	YES	YES
vCENTER INFRASTRUCTURE NAVIGATOR	NO	NO	YES	YES
vCENTER CHARGEBACK MANAGER	NO	NO	YES	YES
vCENTER CONFIGURATION MANAGER	NO	NO	YES (For vSphere Hosts Only)	YES

DIFFICULT TO IMPLEMENT A PRIVATE CLOUD WITHOUT HAVING CONFIGURATION MANAGEMENT CAPABILITIES FOR VMs & GUEST OPERATING SYSTEMS

[8] vCenter Operations Management Suite SKUs list from VMware website as of January, 2012

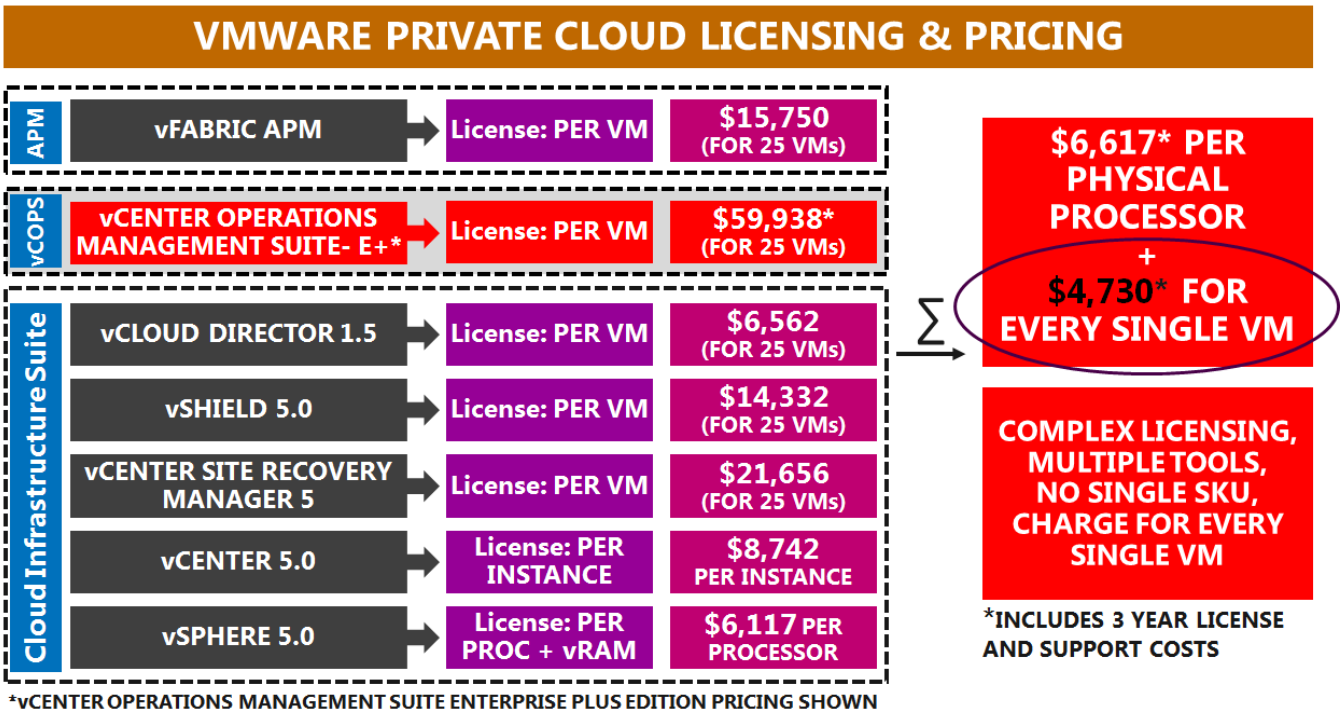
vCenter Operations Management Suite – Enterprise Plus edition is priced at $34,250 (U.S. suggested license list price for 25 VMs). Adding production SnS (@ 25% of base license price per year) for 3 years gives a total cost of $59,938 for 25 VMs. ($34,250 + 3*($34,250*.25))

VMware Private Cloud Licensing Cost Per-VM = ∑ List License Prices (Cloud Infrastructure Products + **vCenter Operations Management Suite- Enterprise Plus** + vFabric APM)/25

VMware Private Cloud Licensing Cost Per-VM =∑ ($21,656 + $14,332 +$6,562+ **$59,938**+ $15,750)/25 = **$4,730** USD

This is illustrated through a simple graphic below. Note that vCenter Operations Management Suite- Advanced edition has been replaced with the Enterprise Plus edition.

Fig. 9: VMware Private Cloud Licensing & Pricing with vCenter Operations Management Suite – Enterprise Plus



VMware Private Cloud Licensing Cost Per-VM for a Medium-Sized Business = $2,551 USD

VMware Private Cloud Licensing Cost Per-VM for an Enterprise Business = $4,730 USD

Depending on a medium-sized or enterprise business scenario, you might need to pay $2,551- $4,730 USD for every VM running in your private cloud if you are using VMware technologies. On the other hand, with Microsoft ECI Datacenter, you benefit from unlimited virtualization rights for Windows Server VMs along with management (monitoring, configuration, automation, orchestration, backup, virtual management, service management) for an unlimited number of VMs. Our licensing model delivers cost benefits up front and as you scale – helping you achieve the economic benefits of cloud computing. We illustrate this below through a simple example.

Private Cloud Cost Comparisons

In our analysis of private cloud costs between Microsoft and VMware, we only consider the software acquisition and support costs, including software licenses for virtualization, private cloud, management, and guest operating systems. We are not providing a complete datacenter or private cloud TCO (Total Cost of Ownership) analysis, as calculating operational costs, capital costs, and other datacenter related costs require complex calculations and are beyond the scope of this whitepaper. Additionally, complete datacenter TCO cost comparisons can get misleading because of different assumptions around operational and capital costs.

Set up your Private Cloud (let's say with 500 VMs)

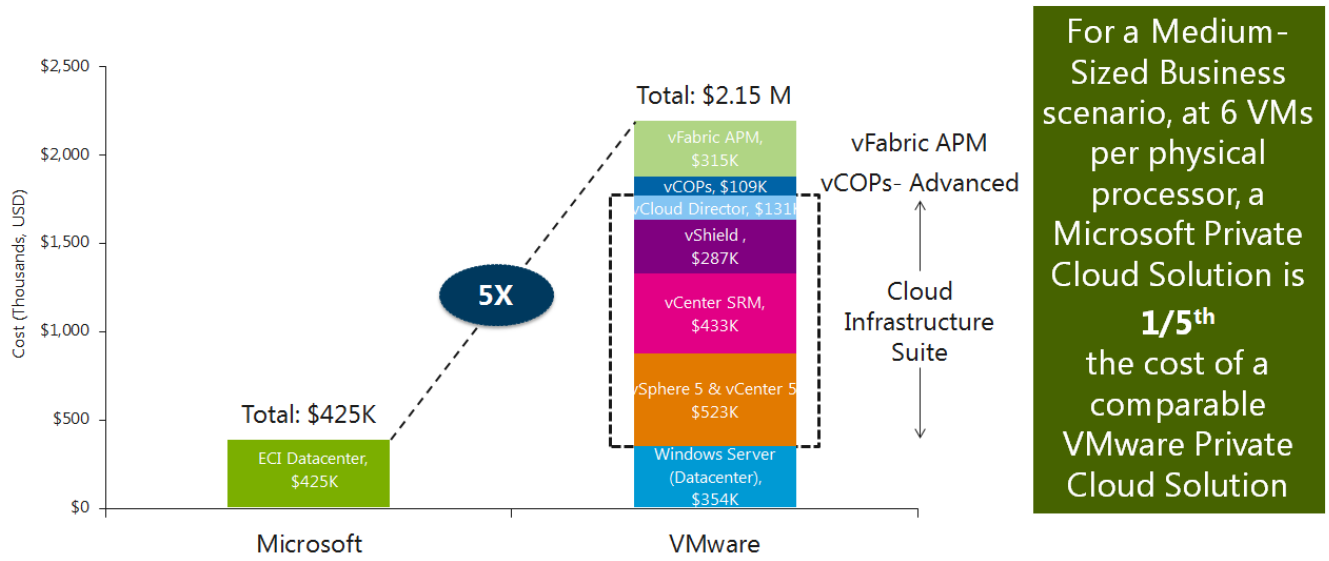
Let' say you want to set up a new private cloud with a fixed number of VMs. In our example, we consider an initial private cloud set up with 500 VMs. The costs below don't include hardware, storage, or operational costs. We consider both Medium-Sized and Enterprise Business scenarios.

Medium-Sized Business Scenario

In this case, we are using the **Advanced** edition of vCenter Operations Management Suite as it is targeted towards the SMB segment. Microsoft private cloud is licensed through ECI Datacenter and VMware private cloud through a combination of Cloud Infrastructure Suite, vCenter Operations Management Suite, and vFabric APM.

As shown below, with a fairly conservative consolidation ratio of 6 VMs per physical processor, a VMware private cloud solution can cost 5 times more than a comparable Microsoft private cloud solution over a period of one to three years. As you factor in the hardware costs, the cost difference is bound to go up because of the limitation imposed by vSphere 5.0 memory based licensing, which makes scale-up scenarios and memory overcommitment expensive to implement for VMware based private clouds.

Fig. 10: Medium-Sized Business: Private Cloud Cost Comparison- Microsoft & VMware for 500 VMs



vCOPs stands for vCenter Operations Management Suite. Appendix B provides detailed cost breakdowns

Assumptions

- Assumes 42 physical hosts with 2 CPU and six cores each

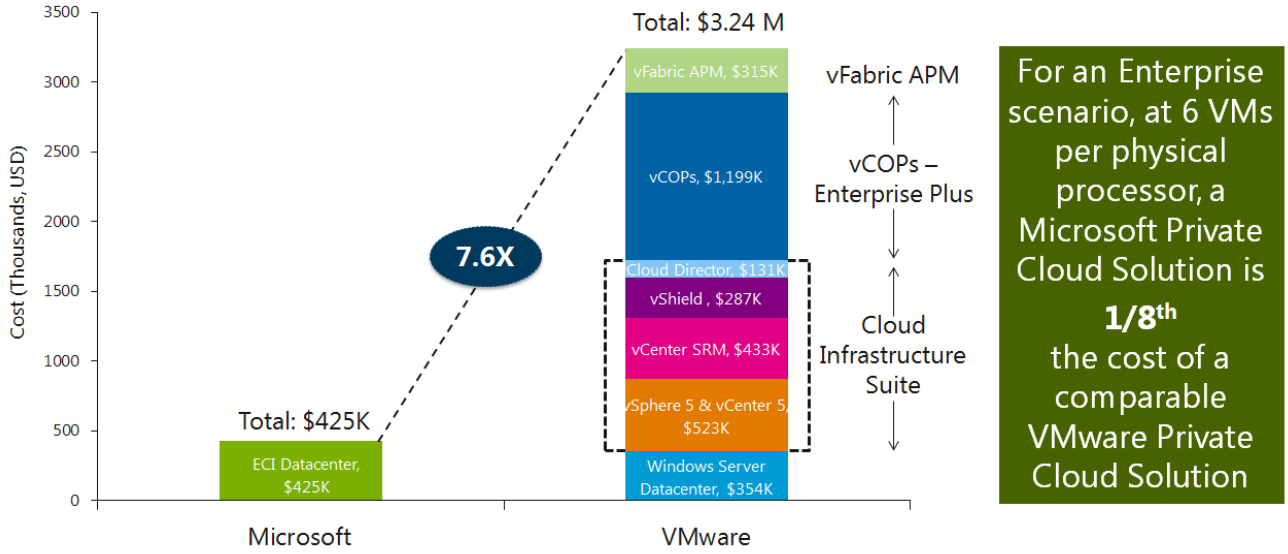
- Assumes 500 VMs at 6:1 consolidation ratio, meaning 6 VMs are run per physical processor
- Costs shown for 3 years for License and Maintenance, VMware cost includes Windows Server 2008 R2 Datacenter edition for running guests, cost doesn't include hardware, storage or IT labor costs
- Calculation uses licensing and support prices based on published U.S. suggested list prices for VMware and Microsoft as of January 2012

Enterprise Scenario

In this case, we are using the **Enterprise Plus** edition of vCenter Operations Management Suite. Like above, Microsoft private cloud is licensed through ECI Datacenter and VMware private cloud through a combination of Cloud Infrastructure Suite, vCenter Operations Management Suite, and vFabric APM.

Since the Enterprise Plus edition of vCenter Operations Management Suite is significantly expensive, for an enterprise with 6 VMs per physical processor, a VMware private cloud solution can cost 8 times more than a comparable Microsoft private cloud solution over a period of one to three years.

Fig. 11: Enterprise Business: Private Cloud Cost Comparison- Microsoft & VMware for 500 VMs



vCOPs stands for vCenter Operations Management Suite. Same assumptions as the Medium-Sized Business scenario above

In the calculations above, we allow for 6 VMs per physical processor, a very typical and conservative consolidation ratio used by majority of customers today. But, we are already witnessing several customers that are running much higher VM densities and 12 or 15 VMs per physical processor is not unheard of. The cost efficiency of private cloud computing depends on economies of scale, higher workload density, and dynamic management of resources that ensure service levels. Optimal costs are achieved when all resources in a pool can be allocated to specific workloads, so it is likely that you're considering higher VM densities.

As you saw earlier, Microsoft ECI Datacenter allows for unlimited virtualization rights, which means that as VM densities increase, your licensing costs remain predictable. With VMware, as your VM densities increase, your costs increase significantly, as you end up paying a separate licensing fee for every VM.

Six Months Later: Get Aggressive about Efficiency and Increase VM Density in your Private Cloud

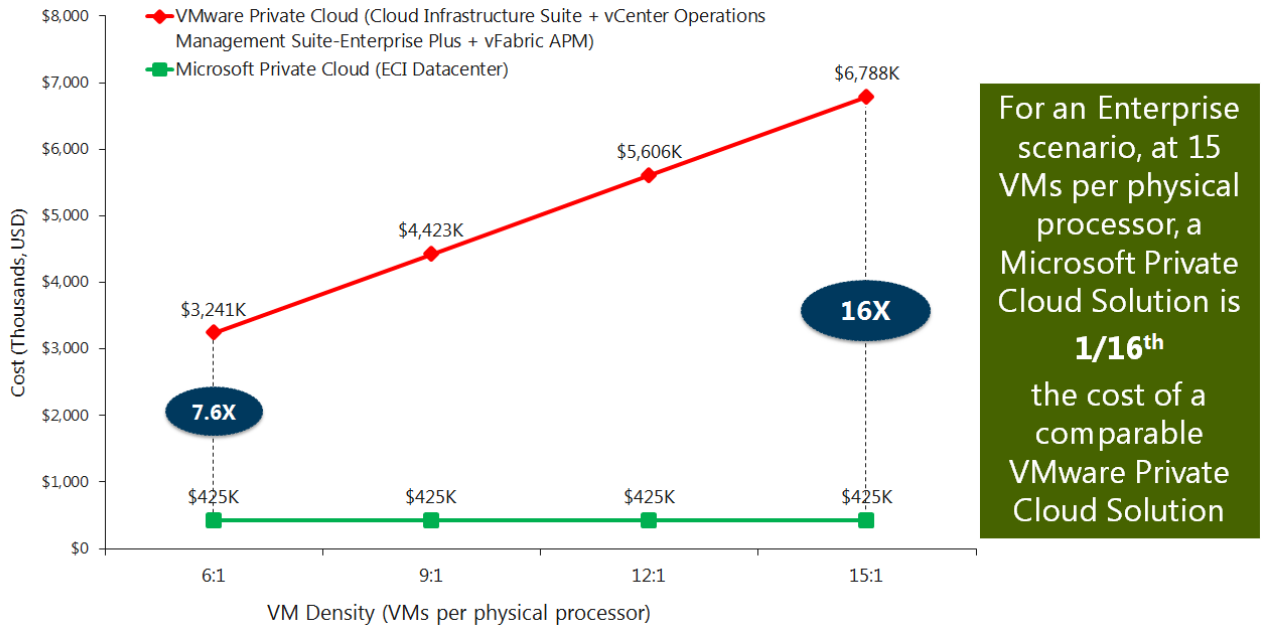
Once you have set up your private cloud, within the next 6-12 months you want to get aggressive about efficiency to reduce your IT costs. You achieve this efficiency by maximizing hardware utilization and driving up workload density through increased virtualization. As a result, your costs should decrease as your VM density increases.

We model this situation below where we start with 6 VMs per physical processor (the configuration with which you set up your private cloud) and go to 15 VMs per physical processor, increasing your VM density by adding 1 more VM per physical processor at a time. As you can see from the chart below, Microsoft costs remain predictable- in this case flat, as we are increasing the VM density on the physical hosts from 6 VMs to 15 VMs per physical processor and not adding additional physical hosts or processors.

As customers, this is your typical consolidation strategy and lets you achieve a better TCO. Since ECI Datacenter allows unlimited virtualization rights, it doesn't matter whether you run 6 or 15 VMs per physical processor. You end up paying only for the number of physical processors you use. VMware on the other hand, charges per physical processor and also charges individually for every VM used. This per-VM charge, which is incremental and directly related to number of VMs leads to a significant cost differential between a Microsoft and a comparable VMware private cloud solution.

As shown below, for an enterprise with 15 VMs per physical processor, a VMware private cloud solution can cost 16 times more than a comparable Microsoft private cloud solution over a period of one to three years. This cost difference is driven mainly by the per VM licensing of VMware products.

Fig. 12: Enterprise Business: Private Cloud Cost Comparison- Microsoft & VMware for increasing VM densities



Appendix C provides detailed cost breakdowns

Assumptions

- Assumes 42 physical hosts with 2 CPU and six cores each.
- Number of physical hosts and processor remain constant and the number of VMs are increased
- VMs per processor is varied from 6:1 to 15:1 meaning 6 to 15 VMs are run per physical processor
- Costs shown for 3 years for License and Maintenance, VMware cost includes Windows Server 2008 R2 Datacenter edition for running guests, cost doesn't include hardware, storage or IT labor costs
- Calculation uses licensing and support prices based on published U.S. suggested list prices for VMware and Microsoft as of January 2012

As you saw in the example above, as you doubled your efficiency (went from 6 VMs to 15 VMs per physical processor), your costs on VMware doubled, while costs on Microsoft remained the same. With Microsoft, your private cloud ROI increases as your VM density increases. With VMware, your private cloud costs grow, as your VM density increases. Basically, VMware "taxes" you when you do a good job of increasing your private cloud efficiency.

Conclusion

Our analysis clearly demonstrates that with Microsoft the ROI of your private cloud increases as you scale. VMware approach to private cloud ensures you are "taxed" as you virtualize more workloads, grow your private cloud and scale your business critical tier-1 apps.

Cloud computing, both private and public, is fundamentally shifting the IT industry and a primary driver of that trend is economics. Customers that implement Microsoft's private cloud solutions are well poised to realize many benefits. They will be able to leverage a hybrid cloud model and choose either a private or public cloud model depending on what best suits their requirements. For any private cloud model (on-premise or hosted) that they choose, they will have access to System Center's complete, integrated management capabilities and will get a single pane of glass to manage physical, virtual, private, and public cloud environments. This will enable them to manage their infrastructure more effectively than with VMware's private cloud solutions.

Finally our history, and ongoing, commitment to helping customers benefit from technology – at scale – will continue.

Our approach is focused on you – your apps, your heterogeneous environments, your need for a solution that scales with a public cloud that's real today. Our approach to cloud – is on your terms – and it will grow with you – not against you.

Visit this site – http://www.microsoft.com/privatecloud/ – to learn more about our private cloud offerings.

Appendix A: VMware & Microsoft U.S. Suggested Price List

VMware Private Cloud Products Price List (U.S. Suggested List Prices) All per-VM prices calculated for packs of 25 VMs.						
Product	Components	License Type	Base License Price	Production SnS for 1 Year*	Production SnS for 3 Years	Total Cost (License + 3 year SnS)
Cloud Infrastructure Suite	vSphere 5 (Enterprise Plus)	Per-Processor with vRAM	$3,495[9]	$874	$2,621	**$6,117**
	vCenter 5 (Standard)	Per-Instance	$4,995[10]	$1,249	$3,746	**$8,741**
	vCenter Site Recovery Manager 5 (Enterprise)	Per-VM	$12, 375[11]	$3,094	$9,281	**$21,656**
	vShield 5	Per-VM	Calculated by adding App, Edge and Endpoint License+ 3 Yr. SnS			**$14,332[12]**
	vCloud Director 1.5	Per-VM	$3,750[13]	$937	$2,812	**$6,562**
vCOPs-Advanced	vCenter Operations Management Suite – Advanced	Per-VM	$3125[14]	$781	$2,343	**$5,469**
vCOPs-Enterprise Plus	vCenter Operations Management Suite – Enterprise Plus	Per-VM	$34,250[15]	$8,562	$25,688	**$59,938**
vFabric APM	vFabric Application Performance Manager (APM)	Per-VM	$360[16] per VM or $9,000 per 25 VMs	$2,250	$6,750	**$15,750**

* Production SnS fee is 25% of base license price per year
All VMware private cloud products, except vFabric APM, licensed on a per-VM basis are sold in packs of 25 virtual machine licenses.

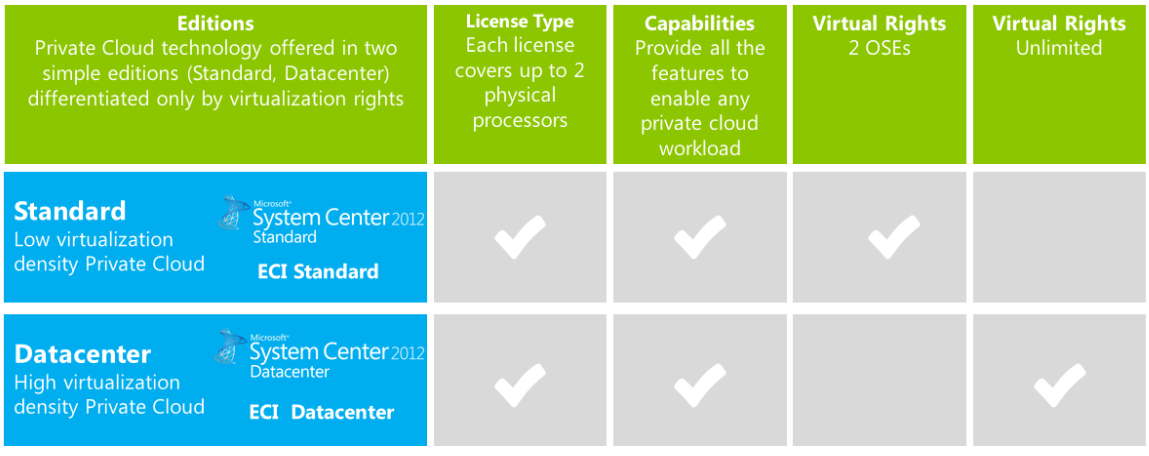
[9] vSphere 5 U.S. suggested list price from VMware website as of January, 2012
[10] vCenter U.S. suggested list price from VMware website as of January, 2012
[11] vCenter SRM Enterprise U.S. suggested list price from VMware website as of January, 2012
[12] vShield U.S. suggested list price from VMware website as of January, 2012
[13] vCloud Director U.S. suggested list price from VMware website as of January, 2012
[14] vCenter Operations Management Suite – Advanced U.S. suggested list price from VMware website as of January, 2012
[15] vCenter Operations Management Suite – Enterprise Plus U.S. suggested list price from VMware presentation as of January 2012
[16] vFabric APM U.S. suggested list price U.S. suggested list price from VMware website as of January, 2012

Microsoft Private Cloud Products Price List (Microsoft Open License Estimated Retail Price List in USD, reseller pricing may vary)						
Product	Components	License Type	Base License Price per Processor	SA for 1 Year	SA for 3 Years	Total Cost (License + 3 year SA)
System Center 2012	Operations Manager Configuration Manager Orchestrator Data Protection Manager App Controller Virtual Machine Manager Service Manager Endpoint Protection	Per-Processor	$1,206	$302	$904	**$2,111**
Windows Server 2008 R2	Windows Server 2008 R2 Datacenter	Per-Processor	$2,405	$601	$1,803	**$4,208**
ECI Datacenter	System Center 2012 Datacenter Windows Server 2008 R2 Datacenter	Per-Processor				**$5,056**

Each ECI and System Center 2012 license covers up to 2 physical processors. ECI requires a 25 license minimum initial purchase. The simplified licensing schemes for ECI and System Center 2012 are shown below.

System Center 2012 introduces the following licensing improvements

- Standalone 'products' become components of integrated product Management Licenses
- Software Assurance is included with all licenses
- Server Management Licenses align to 'processor-based' model, each license covers 2 processors
- The right to run Management Server software and supporting SQL Runtime are now included with every Management License. Management Server Licenses are discontinued**.**



ECI STANDARD CUSTOMERS CAN CHOOSE TO RUN WINDOWS SERVER 2008 R2 STANDARD EDITION OR WINDOWS SERVER 2008 R2 ENTERPRISE EDITION

Appendix B: Medium-Sized Business: Private Cloud Cost Comparison- Microsoft & VMware for 500 VMs

Private Cloud Environment	
Number of Physical hosts	42
Number of Physical Processors (2 per host)	(42*2) = 84
Number of VMs per physical processor	6
Total Number of VMs (VMs per physical processor* number of physical processors)	500

Product	Components	License Type	Total Cost (License + 3 year SnS)	Calculation	Final Cost
Cloud Infrastructure Suite	vSphere 5 (Enterprise Plus)	Per-Processor with vRAM	**$6,117**	=$6,117*84	**$513,828**
	vCenter 5 (Standard)	Per-Instance	**$8,741**	=$8,741*1	**$8,741**
	vCenter Site Recovery Manager 5 (Enterprise)	Per-VM	**$21,656**	=$(21,656*500)/25	**$433,120**
	vShield 5	Per-VM	**$14,332**	=$(14,332*500)/25	**$286,640**
	vCloud Director 1.5	Per-VM	**$6,562**	=$(6,562*500)/25	**$131,240**
vCOPs-Advanced	vCenter Operations Management Suite – Advanced	Per-VM	**$5,469**	=$(5,469*500)/25	**$109,380**
vFabric APM	vFabric Application Performance Manager (APM)	Per-VM	**$15,750**	=$(15,750*500)/25	**$315,000**
Windows Server 2008 R2	Windows Server 2008 R2 Datacenter	Per-Processor	**$4,208**	=$4,208*84	**$353, 472**
Total VMware Private Cloud cost for 500 VMs					**$2,151,421**

Product	Components	License Type	Total Cost (License + 3 year SA)	Calculation	Final Cost
ECI Datacenter	System Center 2012 Datacenter Windows Server 2008 R2 Datacenter	Per-Processor	**$5,056**	=$5,056*84	**$424,704**
Total Microsoft Private Cloud cost for 500 VMs					**$424,704**

A VMware Private Cloud is 5X more expensive than a Microsoft Private Cloud solution.

Appendix C: Enterprise Business: Private Cloud Cost Comparison- Microsoft & VMware for 15 VMs per processor

Private Cloud Environment	
Number of Physical hosts	42
Number of Physical Processors (2 per host)	(42*2) = 84
Number of VMs per physical processor	**15**
Total Number of VMs (VMs per physical processor* number of physical processors)	1250

Product	Components	License Type	Total Cost (License + 3 year SnS)	Calculation	Final Cost
Cloud Infrastructure Suite	vSphere 5 (Enterprise Plus)	Per-Processor with vRAM	**$6,117**	=$6,117*84	**$513,828**
	vCenter 5 (Standard)	Per-Instance	**$8,741**	=$8,741*1	**$8,741**
	vCenter Site Recovery Manager 5 (Enterprise)	Per-VM	**$21,656**	=$(21,656*1250)/25	**$1,082,800**
	vShield 5	Per-VM	**$14,332**	=$(14,332*1250)/25	**$716,603**
	vCloud Director 1.5	Per-VM	**$6,562**	=$(6,562*1250)/25	**$328,125**
vCOPs-Enterprise Plus	**vCenter Operations Management Suite – Enterprise Plus**	Per-VM	**$59,938**	=$($59,938*1250)/25	**$2,996,900**
vFabric APM	vFabric Application Performance Manager (APM)	Per-VM	**$15,750**	=$(15,750*1250)/25	**$787,500**
Windows Server 2008 R2	Windows Server 2008 R2 Datacenter	Per-Processor	**$4,208**	=$4,208*84	**$353, 472**
Total VMware Private Cloud cost for 15 VMs per physical processor					**$6,787,969**

Product	Components	License Type	Total Cost (License + 3 year SA)	Calculation	Final Cost
ECI Datacenter	System Center 2012 Datacenter Windows Server 2008 R2 Datacenter	Per-Processor	**$5,056**	=$5,056*84	**$424,704**
Total Microsoft Private Cloud cost for 15 VMs per physical processor					**$424,704**

A VMware Private Cloud is 16X more expensive than a Microsoft Private Cloud solution.