

Microsoft Private Cloud- Making It Real

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Built for the Future. Ready Now.

Providing technology solutions that meet business needs in a cost effective manner is a cornerstone of IT departments around the world. As businesses grow and adapt to their changing markets it is incumbent on IT to deliver the necessary agility and support. Business users expect IT to respond quickly to their ever-changing requirements while delivering “continuous services”. Organizations are looking to private cloud solutions to transform their traditional approach. According to IDC, 69% of customers in a recent survey either have or will be implementing private cloud solutions in 2012. The Microsoft private cloud solution, based on Microsoft System Center 2012 and Microsoft Windows Server 2008 R2, empowers IT organizations to help deliver this notion of continuous services to meet today’s business challenges and the increasing demands of tomorrow. This paper describes the key components and technologies from Microsoft that organizations can use to deliver a private cloud solution. With a private cloud, organizations can pool their current datacenter resources, automate and manage them efficiently simplifying their ability to provide standardized IT service offerings. Now, IT teams are in a position to deliver greater agility, cost efficiency, and improved levels of responsiveness to their organizations.

A Private Cloud: Today’s Datacenter . . . Optimized

The architecture and functionality of most modern datacenters reflect the growth of the parent organization they serve. Whether by steady organic growth or by rapid expansion through mergers and acquisitions, these environments are a mix of best-of-breed point solutions, varying levels of standardization and isolated environments tailored to fit demands of a specific business group. This makes for an environment that can be difficult to manage, impairing the agility of the various business units. Each time a request is submitted for a new application or service, the centralized IT function needs to hand-craft and deliver that request in a made-to-order fashion. Applications are built to accommodate high demand, dedicating infrastructure which then may be underutilized during off-peak times.

Modeled around the success of its public cloud offerings, Microsoft’s private cloud solution is about automatically and efficiently delivering IT services on request and dynamically scaling those services on demand. A private cloud shares many of the characteristics of public cloud computing such as resource pooling, self-service, elasticity and pay-by-use but does so with dedicated physical resources that allowing organizations to maintain complete control over their data and processes.



Figure 1: The private cloud delivers the broad benefits of cloud computing with added levels of control and customization

The notion of pooled resources means that all compute network and storage assets are aggregated into a common grouping that can then be delegated within the organization. This is a shift from today's model in which an application owner will likely know (and probably fund) the exact hardware on which the application is physically deployed. In a private cloud environment, this owner will only care that adequate capacity to run the application has been delegated appropriately. The datacenter administrator is freed up to better optimize resource utilization and focus on activities that enable greater value to the organization. A self-service interface to which standardized services are published from central IT, empowers application owners and other internal customers to be able to easily provision resources when needed at the level of service and cost they choose. This common understanding of available 'off the shelf' service offerings is fundamental to the notion of cloud computing. Standardized offerings don't mean that custom requests aren't possible; indeed a key benefit of the private cloud over public is that it maintains a greater degree of flexibility, but standardized offerings vs. custom offerings is the difference between completing the task in minutes vs. days or weeks.

Once deployed, services can scale up and down based on demand. By designing this capability into the services that are deployed, central IT no longer needs to over-provision infrastructure capacity to accommodate potential spikes in load. The datacenter administrator and application owner can view resource utilization, show back and chargeback information related to their allocated capacity.

A private cloud deployment captures all of these characteristics, allowing organizations to maintain total control over their applications and data as well as offering an ability to customize deployed resources; both common blockers for businesses looking at public cloud solutions. Ultimately, most customers will find portions of their organization that live best in a private deployment and portions that live best in a public deployment. The world will exist in a hybrid state for the foreseeable future and it is important for companies to evaluate their particular needs to determine the best combination for them. As a leader in both public and private cloud technology Microsoft is well positioned to help organizations realize this vision of cloud computing.

Why Microsoft?

Over the last twenty years, Microsoft has built some of the world's largest datacenters running many of the world's largest cloud hosted services. The expertise that has been built up in efficiently running these massive data centers forms the foundation for the Microsoft private cloud offering. Built on System Center 2012 and Windows Server 2008 R2, a Microsoft private cloud allows datacenter administrators to deploy a flexible and responsive infrastructure that is designed to simplify day-to-day tasks and to enable management of applications at the service level, rather than the level of individual servers.



Figure 2: Microsoft delivers over 200 of our own [online services](#) and web portals from data centers over 3 continents

System Center 2012 makes it easy for customers to build private clouds today, taking advantage of currently deployed IT investments and building an infrastructure for the future. This comprehensive offering was designed around the following principles.

- **All About the App:** The agility to deliver critical applications faster, more reliably and with greater transparency – after all, applications power the business
- **Cross-Platform From the Metal Up:** The flexibility to comprehensively manage your heterogeneous IT environment taking advantage of investments in technology you’ve already made.
- **Foundation for the Future:** The power to drive innovation with true cloud computing capabilities on an enterprise-class platform and the knowledge that this platform will grow as your business grows
- **Cloud On Your Terms:** The freedom to choose the right mix of private and public cloud options that add the greatest value for your unique business requirements

These principles are surfaced through a core set of capabilities in System Center 2012 and Windows Server 2008 R2, allowing datacenter administrators and application owners to access and consume IT services from these private clouds.

The rest of this paper will describe the private cloud capabilities provided by System Center 2012. For the datacenter administrator, this includes infrastructure management, service delivery and automation. For the application owner or business unit IT professional, this includes application management, monitoring and reporting.

The table in Figure 3 highlights these capabilities, how they align to industry concepts and System Center 2012 components.

Customer Scenario	Industry Capability	System Center 2012 Component
Application Management	Application Self-Service	App Controller, Service Manager
	Application Performance Management	Operations Manager
	Application Management Across Clouds	Virtual Machine Manager
Service Delivery & Automation	IT Service Management & Reporting	Service Manager
	Process Automation & Orchestration	Orchestrator
Infrastructure Management	Cloud Creation & Delegation	Virtual Machine Manager
	Data Protection & Disaster Recovery	Data Protection Manager, Orchestrator
	Monitoring	Operations Manager
	Configuration & Compliance	Configuration Manager

Figure 3: Mapping of industry cloud computing concepts to System Center 2012 products and features.

System Center 2012 capabilities explained

Infrastructure Management

Despite the name, cloud computing won't run on thin air. Highly reliable and available physical infrastructure is the foundation for the private cloud. Appropriate infrastructure management is essential to the cloud's success. Before delving deeper into management specifics it's important to establish that a private cloud is formed around two core infrastructure approaches; one physical and one virtual.

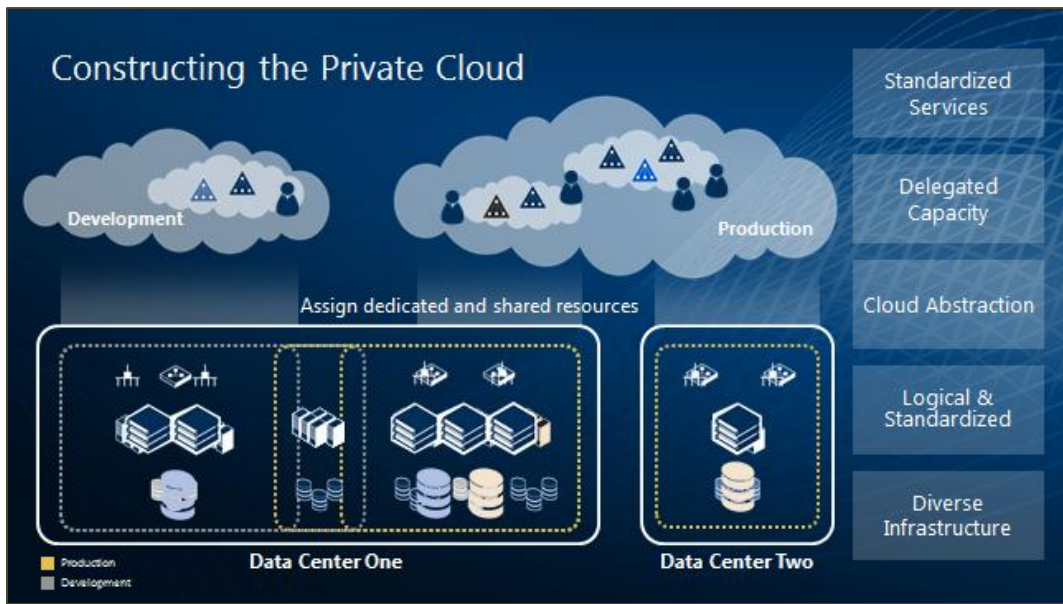


Figure 4: Private Cloud are built on heterogeneous infrastructure transformed into logical resource pools

Diverse Infrastructure

The infrastructure components layer represents the physical; the bare metal servers, storage, networking and the virtualization layer atop which the private cloud will be built. This is the datacenter today. System Center 2012 Virtual Machine Manager enables a datacenter administrator to bring these diverse components under unified management control.

Elasticity is a key tenet of cloud computing. Both Virtual Machine Manager and Operations Manager provide detailed capacity utilization reports to identify growth constraints early enough to allow for new hardware to be provisioned. Using Virtual Machine Manager additional physical resources can be added to a Microsoft private cloud without downtime to production services.

High availability is critical to application owners and their end users. A failure at the physical layer must not bring down cloud-based applications. Applications must be able to run across a diverse set of physical machines; this ability to abstract the running application from the physical hardware on which it resides allows for not only high availability and fault tolerance but benefits elasticity as workloads can, in many cases, be across a logical pool of existing resources rather than by racking and stacking more physical boxes. Failover Clustering in Windows Server is core to meeting this need, and Virtual Machine Manager now includes a simple wizard based interface to create new Hyper-V clusters and add them to the compute pool; rendering a once daunting task into something far simpler. Not only will Virtual Machine Manager create the failover cluster, but will also mask the storage to the servers as necessary. The datacenter administrator can also take advantage of current investments by managing their existing Citrix XenServer and VMware vSphere pools within their Virtual Machine Manager host groups.

Storage classification within System Center 2012 helps the datacenter administrator better utilize storage within their private cloud providing the ability for Virtual Machine Manager to discover and communicate with SAN arrays. Datacenter administrators can now quickly handle common storage tasks for better managing their private cloud. This capability allows such activities as the creation of logical unit numbers (LUNS) and then assignment of storage to hosts and clusters as standalone LUNs or clustered shared volumes. Virtual Machine Manager communicates with third-party storage devices using the industry standard Storage Management Initiative – Specification (SMI-S).

Finally, consider network resource requirements. A key enabler of highly available and elastically scalable applications is the extensive support for network load balancing within System Center 2012. As well as native support for Microsoft Windows Network Load Balancing, Virtual Machine Manager interfaces with hardware load balancers and other network devices from a variety of vendors such as F5, Brocade, and Citrix.

Once these infrastructure components are deployed and configured, the datacenter administrator needs to ensure they remain up and running. Using Operations Manager, administrators can proactively monitor their resource utilization, preventing problems before they occur. In the event of an outage or a reduction in service level due to a failure in physical hardware, the embedded organizational knowledge that Operations Manager provides helps in reducing the time it takes to get the systems back up and running efficiently.

Logical and Standardized

Most organizations source their hardware from a variety of vendors. They will typically have many different processor types, different classes or vendors of fiber-channel and iSCSI SAN storage and a

variety of networking devices. The private cloud infrastructure is the aggregation and abstraction of these physical infrastructure components into logical resources. These logical resources of compute, networking, and storage are allocated, as either dedicated or shared capacity, to make up the cloud environment(s). It is these cloud resources that the datacenter administrator can delegate to the application owner. Application owners deploy their applications within the boundaries of the cloud resources provided to them.

Private cloud infrastructure can encompass heterogeneous resources, datacenter administrators now avoid a rip-and-replace approach when establishing the private cloud making the addition of new resources simpler. Using Virtual Machine Manager's abstraction of the infrastructure components, datacenter administrators can deploy many of their existing physical datacenter assets into the new private cloud and be confident they can take advantage of new technology trends.

Cloud Abstraction

Microsoft private cloud infrastructure allows datacenter administrators to parcel heterogeneous datacenter resources from a range of physical hardware and virtualization vendors, into consistent logical pools. These logical pools of resources are then interchangeable throughout the private cloud. It is this mapping of heterogeneous physical resources to logical resource pools that allows System Center 2012 to deliver a truly scalable, elastic and highly available cloud. It provides the ability to dynamically reallocate workloads and delegate capacity while maintaining granular control over resource utilization.

An important characteristic of these pooled resources is that the physical infrastructure on which they reside can be shared between multiple private clouds. The increased scalability and flexibility that this affords does, however, come at a price in terms of overall efficiency. To help ensure that the services running on top of these clouds receive the resources they need, Virtual Machine Manager provides a feature called dynamic optimization which will migrate virtual machines between hosts within a cluster to rebalance workloads and ensure the best utilization of the physical resources. Virtual Machine Manager can even be configured to optimize power usage by moving workloads off certain nodes and then powering these nodes down during periods of inactivity in the private cloud and powered back on when activity demands increase.

Most organizations have fairly complex networking environments with multiple VLANs across different datacenters. Many line of business applications will typically span multiple tiers and as such have quite complex networking requirements. By abstracting a logical network from the physical network resources, Virtual Machine Manager takes the complexity out of network infrastructure making it simple for the datacenter administrator to present the network infrastructure in a logical and standardized manner.

Delegate Capacity

Datacenter administrators can allocate cloud capacity to application owners based on need, application size, or any other requirement and are not limited by the physical resources allocated to that group. Delegated capacity in the private cloud sense is simply an allocation of compute, storage and memory to a specific user or group.

Datacenter administrators use Virtual Machine Manager to specify the overall capacity of each cloud and then provide quota to users (or groups).

- Virtual CPUs
- Memory
- Storage
- Number of Virtual Machines
- Custom quota points

Quota can be set at both the role level and member level. Role level quota defines the aggregate amount of resources that may be used by all members of that role. Member level quota defines the resources that may be consumed by any one member of that role.

Standardized Services

Datacenters administrators create virtual machine templates leveraging the underlying virtual disk components of the hypervisor, be that Hyper-V or another platform such as Citrix XenServer or VMware vSphere. They then add the operating system and application information into the template to make it ready to deploy.

The additional option of using Server Application Virtualization (Server App-V) virtualizes the configuration and state information of an application; local disk, windows services, registry settings and so forth, allowing them to be packaged and moved, thus simplifying install and update management for server based applications. Together, with service templates, Server App-V provides comprehensive application manageability. The entire state of an application can be saved and reapplied to updated virtual machines.

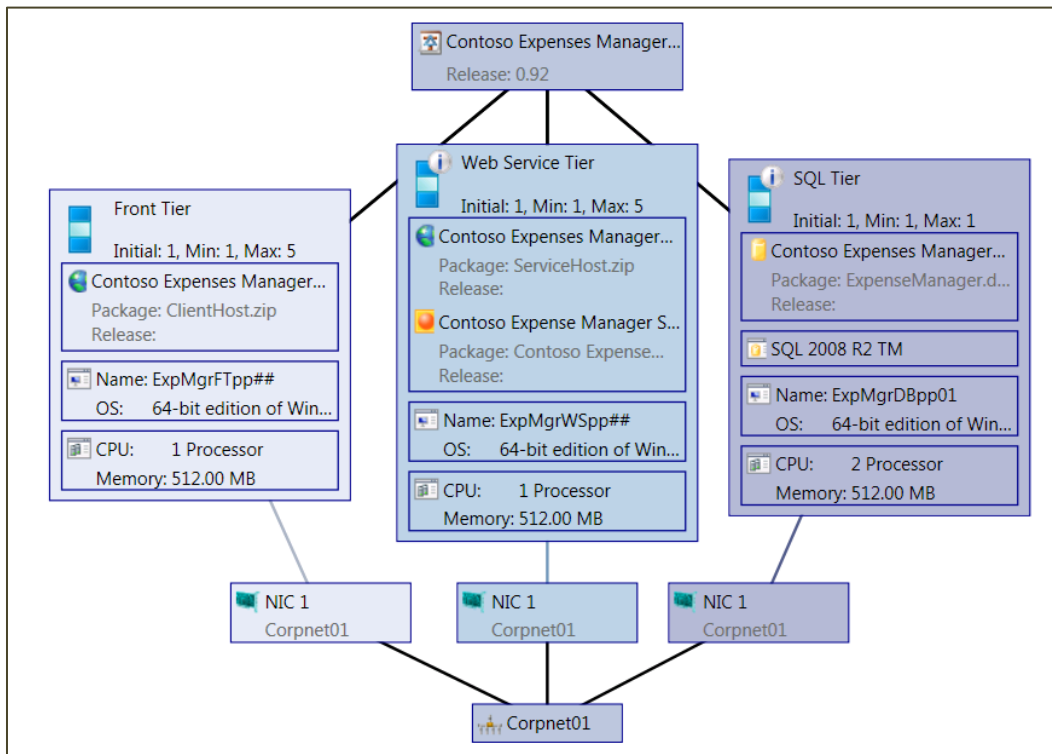


Figure 5: Sample Multi-Tier Service Template from System Center 2012 Virtual Machine Manager

Through Virtual Machine Manager's service template designer, datacenter administrators specify both the business and IT requirements of an application into a single service template. This enables repeatable deployments of applications and services in a standardized fashion. Copying and modifying the service template allows for upgrading of existing services within the cloud, while offering the latest version for any new deployments. This enables an organization to deliver self-service within the private cloud in a consistent and controlled manner. Application owners can control how their cloud services perform, while allowing the datacenter administrator to manage all aspects of the infrastructure, including how to automatically scale out the service.

Service Delivery and Automation

System Center 2012 helps datacenter administrators deliver standardized IT services through a self-service experience and enabling delivery at scale through automation. By systematically, and in most cases automatically, provisioning and managing their service delivery processes, IT organizations enable the repeatable and efficient service delivery that customers expect from a cloud environment. Using the System Center 2012 Service Manager and Orchestrator components, datacenter administrators can now deliver these services in a structured and repeatable fashion enabling:

- Self-service and standardization of offerings through a service catalog
- Automation of service delivery across the organization
- Integration across datacenter and private cloud technologies
- Reporting to ensure quality and to provide early identification of potential capacity constraints.

Self-Service and Standardization of Offerings through a Service Catalog

Delivering a self-service experience within the private cloud begins with defining what the standardized service offerings will be. For each proposed service, lines of business application owners and IT across the organization agree on what information is required to fulfill requests, where this information will come from, who needs to approve such requests, and establish the expected performance levels that are required for this service. IT then determines how best the request will be fulfilled through automation.

Service Manager and Orchestrator allow the datacenter administrator to establish standardized offerings by storing the above information and using it to drive the service delivery and automation process. The primary interface to the above processes is through the Service Manager service catalog. The service catalog is based on Microsoft Silverlight and Microsoft SharePoint¹ meaning that customers can adapt the look and feel of the portal using standard SharePoint tools.

¹ System Center 2012 Service Manager requires SharePoint 2010 Foundation as a minimum for the service catalog.

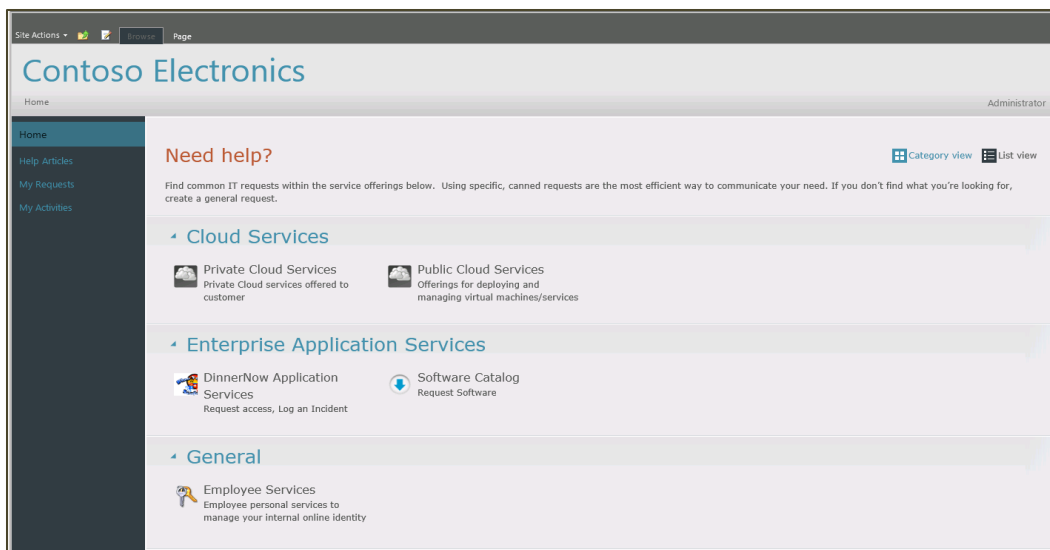


Figure 6: Sample view of System Center 2012 Service Catalog and Service Request Portal

From the service catalog, IT customers identify and request services offered by IT. Users start by selecting a service offering. These provide the high level list of all of the things that can be requested; for example the top level offerings might be Cloud Services, Desktop Services and so forth.

Consistency of service across the business and at scale

Within each service offering that a datacenter administrator defines, a customer can select one or more request offerings. Request offerings contain details of a specific request that IT offers to the organization. Each request offering contains information such as cost, SLA details, knowledge articles and specific input requirements in the form of user prompts that a requestor, such as the application owner, completes as part of the request process. To drive further consistency, service requests can be created from a template allowing the organization to enforce common rules and data collection standards across requests. Templates allow datacenter administrators to capture the correct information and the corresponding activities necessary to fulfill the request correctly and efficiently.

The request fulfillment process is governed by the Service Manager and Orchestrator components within System Center 2012. Service Manager facilitates process, notification and approval related activities. Orchestrator executes and manages technical system activities necessary to the fulfillment process via an Orchestrator RunBook. This end to end automation approach allows a user to create a service request knowing that System Center 2012 will manage and execute the request in a timely manner giving IT confidence the correct controls and business rules are in place.

Cost effective request fulfillment within the private cloud requires automation and integration across many IT systems and data sources. System Center 2012 provides this integration capability through Service Manager connectors and Orchestrator integration packs.

Integration across the private cloud technologies to reduce complexity

Having an accurate representation of the IT infrastructure, its components and their complex inter-relationship is a challenge for many organizations and is a core requirement for consistent service delivery. Service Manager uses connectors to populate the configuration management database (CMDB) to facilitate a single point of reference for IT organizations. Out of the box, connectors for Configuration

Manager, Operations Manager, Active Directory, Virtual Machine Manager and Orchestrator populate and update the CMDB. Service Manager automatically reconciles this information providing a single point of reference for accurate understanding of the IT services.

Integration packs are used within Orchestrator to automate processes and system activities in the private cloud and datacenter infrastructure. These integration packs allow Orchestrator to execute activities from a service request across other components of System Center, line of business applications, and third party management tools. As private cloud demand grows the requirement for automation increases. The economic benefits of cloud computing rely on achieving economies of scale whereby the operational costs per unit of capacity, say per virtual machine, decreases as the overall capacity increases; automation is key to achieving this goal.

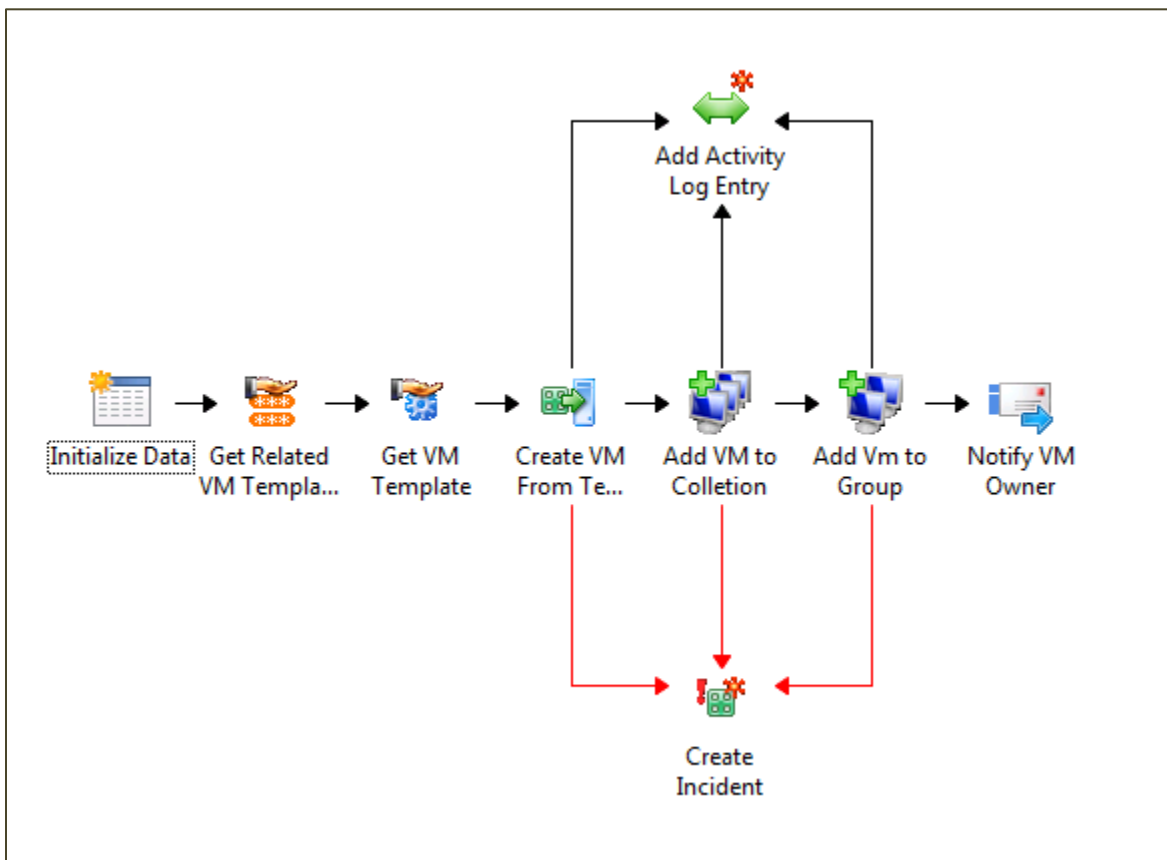


Figure 1 Example Orchestrator Runbook for Provisioning a Virtual Machine

Automation of processes and systems ensures best practices are delivered consistently, operational ROI is maintained, and compliance to company and industry regulations is supported. System Center 2012 brings these advanced automation capabilities to private cloud deployments.

IT service reporting

By managing the entire provisioning and operational processes of private cloud services, System Center 2012 is able to capture rich information on the overall IT services delivery against agreed service levels. One of the traditional challenges in any datacenter is the ability to consolidate reporting across multiple, disparate systems, to provide a comprehensive view of IT. Service Manager builds a rich data warehouse of information from all of the deployed and integrated System Center products. The data warehouse can

also retrieve information from various other sources including active directory and any other Microsoft SQL Server based data repository. This information can then be surfaced to both business and IT users using tools that they are familiar with such as Excel pivot tables and SharePoint based dashboards.

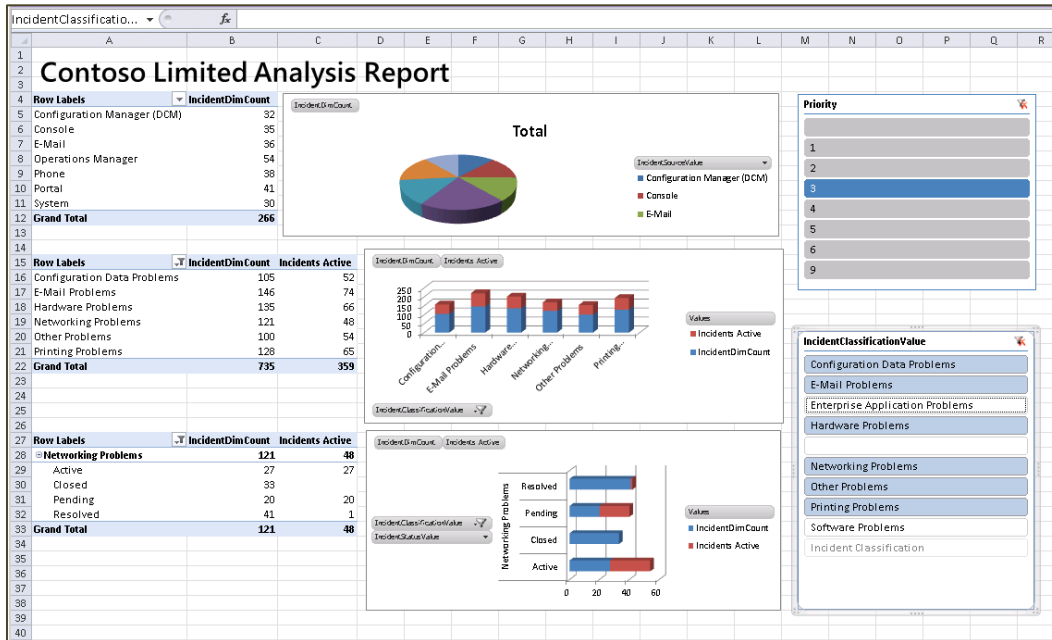


Figure 7: Sample Analysis Report from Service Manager Data Warehouse using Pivot Tables in Excel

Application Management

A goal of the Microsoft private cloud is to enable a highly productive application and service experience to application owners. Microsoft has advanced System Center’s datacenter application management and monitoring capabilities significantly to help to achieve this.

It is important to understand how the terms ‘application’ and ‘service’ are defined in the private cloud context. In a Microsoft private cloud, a ‘service’ is a deployed instance of an ‘application’ combined with its associated configuration parameters and virtual infrastructure. In this context, you will see that Microsoft talks about ‘applications’ but manages them as ‘services’. Using System Center 2012 with Windows Server 2008 R2 provides application management across three key private cloud capabilities:

- Application Self-Service
- Application Performance Monitoring
- Management Across Clouds

Application Self-Service

On the surface, self-service would appear to exchange the datacenter administrators management and oversight for end-user convenience. This is not the case. Application self-service allows application owners to implement new applications with greater autonomy within their delegated cloud capacity. Datacenter administrators are able to delegate capacity and empower the application owner to deploy

and operate applications within that capacity and not encroach on other application owners operating with the same private cloud.

System Center 2012 enables the private cloud to deliver application self-service by introducing the concepts of services and service templates. You can think of a service template as the agreement between the datacenter administrator and the application owner. Within the service template, you embed the business and IT requirements which result in configuration profiles, not just for an application but for the underlying infrastructures that hosts the service; things such as networking, storage, compute resources, operating systems and databases.

The application owner provides the specification; defining the structure of the application, the required resources and the performance profiles needed to deliver the necessary service levels. Based on this specification, the datacenter administrator creates a service template, performs functional testing and then delegates rights back to the application owner for deployment.

Using the service template, application services can be deployed as a single unit by the application owner into their delegated private cloud resources. Application owners deploy and scale their applications as desired within the boundaries of their delegated capacity.

Applications can be updated by creating and delegating new versions of the service template. The timing of these changes can be either forced by the datacenter administrator, when immediate security updates are required, or delegated to the application owner to apply when best suits their particular business needs.

Through System Center 2012 App Controller, the application owner has a self-service experience to deploy their application, start and stop instances of their application and make other changes to the application in response to their business needs. Application self-service happens without direct involvement from the datacenter administrator, but, because the application is based on the agreed upon service template, the IT provider is still in overall control.

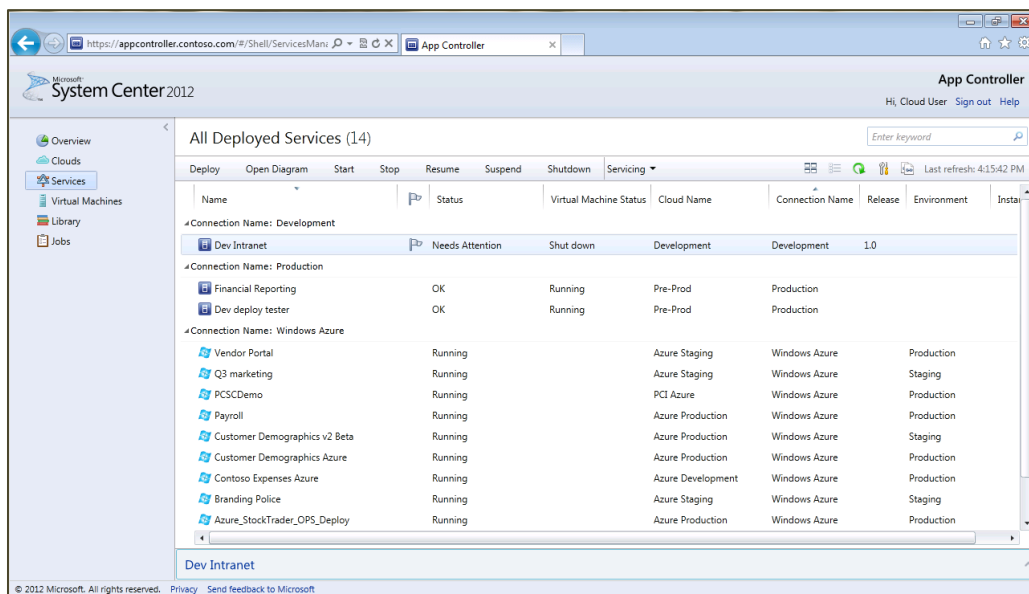


Figure 8: System Center 2012 App Controller allows application owners self-service access to services and virtual machines

Virtual machines are core to the Microsoft private cloud. These are created using virtual machine templates which provide a consistent model for deploying a single virtual machine. They provide the definition of hardware specifications, operating system configurations and the dynamic configuration of Windows Server roles and features. Additionally, templates can include application packages such as Microsoft SQL Server and their accompanying configurations.

At the next level are single tier service templates. These templates allow you to do everything that a virtual machine template can, but also provide 'cloud style' characteristics for defining scale units and upgrade domains. Upgrade domains allow the template to specify portions of the application that can be upgraded independently; this can allow appropriately architected applications to be upgraded with zero downtime.

Finally, there is a full multi-tier service template which includes all elements of an application so it can be delivered as a service, from the database to the web front end. Leveraging a multi-tier service template delivers consistency across the entire application, allows referencing the application as a single entity and means that the performance of the application can be measured as a whole against desired service levels.

Private Cloud Application Performance Monitoring

System Center 2012 provides a complete monitoring solution covering both the underlying infrastructure as well as all aspects of the application. System Center 2012 monitors the performance of an application by tracking:

- The infrastructure hosting the application – the physical components like network and storage, the virtual platforms and the operating systems.
- The server-side components of the application – the execution performance of the application inside the service template.
- The client-side components of the application – the end user experience
- A set of synthetic workloads designed to highlight failures in situations that might not otherwise be caught.

Aggregating this information enables the datacenter administrator to build rich dashboards and visualizations to quickly see how applications are performing against the defined service levels. These dashboards can be delegated to application owners and operators to give them quick and rich visibility of application performance and availability.

In System Center 2012 Microsoft delivers deep application insight and diagnostics through Operations Manager. This allows drill down into performance alerts even down to the line of code causing the problem. Integration with Service Manager and Visual Studio Team Foundation Server 2010 mean this rich information can be passed to the business owner, support staff and the developer who authored the code.

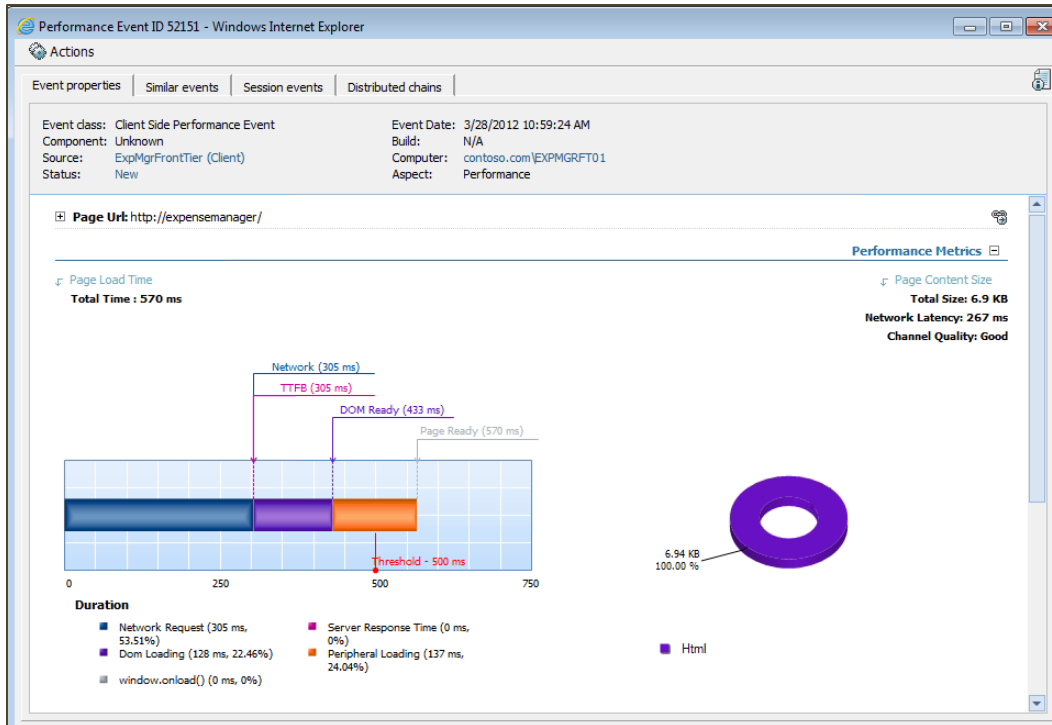


Figure 10: Sample Application Performance Monitor event from System Center 2012 Operations Manager

Application Management across Clouds

The ability to control and manage applications and services within the private cloud is critical. A key requirement, as organizations begin using hybrid apps, will be the ability to connect with services in other clouds and to manage them through a single management experience.



Figure 11: System Center 2012 provides for management of services across both public and private cloud environments

System Center 2012 provides application owners with the ability to manage their applications running in both private clouds and other public service provider clouds such as Windows Azure. This consolidated

view allows the application owner to manage their applications regardless of the physical location in which they are ultimately deployed.

This common model delivers a consistent method to view the application structures, as well as configure and deploy new services and Azure applications. App Controller uses a common deployment process regardless of the application deployment destination. Application owners have full visibility as to what their delegated quota is and how any new deployment will reduce their available capacity.

This capability to manage not only private cloud applications but also to span out into the public cloud is a critical requirement for many organizations to ensure they have the freedom to run their applications on the cloud that makes the most sense for their business.

What about Windows Server 2012?

Looking ahead, with the next release of Windows Server, Windows Server 2012, the capabilities to deliver more scalable, robust and adaptable applications and services will be available. The new and enhanced features of Hyper-V provide even higher levels of performance and scalability to meet the demands of business users, support SLAs and to help support showback. Datacenter administrators will have access to better tools to automate systems through software-based policy controls and use the Hyper-V functionality to help further lower the overall costs of cloud environments. Windows Server 2012 helps you achieve these goals with:

- **A complete virtualization platform.** The new Hyper-V delivers an isolated, multitenant environment that helps in the creation of unlimited private networks by using your existing network infrastructure. You can connect virtual machines from around the world as if they were in the same server rack. To improve security, each customer's virtual machines are isolated from those of other customers running on the same Hyper-V hosts. It also includes tools that support SLAs, enable chargebacks through usage-based billing, and support self-service delivery.
- **Increased scalability and performance.** Hyper-V in Windows Server 2012 delivers a high-density, highly scalable environment that can be modified to perform at the optimal level based on customer needs, with features like the ability to easily migrate virtual machines and being able to take advantage of emerging high-performance hardware technology.
- **Connectivity to cloud services.** Windows Server 2012 uses a common identity and management framework for more secure and reliable cross-premises connectivity to help people work and collaborate more effectively regardless of whether the applications and services they need are on premises or in the cloud.

With Windows Server 2012, you will add to the current private cloud solution to give greater ability to efficiently manage your cloud infrastructure while maximizing uptime and minimizing failures and downtime. Windows Server 2012 is a cost-effective solution, integrating a high-availability, easy-to-manage multi-server platform with breakthrough efficiency and widespread automation.

Where to now?

Providing technology solutions that meet business needs in a cost effective manner is a cornerstone of IT departments around the world. Expectations continue to grow as businesses grow and adapt to changing markets; business users expect IT to respond as quickly to their ever-changing requirements while delivering “continuous services” that are always available. The Microsoft private cloud solution, based on Windows Server 2008 R2 and System Center 2012, helps enable this notion of continuous services to meet today’s business challenges and the increasing demands of tomorrow.

The implementation of a Microsoft private cloud solution has been used to solve different business problems for different organizations. IDC recently published a paper, *Delivering Private Clouds Today with Microsoft System Center 2012*, which interviewed customers who participated in the Microsoft private cloud Technology Adoption Program (TAP). The paper outlines how these customers applied System Center 2012 and Windows Server 2008 R2 to their IT organizations and the business benefits they realized.

Some examples of the benefits received from implementing a private cloud include:

- 33% reduction in energy costs through better resource utilization via application monitoring and workload migration.
- Savings for one firm of more than \$250,000 due to automating manual activities.
- 75% reduction in service desk tickets due to better capacity utilization through automation of provisioning, patching and capacity adjustments.

These are just some examples across a number of companies in different industries. Evaluate for yourself how the Microsoft private cloud solution can transform your business today and for tomorrow at <http://www.microsoft.com/privatecloud> or talk to your Microsoft representative about our private cloud immersion experience!

Education

Get educated on the private cloud with resources from the Private Cloud Solution Hub, Microsoft TechNet, and Microsoft Virtual Academy.

Certification

Check out Microsoft Learning’s update to the MCSE for the private cloud and update your certification.

Resources for the IT Pro

Here’s a list of available resources to help you plan, design, and build your private cloud:

Private Cloud Solution Hub

<http://technet.microsoft.com/en-us/cloud/private-cloud>

Microsoft private cloud Reference Model

<http://social.technet.microsoft.com/wiki/contents/articles/4399.private-cloud-reference-model.aspx>

Microsoft private cloud

<http://www.microsoft.com/privatecloud>

Microsoft System Center 2012

<http://www.microsoft.com/systemcenter>

Microsoft System Center 2012 – TechNet

<http://technet.microsoft.com/en-us/library/hh546785.aspx>

Windows Server 2008 R2 Hyper-V

<http://www.microsoft.com/en-us/server-cloud/windows-server/hyper-v.aspx>

Learn about Microsoft's private cloud technologies by completing Microsoft Virtual Academy training courses and assessments

<https://www.microsoftvirtualacademy.com/colleges/PrivateCloud>

Purchase private cloud solutions pre-configured with hardware, Microsoft software, and best practices with Microsoft private cloud fast track

<http://www.microsoft.com/en-us/server-cloud/private-cloud/hyperv-cloud-fast-track.aspx>

System Center 2012 Unified Installer

<http://technet.microsoft.com/en-us/library/hh751290.aspx>