



Microsoft Cloud Platform System Standard



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Introduction

IT organizations are under pressure to deliver higher levels of service (for example, availability, compliance, and time to market) to the business organization, while responding to ongoing pressure to reduce costs and increase margins.

Increasingly sophisticated virtualized environments and hybrid cloud technologies are the solution that many organizations turn to. However, while the promise of hybrid cloud is attractive, implementation has often proven difficult.

Challenges

Building a hybrid cloud is a complex undertaking. It involves integrating the hardware, installing and configuring the software, and optimizing the overall infrastructure for performance, scale, and reliability. The inherent complexity can make a hybrid cloud deployment fall short of its goals. After the infrastructure is configured, necessary templates for services and applications also must be created. This requires additional time and investment.

These are challenging tasks for IT organizations that are already fully occupied with the challenges involved in maintaining the existing environment, and delivering the level of availability and performance required by the business. Patching and updating the system, protecting data, and troubleshooting applications can consume all available resources. Because of this, IT organizations often hesitate to make changes to their environment. For example, they do not consolidate their hardware or improve their management tools, even when they are convinced that the changes would be beneficial in the long run. Certain issues, such as planning for disaster recovery, are rarely addressed by smaller IT organizations. This can leave the business exposed to serious risk if a disaster occurs.

Organizations of all sizes increasingly are turning to preconfigured solutions to address the challenges of operating and evolving their infrastructure.

The Microsoft Cloud Platform System Family

The Microsoft Cloud Platform System (CPS) family of solutions consists of hybrid cloud solutions that enable organizations of all sizes to operate their IT infrastructure efficiently, to scale according to their needs, and to deliver the workloads that the business needs, all with a lower total cost than the alternatives.

CPS solutions are designed specifically to reduce the complexity and risk of implementing and operating a self-service cloud. CPS solutions include all the needed software and hardware. The solutions are validated and configured according to best practices, so that service providers and enterprises can give customers the self-service offerings they want, in a faster and predictable way. As a result, these providers can respond quickly to business opportunities—without worrying about the ability to manage dynamic, highly virtualized workloads.

CPS solutions can go from receiving at the datacenter loading dock to live within hours or days—not months, and let service providers or enterprises focus on delivering services to users.

Preconfigured hardware and software—specifically, Windows Server 2012 R2, Microsoft System Center 2012 R2, and Windows Azure Pack—work together to speed up the ability to offer customers the Infrastructure-as-a-Service (IaaS), and Platform-as-a-Service (PaaS) resources they want, whether these are self-provisioned Linux and Windows virtual machines (VMs), web applications, or databases. A CPS solution brings together the hardware and software needed to create the agile datacenter of the future, today.

CPS solutions also significantly simplify day-to-day IT operations. The Windows Azure Pack self-service portal reduces the burden of routine operations. Integration with Microsoft Azure services simplifies critical operations like backup/restore and disaster recovery. With the ability to use a secondary recovery site in the cloud, you can avoid the effort and expense of building a second datacenter.

Patch and update operations are automated. Administrators need to decide only when to start the update process. Pre-validated updates are downloaded and installed with no downtime to applications. CPS automatically orchestrates the migration of live workloads. Support is delivered through a single point of contact that provides both hardware and software support for the entire solution.

The CPS family scales from three-server solutions all the way up to four racks (128 servers), enabling customers to grow as their needs change over time. The infrastructure can expand while services remain continuously available.

Microsoft Cloud Platform System Premium

CPS Premium offers maximum scalability and availability. It scales from one to four racks, that is, from 32 to 128 Hyper-V hosts. CPS Premium enables the highest degree of resilience against hardware and software

failures, and delivers the computing power and storage to support up to thousands of VMs.

For more information about CPS Premium, see the [Microsoft Cloud Platform System Premium](#) white paper.

Microsoft Cloud Platform System Standard

CPS Standard starts as small as three servers, and can scale up to 16 servers. Compared with CPS Premium, CPS Standard has a much smaller minimum hardware footprint in terms of memory, storage, CPUs, and NICs.

CPS Standard is an ideal solution for organizations of all sizes. It can be deployed by smaller enterprises, departments or regional offices, and service providers to deliver a full IT infrastructure for the organization, or to support a specific application. You can expand an existing installation by as little as one server at a time. This makes it easy for an organization to grow the system according to their needs.

CPS Standard was designed to give Microsoft partners the ability to customize configuration characteristics while maintaining the reliability, integration, and ease of use that characterize the family. For example, partners can customize processor and memory configurations to optimize the solution for specific applications. Partners can also choose to integrate their own components into the solution; for example, integrating storage components to delivery hyper-converged solutions instead of solutions relying on discrete file servers. This allows users to a choice of solutions that are optimized for different use cases.

Delivering Services

CPS Standard comes with a complete virtualization management platform. With the fully-integrated System Center 2012 R2 suite on top of a Hyper-V cluster, you can perform traditional infrastructure management operations through the familiar System Center interfaces (graphical user interface or Windows PowerShell).

In addition, with the built-in Windows Azure Pack component, CPS Standard users can have an Azure-consistent experience, that is, an experience consistent with what they would have if they were using the Microsoft Azure public cloud service.

It is important to understand how Microsoft Azure operates before looking at how CPS can offer a consistent experience through Windows Azure Pack (Figure 1).

In Microsoft Azure, customers (or subscribers), access the public cloud through a web site, known as the *management* or *customer portal*. This portal acts as their gateway to a range of IT services delivered on top of compute, storage, and network resources that are located in Microsoft datacenters across the globe. Microsoft employs a sophisticated automation framework leveraged by a small number of IT staff at its datacenters to manage datacenter resources, allocate those resources to the various services, and manage the tenant subscriptions and billing for services consumed by the tenants. CPS, through Windows Azure Pack, provides users with a similar portal experience that can serve as a gateway to the compute, storage and network resources in CPS.

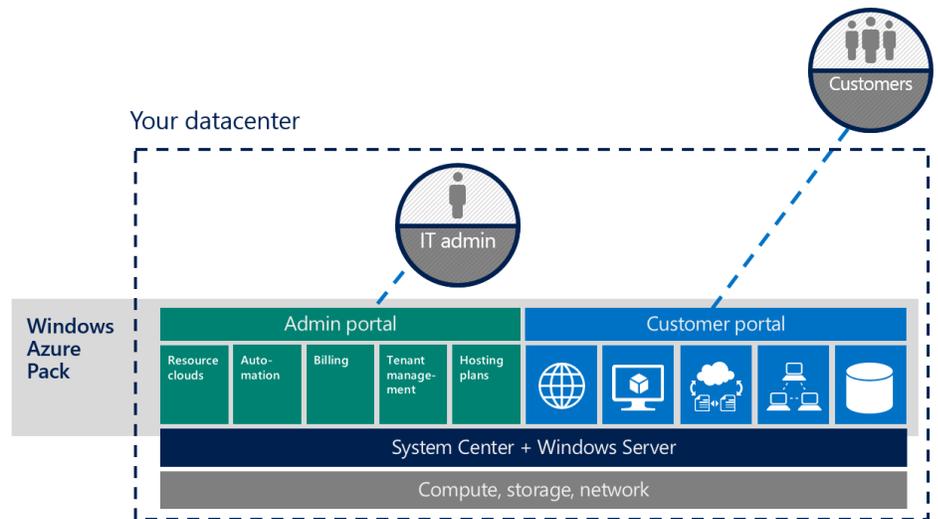


Figure 1: Overview of how Windows Azure Pack helps to deliver services

The User Experience

End users of the cloud environment can access the system in one of two ways: through the Microsoft Azure-consistent portal or through a custom portal in which CPS can be integrated through the Windows Azure Pack REST API. CPS ships with customer identity support. Therefore, users can leverage the directory services, such as Active Directory, that they may already have.

Windows Azure Pack provides the familiar, self-service interface that every subscriber uses to provision and manage services such as the virtual machines (IaaS) service (Figure 2). Additional services can be deployed to the Windows Azure Pack portal after the initial deployment.

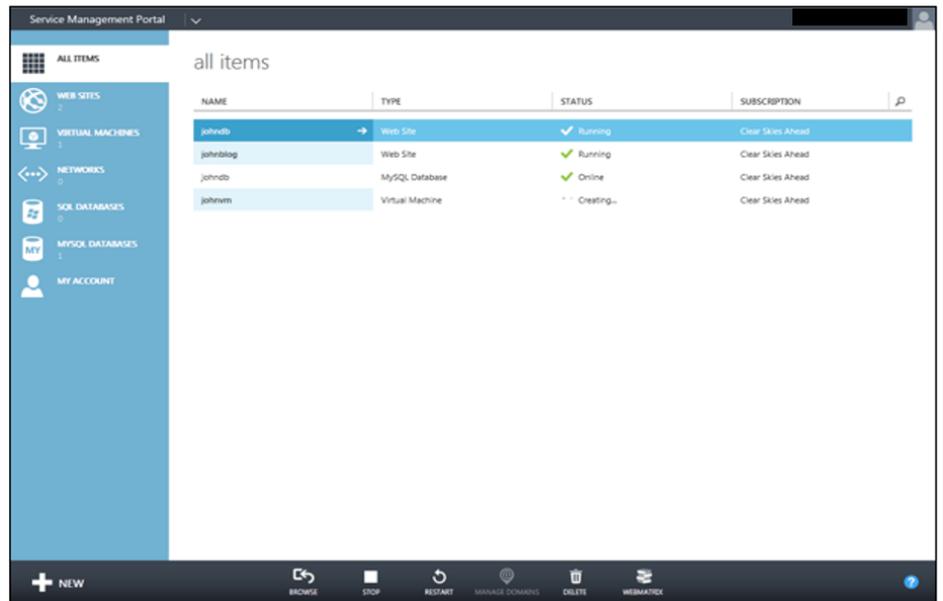


Figure 2: Windows Azure Pack management portal for tenants
(Note the strong consistency with the Microsoft Azure portal)

Virtual Machines (IaaS)

CPS provides IaaS services for provisioning VMs that are running either Windows or Linux. Service administrators can offer various preconfigured images through the service gallery or users can create their own. This allows for a very simple and standardized way to not only provide VMs with a base operating system image, but also preconfigured applications within those images.

Workloads

A major appeal of the cloud services model is the variety of prebuilt templates that can accelerate productivity for the end user. With CPS, service providers and enterprises can build a robust portfolio of potential workloads that they can make available to customers and end users.

Predefined Gallery Items for Microsoft Workloads

To help providers quickly start delivering tenant-facing workloads, there are many workload templates in the Windows Azure Pack Gallery (for example, Active Directory and Microsoft SQL Server) that can be leveraged and adapted for CPS Standard.

Custom Workloads

Service providers and enterprises can create their own custom workloads to meet unique or specific customer requirements—adding more value to their services. For example, service providers can configure applications, operating systems, deployment rules, and the wizard that the tenant uses in the self-service portal to provision services.

Enterprises can make business applications available to users in various departments to speed up deployment of those critical in-house workloads, and eliminate the discrepancies among multiple application deployments through the reuse of the same deployment template.

Fabric Architecture

The CPS fabric is composed of the hardware components, their firmware and drivers; the operating environment for the various types of resources; and the management software components running on top of the resources. From an architectural point of view, cloud infrastructure fabric resources can be grouped into three logical resource layers: compute fabric, network fabric and storage fabric.

The CPS fabric combines forward-looking design, testing and automation to ensure that the system maintains the highest availability levels with as little human intervention as possible. Automation of the day-to-day operations of the system frees up the IT staff to focus on higher-level tasks and on bringing additional value to the business.

The self-service portal further simplifies management by enabling users to create and manage workloads in a dynamic fashion, while isolating tenants from each other. This means that user-provisioned workloads will always be agile and able to adapt as needs and uses change.

Stability and lower total solution cost are attained by decoupling the tenant-provisioned resources from the operations of the physical resources through a software defined infrastructure.

Customizable Architecture

The CPS Standard fabric was designed to allow the flexibility to substitute certain components of the base Microsoft software-defined stack.

An important example is the ability to change the basic storage architecture, which in the base stack uses scale-out file servers running Storage Spaces, and deliver hyper-converged systems based on software-defined block storage.

This allows customers a choice of solutions that are optimized for different use cases and physical solution topologies.

For an up-to-date survey of the CPS Standard solutions available from Microsoft partners, please refer to the [Microsoft web site](#).

Software-Defined Datacenter Technologies

The CPS software-defined infrastructure provides more flexibility to customers than traditional approaches. Software-defined storage, computing, and networking in CPS deliver better economics through the implementation of industry-standard hardware at scale, and then using software to make that hardware infrastructure reliable, available, and more easily serviceable.

Users can dynamically deploy resources using automation while maintaining the highest levels of availability and reliability. This applies to all facets of a workload, including VM placement, storage, memory, networking, and security.

To enable our customers to take advantage of their existing technologies and to create a variety of offerings that embrace different software-defined datacenter technologies, in CPS Standard, we also invited our OEM partners to bring their software-defined datacenter technologies into the solution.

Compute

With software-defined compute, the goal is to dynamically load balance compute resources. This means having the ability to virtualize compute, memory, and associated devices on a per-tenant and per-workload basis, and being able to allocate more or less memory or CPU from a pool on an as-needed basis.

Software-defined compute in CPS builds on Hyper-V server virtualization by adding the power of System Center 2012 R2 Virtual Machine Manager and Windows Azure Pack. This enables VM management using workload templates, automated deployment and provisioning, intelligent placement, virtualized networking that moves with the VM, and the live migration features of Hyper-V. The ability to manage all

aspects of the VM—including location, CPU, memory, monitoring, and isolation—using a single console across up to 16 compute nodes means that CPS Standard compute resources are easily manageable at various scale points using standardized, repeatable policies and processes.

Hyper-V virtual machine live migration enables workloads to move from any compute cluster node to another, across physical network boundaries, with no downtime. The move is fully transparent, with users typically not even aware of the move. Automated servicing is possible with the capability of live migrating workloads off a cluster node that is about to be serviced, and then migrating them back after the patches and updates have been applied. This is all done without having to take the workload offline. In addition, just like CPS Premium, all CPS Standard servicing releases (typically in the form of "updates") will be pre-validated by our OEM partners. With the tailor-made servicing automation technology for CPS Standard, administrators can enjoy an almost hands-free and worry-free servicing experience to update all software components inside CPS Standard. This includes all Microsoft software components, OEM partner software components, drivers and firmware for the devices in the CPS Standard stamp.

Networking

To transform networking, customers should think about it in the same way as compute—a shared, automated pool of capacity. Software-defined networking reduces operational complexity. Physical resources are carved up into virtual resources.

Given the size of CPS Standard and the intent of keeping a smaller footprint of the system overhead, CPS Standard was designed to leverage the simplistic VLAN-based tenant network isolation model. VLAN isolation is expected to remain common practice in many deployments given its relative simplicity and ease of management at smaller scale. This model enables users to use dedicated VLANs and PVLANS to isolate different customers from one another, which is also key to meeting the multi-tenancy and isolation requirements that exist in service provider or enterprise IT organizations.

To assist administrators of CPS Standard systems to better manage tenant VM network creation, Microsoft created an automation tool to help configure new VM networks for the environment. After the VLANs have been provisioned for tenants at the physical network layer, an administrator can use the automation tool to create the VLAN-based logical networks, VM networks and other associated internal objects in Virtual Machine Manager (VMM) for tenant use.

Storage

CPS Standard solutions allow the flexibility to choose between disaggregated and hyper-converged storage architectures. In both cases, CPS Standard solutions are designed to take advantage of the best practices in the deployment of the software-defined storage solution from either Microsoft or our trusted industry partner, and are tested as integrated solutions.

- The Dell Hybrid Cloud System for Microsoft CPS Standard solution offers a disaggregated storage architecture, in which storage management nodes are physically separate from the nodes used for compute capacity. It uses JBODs (Just-a-Bunch-Of-Disks) as the foundation of the pooled storage infrastructure. Physical hard disks are used to create storage pools of tiered storage that are defined by Windows Server 2012 R2 Storage Spaces. These software-defined units are made available to Scale-Out File Servers that provide the storage resources for the entire system, using SMB 3.0 to provide a high-performance storage architecture. This disaggregated architecture allows the storage capacity to scale independently of the compute capacity, and provides risk separation between compute and storage fabrics.
- The HPE Hyper Converged 250 for Microsoft solution relies on a hyper-converged storage architecture, in which the storage capacity is provided by the same physical nodes that provide the compute capacity. Microsoft worked with HPE to integrate the HPE StoreVirtual software-defined storage technology which enables the hyper-converged architecture into the CPS Standard fabric. HPE's StoreVirtual software aggregates the local storage capacity attached to each compute node into logical storage pools, and provides configurable logical volumes to the Hyper-V failover cluster for tenant storage consumption. This hyper-converged architecture maximizes infrastructure density and enables a smaller physical form factor to start your cloud journey.

Software-defined storage enables workloads to scale with the right mix of capacity and performance. Testing has also been performed against multiple failure scenarios, to minimize impact and improve the overall resiliency of the system.

In CPS Standard, customers are empowered to define the storage configuration based on the storage requirements of the virtual workloads that are to be hosted by the platform. This approach provides more customization and configuration flexibility to

administrators, and integrates better with existing IT planning processes. Microsoft's experience has shown that the virtual workloads most often dictate the requirements that the underlying storage fabric needs to support.

Resilient Fabric

On top of dense and high-performance industry standard hardware, a software-defined fabric of compute, network and storage is created, using features in Windows Server 2012 R2 and System Center 2012 R2. Designing the solution for N+1 redundancy at the hardware layer, and additionally implementing high-availability at the software layer makes CPS Standard a resilient infrastructure.

As an example, storage remains accessible in case of the failure or loss of access to a single storage enclosure. The loss or removal of a single server in the solution will be tolerated without the loss of access to storage resources, or sufficient compute resources to maintain or restart all previously running VMs. Virtual machine mobility is a quick online process because of the storage fabric design which leverages Cluster Shared Volumes (CSV) and Scale-Out File Servers in the storage cluster.

The resulting benefit is that hardware failures will have minimum impact on the virtualized workloads running on CPS Standard.

Scaling Out CPS Standard

CPS Standard is designed in a way that the management components are deployed and configured to be able to handle the maximum scale of the solution. When scaling out CPS Standard from the initial four compute servers up to 16 servers, there is no need to add or deploy any new management software components.

In addition, the capacity expansion operation can be carried out via a simple and user-friendly graphical user interface. After entering some basic information, the built-in automation will add the new resources into the resource pool and make the new capacity available for consumption.

In the disaggregated solution architecture (where the storage nodes and compute nodes reside on separate computers), while we set maximum scale for compute capacity, the maximum storage capacity will be determined by our OEM partners' solution options (number of JBODs, number of slots per JBODs, mix of HDDs and SSDs, storage raw capacity for each disks, and the number of disks). A benefit of disaggregated solution architecture is that the growth of compute capacity can be non-linear to the growth of storage capacity.

Management Services

When it comes to management, CPS is preconfigured for highly automated management of the entire system. As a result, a high level of IT infrastructure agility can be achieved. Management services are pre-deployed, integrated, and customized for CPS in a highly available manner. Administrative work is done from the same consoles that may be familiar to service providers or enterprise IT staff, using the System Center 2012 R2 suite to manage all the underlying cloud fabric used by the tenants. Finally, Microsoft together with its OEM partners has spent a tremendous amount of time on testing and validating each component within CPS, both individually as well as in combination. Ultimately, this means that prequalified patches, firmware updates, and driver updates are packaged for the entire solution, and that updates are made with minimal impact to running tenant services through an automated and orchestrated mechanism.

Fabric Management and Optimization

With System Center Virtual Machine Manager, the fabric has been pre-optimized to manage the aggregated lifecycle of physical compute, storage and network resources. Additionally, tenant workload placement and optimization is handled automatically by the system.

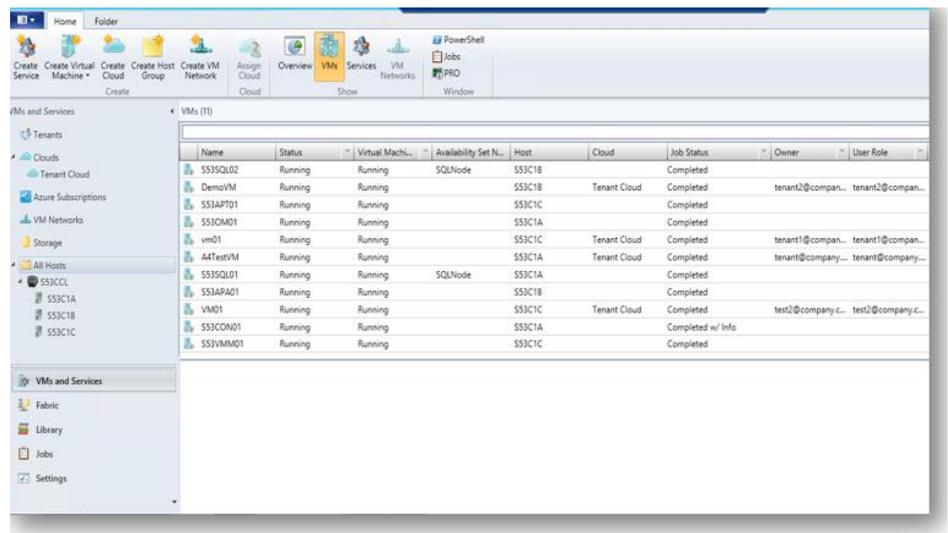
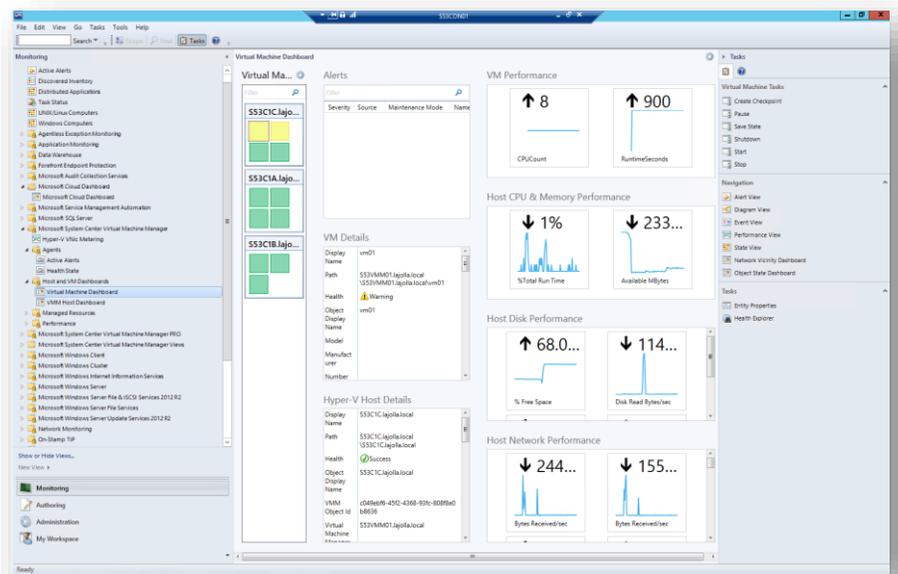
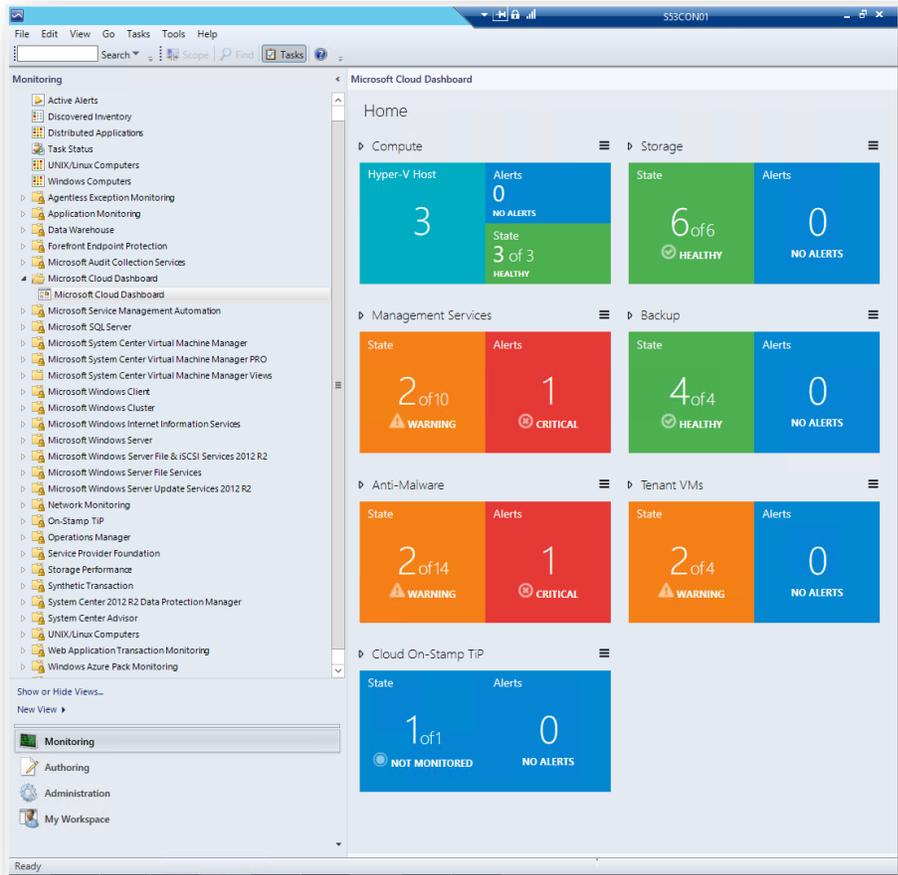


Figure 4: Using Virtual Machine Manager for fabric management and optimization

Fabric Monitoring

Using System Center Operations Manager capabilities, administrators can monitor the fabric compute, storage, and network components using centralized dashboards which have been customized for CPS

(Figure 5). From the dashboards, they can see component health at a glance and drill into granular health, performance, and capacity. Pre-tuned management packs are optimized to eliminate alerting noise and help administrators to focus on what is important.



Backup Services

Backup services that span both tenant workload backup and management infrastructure backup are included with CPS. In CPS Standard, we optimized the backup infrastructure architecture by moving the backup components (both the backup software component and the backup storage) outside of the solution stamp. The physical separation of backup components from the primary stamp further enhances the resiliency of the backup data.

In addition, with the automated integration with Azure Backup service, IT organizations have options to select the desired backup data retention policy and move the aged data to Azure storage via the Azure Backup service. This enables administrators to keep an offsite backup copy without maintaining extra infrastructure.

Tenant Workload Backup

With System Center Data Protection Manager (DPM), CPS can take advantage of pre-deployed service-oriented backup strategies that include the following:

- Automation to protect newly-provisioned tenant VMs with the launch of a runbook
- An alerting mechanism for VMs that miss the backup SLA
- Backups configured to run during a maintenance window
- Deduplication to reduce backup storage consumption
- The ability to configure Azure Backup with a single runbook

Management Components Backup

As with the tenant workload backup, CPS Standard offers pre-deployed service-oriented backup of the management software components. This helps to ensure continued uptime of the system and infrastructure services. DPM servers are provisioned through a runbook and are managed through a central DPM console. All the management components are automatically backed up, and runbooks are provided to validate post-recovery consistency.

Automated Updates

Microsoft developed a Patch and Update engine (P&U) - that enables CPS administrators to easily and reliably update the software on their stamps without disrupting tenant workloads. The updates are tested and validated internally before distribution to customers on a predictable

cadence. The update packages are built to enable customers to operate in a disconnected environment, provide comprehensive logging and complete inventory output. The P&U Engine understands the inter- and intra-dependencies across components, enters and exits maintenance mode when servicing objects and lastly, validates components after servicing to ensure a smooth transition back into the management, storage or compute stack. Hardware and firmware update workflows are also included in the engine.

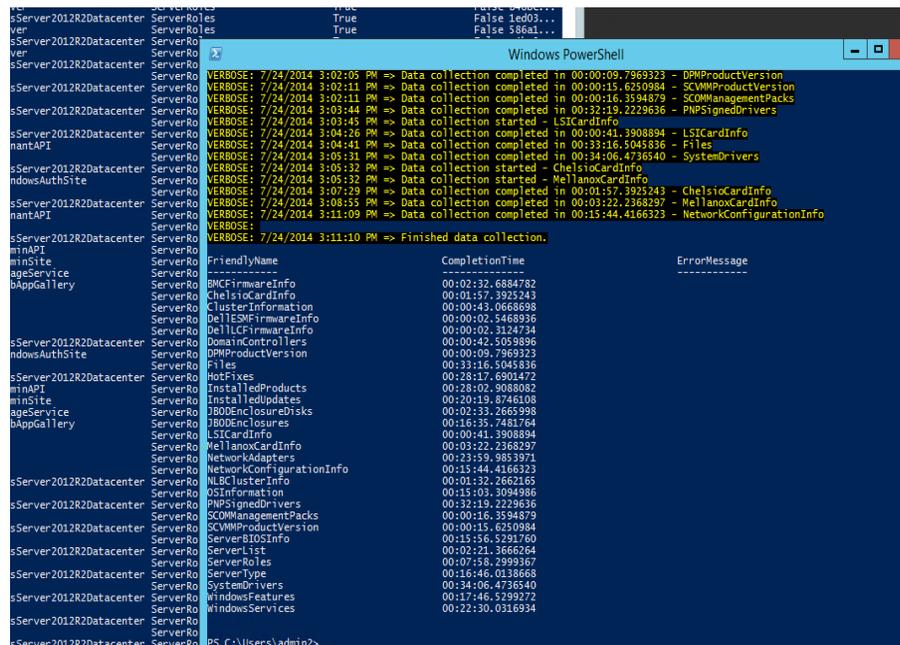


Figure 7: Orchestrated updates in CPS

Disaster Recovery with Azure Site Recovery (ASR)

For many organizations, disaster recovery is a complicated process. It is often difficult to test and difficult to manage. With CPS Standard, you have the option to use Azure Site Recovery (ASR) to create a disaster recovery plan between a CPS Standard stamp and Microsoft Azure as the recovery site.

With ASR, disaster recovery is simplified and incorporated into the overall design of the system. ASR keeps tenant workloads highly available by using only management metadata to structure the recovery. VMs that are located on an on-premises CPS Standard stamp are replicated to Azure automatically. If a disaster occurs, replication and failover is orchestrated by ASR. The data is stored in an Azure storage account. ASR simplifies disaster recovery by providing constructs for single-click application failover and enabling non-production impact testing of failovers.

Conclusion

The world of IT is undergoing constant change. To remain competitive, service providers and enterprises must keep up with the ever-growing complexity and massive speed of innovation.

The Microsoft Cloud Platform System offers a complete end-to-end, Azure-consistent, on-premises hybrid cloud solution. The solution is a pre-integrated, fully validated, and supported package, delivering superior value for Windows and Linux workloads.

IT staff can focus on high-value tasks instead of spending valuable time on building hardware solutions. Through converged systems, the software-defined infrastructure, and unified (and thus simplified) IT operations, customers can achieve greater flexibility while reducing cost. With CPS, developing new business offerings can now happen at cloud speed in the datacenter.