



Microsoft System Center 2016

White Paper

Technical overview for IT professionals

July 2016



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Introduction

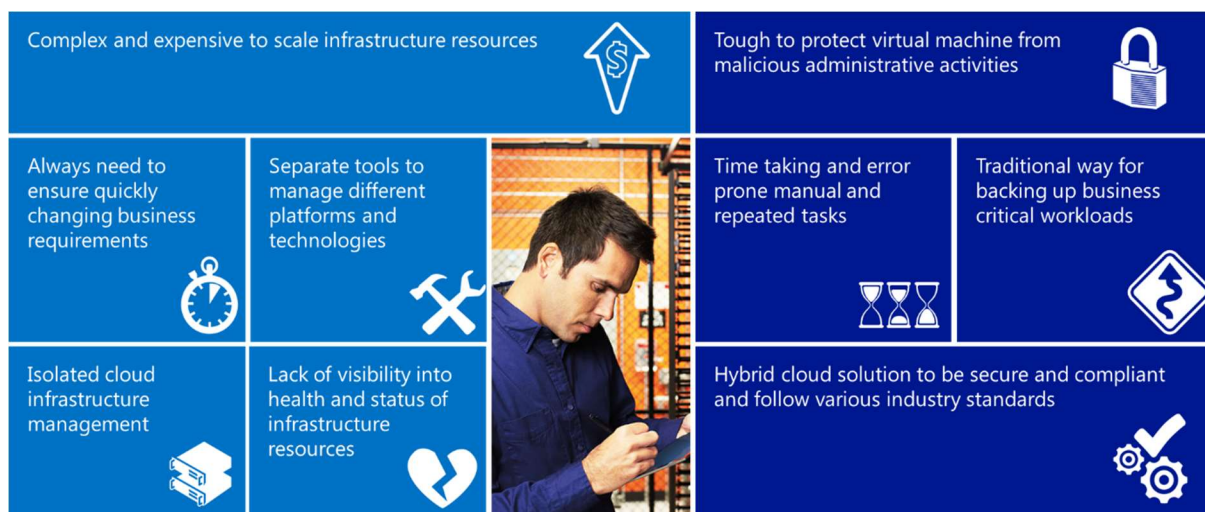
Business needs and technology innovations are converging to offer unique opportunities for IT professionals to better deliver IT resources that meet business requirements. Today's organizations are adopting hybrid cloud to extend their IT infrastructure for better flexibility and scalability. Enterprises are looking for a comprehensive infrastructure management solution that can enable these benefits, including shared resources as well as the elasticity to scale up and down on-demand to meet changing business needs—minimizing downtime and failures while maximizing cost efficiencies.

By transforming a traditional datacenter to a private cloud, you can be more agile and manage resources more effectively. You can also extend your datacenter to the public cloud through a hybrid cloud model. A Microsoft hybrid cloud lets you easily move workloads from your datacenter to Microsoft Azure or a hosting service provider's datacenter, while still maintaining a complete view of the infrastructure. You can build hybrid applications that leverage both on-premises and cloud resources. And you can take advantage of storage, backup, and recovery options with increased efficiency and reduced cost. According to one Gartner report, "By 2017, 50 percent of total IT spending will be sent out of the formal IT organizations."

Datacenter modernization to meet business needs

With the traditional infrastructure management, IT teams are always under pressure to deliver IT resources for ever-changing business requirements. With different projects and department requirements, including short term and long term, the cost of delivering IT resources is increasing day by day and impacting the business revenue model. Without an appropriate solution, infrastructure operations and management can become complex and inefficient.

Some of the common challenges businesses are facing to meet infrastructure management include:



Unify datacenter and cloud management

Microsoft combines its expertise with experiences to deliver leading enterprise operating systems, platforms, and applications in a new approach for the hybrid cloud. A modern platform of products and services helps organizations transform their current infrastructure into a highly elastic, scalable, and reliable cloud infrastructure. Quickly and flexibly build and manage modern applications across platforms, locations, and devices to unlock user productivity from wherever and on any device. Microsoft uniquely delivers a consistent and comprehensive set of cloud capabilities across enterprise private, hybrid, and public cloud, such as Windows Server 2016 and System Center 2016, Windows Azure, or public cloud offerings from service providers using Microsoft Azure Stack.

"With our Microsoft cloud infrastructure, we have reduced our IT costs by 75 percent and gotten out of the business of owning so much IT staff."

Craig Cuyar
Global CIO, Cushman & Wakefield

Microsoft System Center 2016 delivers a unified experience of management across on-premises, service providers, and Windows Azure environments. It includes critical aspects of infrastructure management and DevOps for resource provisioning, configuration, monitoring, automation, service management, endpoint protection, and backup and recovery. With consistent and unified management, System Center 2016 helps in transforming your datacenter into modern IT.

System Center 2016, extended with Microsoft Operations Management Suite (OMS), unleashes new management capabilities to deliver a complete hybrid management experience across any datacenter or cloud. System Center empowers the IT team to manage virtually any infrastructure platform—including on-premises, Azure, and Amazon Web Services (AWS) cloud—and supports running on Windows Server, Linux, VMware, or OpenStack.

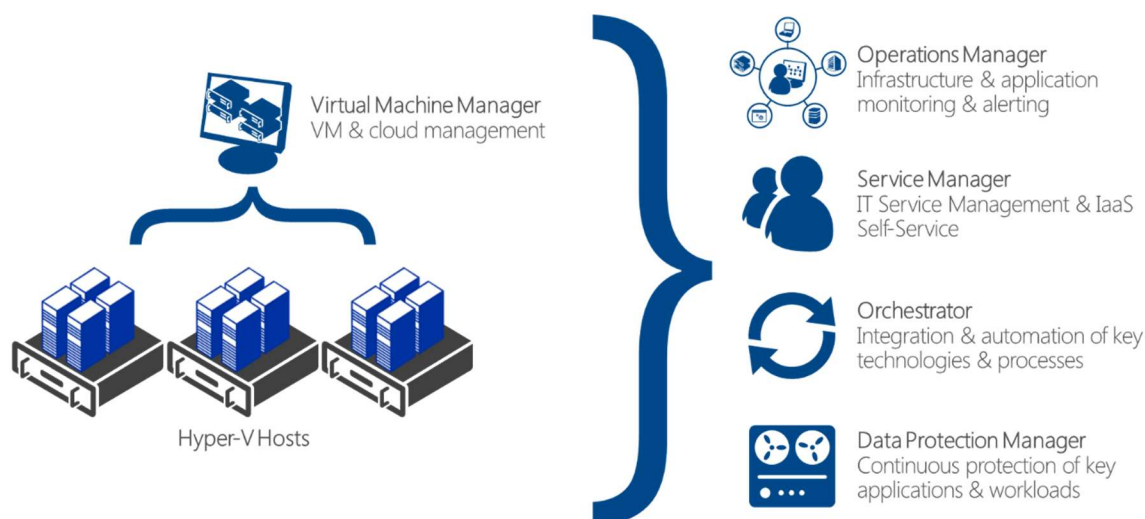


Figure 1: System Center 2016 for unified datacenter and cloud management

Enhanced performance and usability

System Center 2016 enhances performance and usability with a simplified, intuitive management console and a single pane of glass to monitor infrastructure resources in real-time and activate alerts. It also improves the user experience with pre-defined templates, one-click features, alert tuning, and better IT control for more effective configuration management and automation.

Added deployment and management support

System Center 2016 can maintain a heterogeneous environment that includes multiple hypervisors and operating systems. Combined with Windows Server 2016, it supports transformation into a software-defined datacenter (SDDC) to deploy, configure, and manage your infrastructure resource with compute, storage, network, and security.

Extend management to the cloud

Even if you extend your infrastructure to the cloud, System Center 2016 helps unify the management of cloud resources whether you are using Microsoft Azure or AWS. For advanced integration, Operations Management Suite complements System Center to give you the ability to manage and monitor a true hybrid environment.

System Center 2016 capabilities

System Center 2016 delivers five key capabilities for transformation of your datacenter:

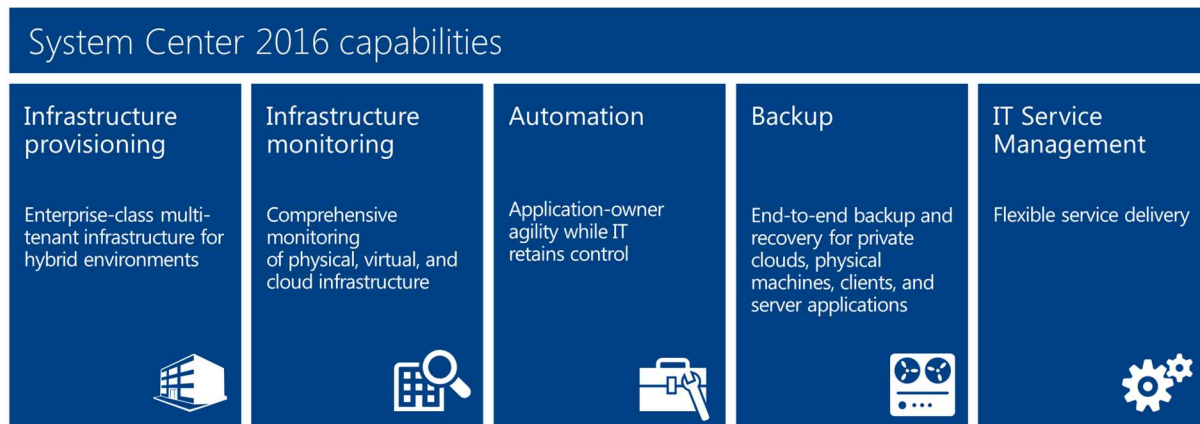


Figure 2: Capabilities of System Center 2016

Infrastructure provisioning

Provision and manage enterprise resources including physical, virtual, and cloud infrastructure to meet different business requirements. Get business workload scalability, high availability, and performance across single or multiple tenants with System Center 2016 provisioning capabilities on a heterogeneous platform. It includes provisioning of compute, storage, and network resources.

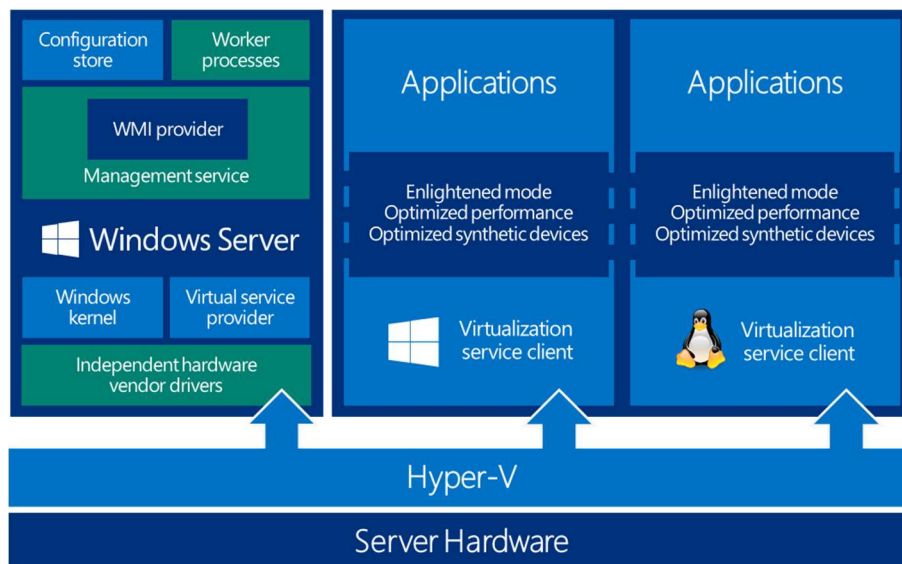


Figure 3: Advanced capabilities for provisioning Linux and Windows virtual machines

Enterprise-class virtualization management with robust Linux support

Microsoft is continuously contributing to take open source software (OSS) support to the next level. System Center 2016 provides the ability to provision Linux virtual machines on Hyper-V and on Azure with a single console. About

25 percent of System Center instances that are out there today also manage Linux, resulting in a rich history for managing diverse environments.

The Microsoft Linux Integration Services (LIS) team pursues ongoing development of enlightened Linux drivers that are directly checked into the Linux upstream kernel, thereby allowing direct integration into upcoming releases of major distributions including CentOS, Debian, Red Hat, SUSE, and Ubuntu.

- **Virtual processor scalability:** System Center 2016 provides scalability and performances for compute-intensive workloads running on the Linux operating system. Now you can add up to 64 virtual processors to a virtual machine running Linux. The number of virtual *processors* supported by a Linux operating system might be lower. For details, see the information published for the specific operating system.
- **Synthetic 2D frame buffer driver:** A synthetic frame buffer driver highly improves graphics performance for Linux virtual machines running on Hyper-V. This driver provides full HD (1920x1080) resolution capabilities for Linux guests hosted in desktop mode on Hyper-V.
- **Dynamic Memory:** System Center 2016 provides dynamic memory support for Linux workloads. Linux dynamic memory drivers continuously monitor memory usage on Linux Virtual Machines and reports on a timely basis. You can automatically allocate and de-allocate dynamic memory across virtual machines. These drivers also provide both hot-add and ballooning support, and can be configured using parameters such as start, minimum, or maximum RAM.
- **Linux kdump/kexec support:** Hyper-V infrastructure is also enhanced to allow seamless creation of crash dumps using enlightened storage and network drivers, which eliminates the need for special configuration. Linux users are free to dump core over the network or attached storage devices.
- **Non-maskable interrupts (NMI) support:** NMIs are useful in obtaining crash dumps of operating systems that have become unresponsive due to application bugs. In the case of an unresponsive Linux virtual machine, you have the option to panic the system with NMI, which is very helpful to diagnose a system deadlocked due to kernel or user mode components.
- **Specification of memory mapped I/O (MMIO) gap:** MMIO provides fine-grained control over available RAM for virtual appliance manufacturers. The MMIO gap is typically used to divide the available physical memory between an appliance's Just Enough Operating Systems (JeOS) and the actual software infrastructure that powers the appliance.
- **Linux secure boot:** Boot Linux OS running on Generation 2 virtual machines on Hyper-V with the secure boot option. The secure boot option uses UEFI-based secure boot mode to verify operating system components using signatures present in the UEFI data store. Configure the virtual machine to use the Microsoft UEFI Certificate Authority before you boot the virtual machine for the first time. This can be done from Hyper-V manager or System Center 2016 Virtual Machine Manager, or with Windows PowerShell.
- **Resize online Linux VHDX:** You can dynamically resize fixed-sized virtual hard disks (VHDs) of Linux virtual machines running on Hyper-V to allocate more storage while keeping the performance benefits of the fixed-size format.

Support for Windows Server scale and performance

System Center 2016 offers native support for Windows Server provisioning and management, including Windows Server 2016. System Center provides advanced features for managing virtual machines with Windows Server as a guest operating system.

- **Hot-add memory and network adaptor:** Modifies assigned memory in running virtual machines built on both Generation 1 and Generation 2. On the other hand, you can also add network adaptors in the running virtual machine built on Generation 2 virtual machines.

- **Nano Server lifecycle management:** Performs lifecycle management of the Windows Server 2016 new installation option, Nano Server, including:
 - Prepare Nano Server-based host for System Center 2016 – Virtual Machine Manager (VMM).
 - Configure **bare metal machines as Nano Server**-based hosts, compute clusters, and storage clusters (both dis-aggregated and hyper-converged).
 - Add and manage existing Nano Server-based standalone hosts, compute clusters, and storage clusters (both dis-aggregated and hyper-converged) using VMM.
- **Checkpoints for virtual machines:** Provides different types of checkpoints for virtual machines to capture the state, data, and hardware configuration of a running virtual machine.
 - **Production checkpoints** are “point-in-time” images of a virtual machine, which can be restored later on in a way that is completely supported for all production workloads. This is achieved by using backup technology inside the guest to create the checkpoint, instead of using saved state technology.
 - **Production-only checkpoints** are the same as production with one key difference: if a production checkpoint fails, then no checkpoint will be taken. This is different from production because if a production checkpoint fails, a standard checkpoint will be taken instead.
 - **Standard checkpoints** capture the state, data, and hardware configuration of a running virtual machine and are intended for use in development and test scenarios. Standard checkpoints can be very useful if you need to recreate a specific state or condition of a running virtual machine to troubleshoot a problem.
- **Resizing of online VHDX** lets you gain scalability by resizing virtual hard disk of a running virtual machine on Hyper-V. To perform online resizing, you need a virtual machine with a .VHDX file attached to a SCSI controller. This functionality is not supported with .VHD files or IDE controllers.

Fiber-channel SAN connectivity

System Center 2016 has improved its support for fiber channel integration. You can seamlessly integrate, discover, and add fiber channel SAN devices while centrally managing iSCSI and fiber channel capabilities. Once connected, you can perform advanced storage management such as creating and assigning LUNs, initializing disks, creating partitions and volumes, removing capacity, unmounting volumes, or masking LUNs.

Storage QoS management

Windows Server 2016 and System Center 2016 Virtual Machine Manager provide new features for effective storage resource management through storage quality of service (QoS) policies. These policies help IT teams define thresholds to ensure QoS for storage resources. These thresholds can be minimum or maximum IOPS, or minimum or maximum bandwidth in MBs/s. Custom QoS policies can be defined for any single virtual machine or for the group of virtual machines.

Simplified provisioning and migration

System Center 2016 provides simplified provisioning of infrastructure resources within the datacenter and on the cloud. These functionalities include provisioning of resources including virtual machines, SAN devices, and network devices. System Center also enables migration of virtual machines from on-premises datacenter to the cloud in a hassle-free manner.

- **Scale-Out File Server and storage space deployment:** Scale-Out File Server provides scale-out file shares that are continuously available for file-based server application storage. Scale-out file shares provide the

ability to share the same folder from multiple nodes of the same cluster. You can have a multi-node file server cluster that is using Server Message Block (SMB) scale-out with a computer running Windows Server 2016, Windows Server 2012 R2, or Windows Server 2012 that can access file shares from any of the four nodes. This is achieved by leveraging new Windows Server Failover Clustering features and the capabilities of the Windows file server protocol, SMB 3.0. System Center 2016 enables deployment and management of Scale-Out File Server clusters on bare metal.

- **Cluster OS Rolling Upgrade:** The Cluster OS Rolling Upgrade is a new feature in Windows Server 2016 that enables upgrading the operating system of the cluster nodes from Windows Server 2012 R2 to Windows Server 2016 without stopping the Hyper-V or the Scale-Out File Server workloads. Orchestrate workflows of draining the node, evicting it, reinstalling the operating system, and adding it back to the cluster. You don't need additional hardware to upgrade the cluster. The upgrade process is reversible until the customer chooses the "point of no return," when all cluster nodes are running Windows Server 2016. It also support patching and maintenance operations while running in the mixed-OS mode.
- **Template-based provisioning:** Provision virtual machines with pre-defined templates that save manual efforts and eliminate chances of committing error. System Center 2016 – Virtual Machine Manager offers you the ability to define standardized application blueprints, which can be used to automatically deploy application services to shared resource pools, thus simplifying application provisioning. These templates can be used for provisioning virtual machines running both Windows and Linux.
- **Shielded VMs and Guarded Fabric:** Provide a more secure environment by protecting virtual machines from malicious administrative attacks and malwares by configuring Shielded VMs and Guarded Fabric. Additionally, protect hosts or other virtual machines from a virtual machine running malicious software and protect virtual machines from a compromised host.
 - **Shielded VM** is a Generation 2 (supported on Windows Server 2016, Windows Server 2012 R2, and Windows Server 2012) that has a virtual TPM, is encrypted using BitLocker, and can only run on healthy and approved hosts in the fabric.
 - **Guarded fabric** is comprised of one Host Guardian Service (HGS)—typically, a cluster of three nodes—with one or more guarded hosts and a set of shielded virtual machines. The HGS supports two different deployments of a Guarded Fabric (attestation modes). First, we recommend the hardware-based, TPM-trusted attestation since it offers stronger assurances (although it requires that your Hyper-V hosts have TPM 2.0). Second, HGS also supports admin-trusted attestation (AD-based), if you currently do not have TPM 2.0.
- **Host dynamic optimization:** System Center 2016 – Virtual Machine Manager provides both Dynamic Optimization and Power Optimization features, and runs Dynamic Optimization on demand for a host cluster.
 - **Dynamic Optimization** enables migration of virtual machines within a host cluster to improve load balancing among hosts and correct any placement constraint violations for virtual machines. Dynamic Optimization can be configured on a host group to migrate virtual machines within host clusters with a specified frequency and aggressiveness. Aggressiveness determines the amount of load imbalance that is required to initiate a migration during Dynamic Optimization. You can specify Dynamic Optimization settings for the following resources: CPU, memory, disk I/O, and network I/O.
 - **Power Optimization** helps save energy by turning off hosts that are not needed to meet resource requirements within a host cluster, and then turning the hosts back on when they are needed again. Power optimization is performed all of the time when the feature is turned on. However, you can schedule the hours and days during the week when power optimization is performed. Power Optimization settings include CPU, memory, disk space, disk I/O, and network I/O.

- **Storage Spaces Direct:** System Center 2016 enables deployment and management of storage clusters with Storage Spaces Direct (S2D) in disaggregated and hyper-converged topology. Storage Spaces Direct is a feature of Microsoft Windows Server software-defined storage (SDS), which enables building highly available and scalable storage systems with local storage and unlocks use of new classes of disk devices, such as SATA and NVMe disk devices that were previously not possible with clustered storage spaces with shared disks. S2D eliminates the need for a shared SAS fabric and its complexities, but also enables using devices such as SATA solid state drives, which can help further reduce cost or NVMe solid state devices to improve performance.
- **Nested virtualization:** Nested virtualization allows for the Hyper-V host itself to be virtualized and run Hyper-V hosts as virtual machines in a Hyper-V virtualized environment. It enables a solid scenario for running a Hyper-V lab in a virtualized environment, without the need for individual hardware. It also exposes hardware virtualization support components (including Intel VT-x and AMD-V) to the guest virtual machine to enable nested virtualization.

Multi-tenant cloud infrastructure

System Center 2016 is designed to work in multi-tenant mode to provide complete isolation among infrastructure resources for different customers. It also provides better visibility and deep insight into infrastructure resource usages separately for different customers, with detailed chargeback reports. System Center offers flexibility to choose hypervisor platforms for unique business requirements.

- **Multi-hypervisor infrastructure:** System Center 2016 Virtual Machine Manager (VMM) enables you to deploy and manage virtual machines and services across multiple hypervisor platforms, including VMware ESXi hosts, by directly integrating with VMware vCenter Server. VMM enables you to manage and provide resources from multiple hypervisors and make the resources available to private cloud deployments, all from a common user interface and common command-line interface (CLI). Perform your day-to-day operations of VMware from Virtual Machine Manager, including discovery and management of ESXi hosts, and create, manage, store, and place virtual machines on ESXi hosts.
- **Virtual network management:** System Center 2016 provides integrated management for software-defined networking (SDN). Easily deploy SDN components like Network Controller, Gateway, and Software Load Balancer (SLB) using pre-defined and customizable service templates. You can create and manage flexible gateway pools instead of traditional gateway clusters to achieve higher availability with fewer virtual machines, and control network traffic coming in and out of a virtual machine using port access control lists (port ACLs).
- **Multi-tenant edge gateways:** System Center 2016 provides a multi-tenant gateway solution that supports multiple host-to-host VPN tenant connections, Internet access for tenant virtual machines by using a gateway NAT feature, and forwarding gateway capabilities for private cloud implementations. Hyper-V network virtualization provides tenant virtual network isolation with NVGRE, which allows tenants to bring their own address space and allows hosting providers better scalability than is possible using VLANs for isolation.
- **IP address management:** IPAM provides highly customizable administrative and monitoring capabilities for the IP address and DNS infrastructure on an enterprise or cloud service provider (CSP) network. You can monitor, audit, and manage servers running Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) by using IPAM. You can add an IP Address Management (IPAM) server that runs Windows Server 2012 R2 or Windows Server 2016 to the resources in VMM. After you add the IPAM server, the IP address settings that are associated with logical networks and virtual machine networks (VM networks) in VMM are kept in synchrony with settings that are stored in the IPAM server. With Windows

Server 2016, many new and improved features are included in IPAM, such as enhanced DNS service management; Multiple Active Directory Forest support; Purge Utilization Data; Windows PowerShell support for role-based access control; enhanced IP address management; and integrated DNS, DHCP, and IP address (DDI) management.

Extend familiar management to Microsoft Azure

System Center 2016 is a unified solution to provision and manage virtual machines running within your datacenter or the Azure environment. It also enables the migration of virtual machines from on-premises to Azure infrastructure.

- **Workloads migrated to Azure:** System Center 2016 Data Protection Manager (DPM) provides migration of on-premises physical and virtual machine to cloud for retention and disaster recovery. Data backed up to DPM can be stored on tape, on disk, or backed up to Azure with Microsoft Azure Backup. With System Center 2016 and System Center 2012 R2 with Update 3, DPM can be deployed as an Azure virtual machine. If DPM is deployed as an Azure virtual machine, you can back up data to Azure disks attached to the DPM Azure virtual machine, or you can offload the data storage by backing it up to a Recovery Services vault.
- **Manage Azure instances:** System Center 2016 provides unified provisioning and management of virtual machines across the on-premises or Azure environment. By adding Azure subscriptions to the VMM console, you can perform basic operations on virtual machines running in Azure including instances start, stop, restart, and connect instances through RDP. For each Azure subscription you add, you can use a console to see all role instances in all deployment groups in that subscription.

Infrastructure monitoring

Infrastructure monitoring is an important aspect of infrastructure management. Enterprises are looking for comprehensive monitoring for infrastructure resources—whether deployed within the datacenter, physical, virtual, or on the cloud and business-critical application workloads.

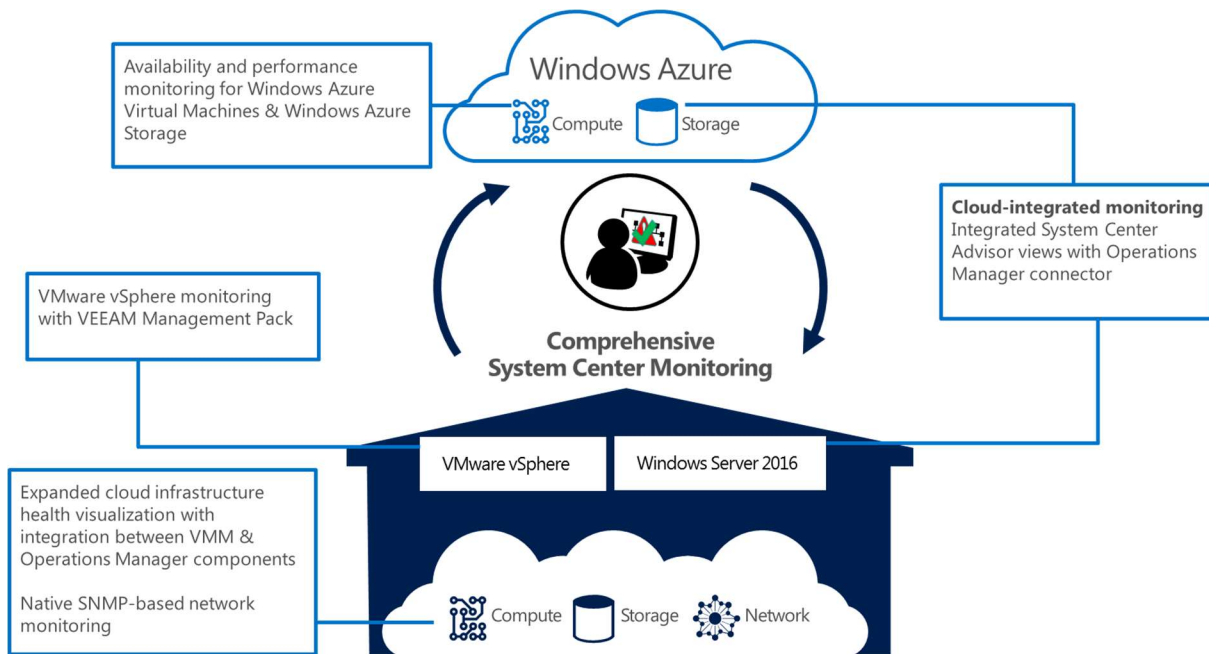


Figure 4: Deep infrastructure and workload monitoring and insights

Best-of-breed Windows monitoring, robust cross-platform support

System Center 2016 provides unparalleled insights into both infrastructure and application level. It offers monitoring for workloads either deployed on the Windows Server environment or non-Windows Server environment. System Center 2016 Operations Manager provides built-in management packs for monitoring Windows Server infrastructure and cross-platform infrastructure resources.

System Center 2016 provides the following monitoring capabilities for different operating system platforms:

- **Windows Server monitoring:** With built-in management packs of Windows Server, System Center provides detailed monitoring for different operating system versions including Windows Server 2008/2008 R2, Windows Server 2012/2012 R2, and Windows Server 2016. System Center provides automated discovery of Windows Server machines and monitors key components including health and availability, Windows services, performance data, network resources, and storage resources.
- **Cross-platform monitoring:** System Center 2016 Operations Manager supports monitoring of infrastructure resources deployed within the cross-platform environment. Monitor twice as much as Linux/Unix agents per management server compared to the previously supported scale. Operations Manager would now use the new Async Windows Management Infrastructure (MI) APIs instead of WSMAN Sync APIs. It supports monitoring across UNIX, RedHat/SUSE Linux, Oracle Solaris, HP-UX, and IBM AIX environments.
- **Integrated monitoring of Microsoft Cloud Platform System (CPS):** System Center 2016 provides seamless integration with Microsoft CPS. Operations Manager monitors for CPS installed and configured as a part of CPS. It provides a centralized dashboard for health and alert visualization for cloud resources.
- **Data visualization:** System Center 2016 provides a centralized dashboard with intuitive visualizations and navigational widgets for categories such as health and availability, resource utilization, alerts, and performance at the host and virtual machine levels. System Center 2016 Operations Manager integrates with Operations Management Suite to provide enhanced visibility and control of your data and applications across on-premises and public, hosted, and hybrid cloud environments. OMS extends Operations Manager

capabilities with Log Analytics, and you can leverage other capabilities of OMS while continuing to use Operations Manager.

- Continue monitoring the health of your IT services with Operations Manager
- Maintain integration with your ITSM solutions supporting incident and problem management
- Manage the lifecycle of agents deployed to on-premises and public cloud infrastructure-as-a-service (IaaS) virtual machines that you monitor with Operations Manager

Network monitoring and cloud infrastructure health

System Center 2016 offers proactive monitoring of enterprise network resources and topology, which helps customers discover and monitor the health of network devices. System Center enhances network monitoring with a simplified dashboard to give visibility into network resources such as load balancers, network pools, and network utilization. System Center also offers flexibility to monitor public or hybrid cloud resources, whether your infrastructure resources are deployed in an Azure or AWS environment.

- **Network resource monitoring:** System Center 2016 Operations Manager provides monitoring of different aspects of network devices including network connection health, VLAN health, port or interface monitoring, Hot Standby Router Protocol (HSRP) groups monitoring, and network resource usage monitoring. With System Center 2016 Operations Manager, customers can create their own management pack with the new NetMonMPGenerator tool to get extended monitoring for their new/existing devices without the need for Microsoft device certification.
- **System Center Management Pack for Windows Azure:** With System Center 2016 Operations Manager Management Pack for Azure, you can monitor availability and performance of Azure resources. This management pack helps in discovering and collecting instrumentation information of Azure resources including virtual machines, storage, and Azure Services. The management pack runs on a specified server pool and then uses Microsoft Azure REST APIs to remotely discover and collect performance information about the specified Microsoft Azure resources. Virtual machines, web roles, and worker roles are able to store events and performance counters into Azure table storage using Azure diagnostics. If these resources are configured to use Azure diagnostics, this management pack can collect these events and performance counters. As soon as new Azure services are released and older services are moved to the new Azure Resource Manager, they will be discovered automatically.
- **AWS Management Pack:** AWS Management Pack extends monitoring capabilities of System Center 2016 to monitor AWS resources. The management pack can monitor EC2 instances (Windows and Linux), Elastic Block Store (EBS) volumes, Elastic Load Balancing, CloudFormation stacks, Auto Scaling groups, and Elastic Beanstalk applications. With a public .NET API at AWS and the SCOM "Watcher Node," the MP can reach into the AWS infrastructure and capture AWS "CloudWatch" metrics to gain insight into the health of the managed AWS resource.

Advanced monitoring capabilities

Microsoft empowers IT teams with advanced infrastructure monitoring capabilities of different hypervisor and management platforms including System Center 2016 Virtual Machine Manager.

- **Operations Manager Connector for VMM:** Seamless integration of System Center 2016 Operations Manager with System Center 2016 Virtual Machine Manager to monitor the health and availability of the virtual machines and virtual machine hosts. You can also monitor health and availability of the VMM management server, VMM database server, and library servers, and see diagram views of the virtualized environment through the Operations console in Operations Manager. When you integrate VMM with

Operations Manager, the monitoring pack for VMM is automatically imported into Operations Manager, and in addition, the following features become available:

- Performance and Resource Optimization (PRO) with default PRO monitors for dynamic memory to monitor virtual machine dynamic memory allocation issues and maximum virtual machine memory aggregations on Hyper-V hosts.
- Maintenance Mode integration to monitor when hosts are placed in maintenance mode using the VMM management server. Operations Manager places them in maintenance mode, in which the agent suppresses alerts, notifications, rules, monitors, automatic responses, state changes, and new alerts.
- Integrating VMM with SQL Server Analysis Service (SSAS) installed on the Operations Manager Reporting server to enable reporting and forecasting capabilities.
- **MP updates and recommendations:** System Center 2016 Operations Manager scans servers in your environment and recommends management packs for downloading. It also notifies when updates are available to Microsoft-authored management packs that are already running in your environment.
- **SCOM agents for Nano server and workloads:** System Center 2016 Operations Manager supports monitoring various server roles running on Nano Server. Operations Manager supports monitoring the base Nano Server operating system and failover clusters. Some of the roles currently monitored include Windows Failover Cluster, DNS, and IIS server.
- **Integration with OMS:** Get better visibility and control of your data and applications across on-premises and public, hosted, and hybrid cloud environments by integrating System Center 2016 Operations Manager with Operations Management Suite. Integrating adds value to your service operations strategy by leveraging the speed and efficiency of OMS in collecting, storing, and analyzing data from Operations Manager. You can centrally monitor on-premises and cloud resources with comprehensive dashboard, smart alerts, reporting, and performance monitoring.
- **Storage monitoring:** Monitoring the health of Storage Space Direct allows defining actionable alerts for urgency, remediation actions, automatic resolution of any addressed issue, and determining affected objects with System Center 2016 Operations Manager.

Best practices for workload monitoring

System Center 2016 offers extended monitoring capabilities to streamline monitoring across different types of workloads. It helps organizations gain visibility into availability and performance for their business-critical workloads. System Center provides detailed monitoring for both Microsoft and non-Microsoft workloads.

- **Latest management packs:** System Center offers new management packs for workloads. These management packs help ensure optimal and efficient monitoring of workloads like Office 365, SQL Server, Exchange Server, and SharePoint Server.
- **Server management packs:** System Center provides a wide range of management packs to monitor different components of server deployment, including monitoring of server Windows, and UNIX and Linux operating systems.
 - **Management packs for Windows Server 2016 server roles** address monitoring and alerts for major roles. Currently, management pack support exists for monitoring of Windows Server OS, Branch Cache, Print Server, IIS, File and iSCSI Services, DHCP, Active Directory Domain Service, Active Directory Federation Service, Active Directory Right Management Service, Failover Cluster, Network Load Balancing (NLB), Windows Defender, Windows Server Essentials, and DNS and DTC roles for Windows Server 2016. Microsoft is actively working to create management packs for Windows Server 2016 server roles such as Active Directory Certificate Services, Active Directory

Lightweight Directory Services, Remote Desktop Services, Hyper-V, Message Queuing, Host Guardian Service, Routing and Remote Access Service, Active Directory Web Application Proxy, Windows Server Update Services, Windows Deployment Services, Network Policy and Access Services, Active Directory Federation Services, Hyper V, and MSMQ.

- **UNIX and Linux operating systems management packs** enable discovering, monitoring, and managing UNIX and Linux computers and provide both proactive and reactive monitoring. The management packs monitor components such as processes, resources, and server agents. The monitoring provided by the management packs includes availability and configuration monitoring, performance data collection, and default thresholds.
- **LAMP stack monitoring:** With open source software (OSS), management packs bring rich performance and health monitoring to favorite open source applications running on Linux such as Apache HTTP Server and MySQL Server. Paired with the Linux management packs, System Center 2016 Operations Manager allows you to monitor LAMP stacks running on Linux or UNIX.

Automation

IT staff wants to improve efficiency by reducing repetitive manual and error-prone provisioning, monitoring, and other management tasks. With infrastructure automation, you can define automated processes for infrastructure provisioning and monitoring with automation workflows for both on-premises and cloud.

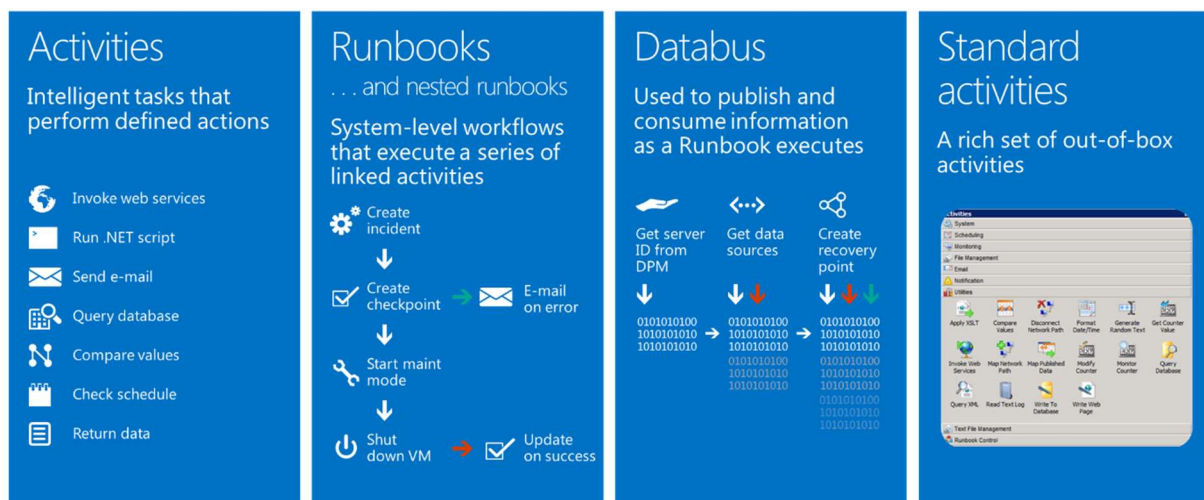


Figure 5: Comprehensive service and process automation

Service and process automation and management

Process automation is all about requests, approvals, and fulfillments of processes. System Center 2016 Orchestrator automates the service processes and systems necessary to fulfill consumer requests. System Center 2016 also provides an integrated platform for automating and adapting organization's IT service management with Service Manager.

- **Automate request routing:** Processes can be automated with System Center 2016 Service Manager for requests, approvals, and other activities that can be configured based on user and application properties. In Service Manager, workflows are created for sequence of activities that automate a business process. These workflows can automatically generate incidents when computers fall out of compliance from desired configuration management. You create a workflow that defines when and under what circumstances it will

run. You can create multiple workflows for each workflow configuration and enable or disable the workflow conditions.

- **Standardized service provisioning:** To provide service request standardization, System Center provides templates, service offerings, and request offerings. Service Manager includes a number of service request templates that are based on a generic incident template. By using these templates, you can categorize information to collect and convey to end users as they submit requests through the Self-Service Portal.
- **Runbook Automation:** System Center 2016 Orchestrator runbooks contain the instructions for an automated task or process. Within the runbook, additional controls provide information and instructions to control the sequence of activities in the runbook. With System Center 2016 Orchestrator or Service Manager, you can automate processes for your datacenter tasks. Service Management Automation incorporates improved experiences for authoring, testing, debugging, and executing runbooks.

Advanced automation management

With advanced and unified automation management capabilities, you can get simplified automation.

- **Enhanced Service Management Automation:** Enhanced Service Management Automation supports PowerShell scripts to provide almost instant execution. Create runbooks with native PowerShell scripts, and execute runbooks more predictably without heavy pre-compilation steps
- **Support for Windows Management Framework 5.0:** System Center utilizes Windows Management Framework 5.0 for authoring runbooks with PowerShell 5.0 scripts
- **Integrated scripting environment:** System Center also utilizes an Integrated Scripting Environment (ISE) plugin for authoring and testing runbooks locally

Scale application tier via automation and integration

Deploy automated workflows for additional capacity provisioning based on defined triggers. Scale application and resources with System Center 2016 Orchestrator and PowerShell as an automation toolset.

- **Integration pack for cloud automation:** With Azure integration pack, System Center simplifies management tasks through automation across your cloud infrastructure, whether it be your on-premises private cloud, Azure infrastructure, or service provider's cloud running Microsoft Azure Stack. Azure Automation runbooks run in the Azure public cloud and are intended to automate Azure-related management tasks. Azure Automation uses a runbook format based on Windows PowerShell Workflow and will primarily use Azure cmdlets to access public cloud resources.
- **SharePoint Integration Pack:** The System Center Integration Pack for Microsoft SharePoint enables automation and management of different types of SharePoint lists and document libraries. There are multiple other reasons you might be using SharePoint in your organization and need to integrate some IT processes with it, such as SharePoint lists to track work items that need to be accomplished in your datacenter and updated automatically as specific tasks are completed. You might also be using SharePoint as an end user portal where requests for IT services are made.

Backup and recovery

A complete backup solution can ensure availability of your business-critical infrastructure even in case of any disaster or failure. System Center provides an end-to-end backup and disaster recovery for infrastructure and workload. System Center allows you to extend backup solution to the cloud via native integration with Operations

Management Suite. With new System Center 2016, you can perform backup and recovery operations at different levels including complete backup and recovery or item-level or end-user recovery.

DPM Backup

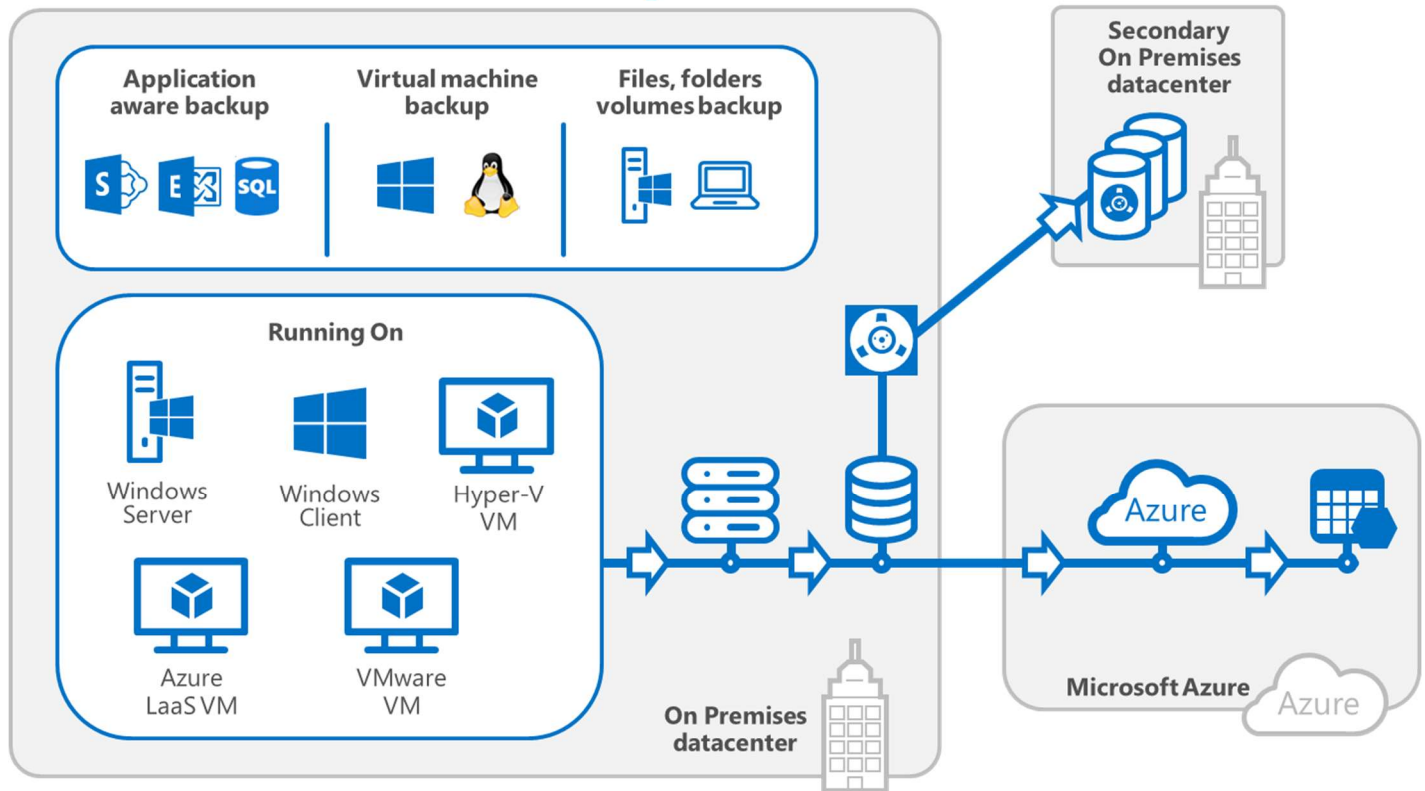


Figure 6: Enterprise-class backup solution for hybrid cloud and workloads

Infrastructure backup and recovery

System Center 2016 Data Protection Manager (DPM) provides unified backup and recovery for data on physical, virtual, or cloud. It also gives flexibility to choose different options to store backup data including traditional tape storage, physical/virtual disk, or in the cloud.

- **Centralized management:** Scale your System Center 2016 Data Protection Manager solution to multiple DPM servers, and monitor and manage your DPM servers from a centralized location. Centralized monitoring of DPM servers from a single location means that you can monitor different versions of DPM, and track the status of servers, tasks, protected resources, tape libraries, available storage, and disk space. You can enable role-based access control, remote recovery, remote corrective actions, and service level agreement (SLA)-based alerting (alerts are generated when an SLA is broken and with alert consolidation).
- **Item-level recovery:** System Center supports item-level recovery (ILR) to perform recovery for any specific file, folder, volume, and virtual hard disks from a host-level backup of Hyper-V virtual machines to a network share or a volume on a DPM-protected server. It doesn't require installation of a DPM protection agent on a guest operation system to perform ILR.
- **Protection of virtual TPM-enabled VMs:** System Center supports and works with latest features of Windows Server 2016 for protection of virtual TPM enable virtual machines. Virtual TPM encrypts VHDs and VHDXs with BitLocker.

- **Backup VM using Storage Spaces Direct:** System Center also protects virtual machines using Storage Spaces Direct (S2D). It includes backup of virtual machines using the S2D hyper-converged scenario with the Hyper-V (compute) and Storage Spaces Direct (storage) components on the same cluster, and the backup of virtual machines using the S2D disaggregated scenario that separates out Hyper-V servers (compute) into a separate cluster from the Storage Spaces Direct servers (storage).
- **Support for mixed-mode clusters:** Cluster OS Rolling Upgrade is a new feature of Windows Server 2016 to upgrade an operating system of cluster nodes from Windows Server 2012 R2 to Windows Server 2016 without stopping workloads. DPM can protect data sources in these mixed clusters, and will protect them seamlessly and without interruption during a cluster upgrade.

Workload-aware backup

Application workload backup is critical to ensure maximum application availability. System Center supports a wide range of application workloads protection.

- **Application-aware backup:** With System Center 2016 Data Protection Manager, you can protect application workloads including SQL Server, Exchange, and SharePoint. It provides flexible backup options, including the ability to back up some workloads as frequently as every 15 minutes. DPM, with its broad range of recovery capabilities, provides application-specific recovery options. For example, customers can replace a current production SQL Server database with an older copy, recover databases to another location for investigation, or recover as files for providing a copy to the legal department.
- **Multiple backup store:** System Center 2016 Data Protection Manager provides multiple options to store backup based on requirements. Apart from backing up data to disk and tape, you can back up data to the Azure cloud for short- and long-term storage using the Azure Backup service.

Advanced backup

System Center 2016 enables retention and off-site protection of on-premises data and physical and virtual machines:

- **Extend backup and recovery to the cloud-based resources:** Enables backup of data to an Azure Recovery Services Vault in addition to disk and tape backup. Backup to the Azure Recovery Services vault allows long-term protection of data to cloud
- **Backup of VMware virtual machines:** Provides backup of VMware virtual machines while DPM is deployed on a VMware virtual machine running Windows
- **Backup Windows or Linux VMs:** Allows backup and recovery for virtual machines running Windows or Linux operating systems
- **Backup of bare metal machines:** Includes full bare-metal backup for physical computers running Windows Server and Windows client operating systems
- **Resilient Change Tracking for incremental backup:** Uses Resilient Change Tracking to identify changes made in VHD and replicate those changed blocks to perform incremental backup

IT service management

System Center provides an integrated platform for automating and adapting your organization's IT service management best practices and built-in processes including incident and problem resolution, change control and asset lifecycle management custom service requests, process integration, and chargeback.

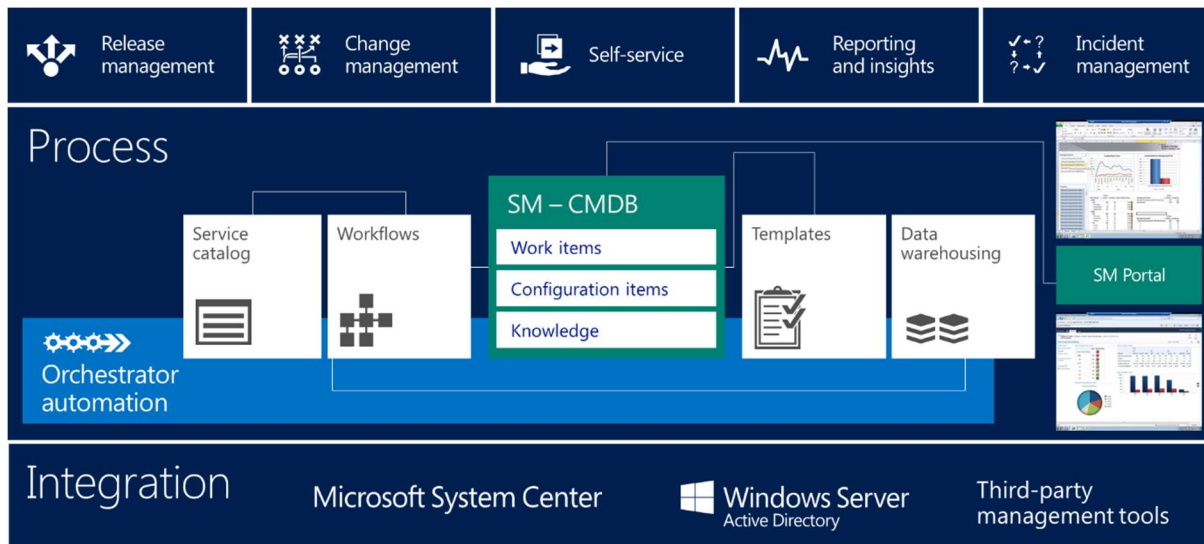


Figure 7: System Center's service management

Self-service requests for private cloud capacity

With System Center 2016 Service Manager, standardize delivery of IT services by defining the service catalog against which users and application owners can request IT services, including private cloud capacity using the Cloud Service Process Pack (CSPP) with Service Manager. This pack helps provide a solution for automating the deployment of private and public cloud infrastructures and self-service experience to facilitate private cloud capacity requests.

- **New HTML-based Self-Service Portal:** Provides a new HTML-based Self Service Portal. This portal has been updated with a modern user interface as well as easier navigation and customization. It uses server caching to help reduce database calls and improve portal performance.
- **Service catalog, including support for Lync 2013 and Skype for Business:** Adds seamless integration with Lync 2013 and Skype for Business, which allows the IT team to contact affected users by instant messaging when any incident form is open. It also shows the current availability status of the affected user through presence indicator.
- **Flexible service templates:** Offers templates to deliver standardized service requests. By default, Service Manager provides a number of service request templates that are based on a generic incident template.

Industry-standard service management and process workflows

System Center 2016 Service Manager is built on industry-standard service management processes, including ITIL and Microsoft Operations Framework (MOF) framework. To assure predictable service delivery, Service Manager includes incident, problem, change, and release management.

- **Automated workflows for service process management:** Automate different service processes by using Windows Workflow Foundation (WF) to define WF activities in specific sequence order and conditions to automatically perform a defined set of tasks.
- **Configuration management database (CMDB):** With CMDB, System Center 2016 gathers and stores information about different configuration items related to infrastructure and application. All IT service requests and changes are tracked in a centralized CMDB, thus ensuring a single repository to manage enterprise changes.

Business and operational insight

System Center 2016 offers detailed business and operational insights to get visibility into resource utilization. Service Manager delivers in-box metering for virtual machines and cloud through integration with VMM and Operations Manager. It also has a data warehouse with rich reporting (including integration with Microsoft Office) to analyze operational service level agreement (SLA) trends.

- **SharePoint dashboard and Excel reporting:** By using SQL reporting services, both Excel and SharePoint can generate reports and dashboards to meet the needs of the business. These reports provide visibility into usage and performance on assigned clouds, workloads, infrastructure costs, trending, and forecasting based on enterprise (or individual business unit) projects.
- **VM-level metering and price sheets:** VM-level metering helps you track virtual machine usage. With price sheets, you can define price policies on existing private cloud objects that are discovered from the Operations Manager CI connector. These price sheets can also be customized per tenant, per cost center, and per level of cloud resource.
- **Meeting SLAs:** Consistently track infrastructure resource consumption by the business and compare against defined SLAs. In case SLA thresholds are breached, System Center will flag this or can be enabled to take action upon breaching of the SLA.
- **Integration with Cloud Cruiser cost analytics solution for chargeback:** By integrating System Center 2016 Service Manager with Cloud Cruiser cost analytics solution, you can deliver rich reporting through web portals based on the enterprise need.
- **Integration with OMS:** System Center 2016 provides native integration with OMS to strengthen hybrid IT management. Incidents can be filled in Service Manager from the alerts generated in OMS while also providing rich reporting dashboards inside OMS showcasing Service Manager incident data.

Summary

Your on-premises infrastructure is key to the business, and extending with cloud services increases reliability and performance. But lack of appropriate technology and tools for managing these complex environments can quickly become costly and inefficient. System Center 2016 offers a simplified datacenter management experience for complex, heterogeneous workloads. With its comprehensive monitoring, hardware and virtual machine provisioning, rigorous automation, and configuration management, System Center 2016 keeps you in control of your IT—whether on-premises, in the cloud, or across platforms unlocking the power and security of a Software Defined Infrastructure.

Next steps

Explore the following reference links to gain more understanding of System Center 2016:

System Center 2016 introduction

<https://www.microsoft.com/en-in/server-cloud/products/system-center-2016/>

System Center 2016 technical overview

[https://technet.microsoft.com/en-us/library/mt445442\(v=sc.16\).aspx](https://technet.microsoft.com/en-us/library/mt445442(v=sc.16).aspx)

System Center 2016 datasheet

http://download.microsoft.com/download/9/A/4/9A450776-8D3A-41A7-84E6-8241765B87E9/System_Center_2016_datasheet.pdf

Evaluate System Center 2016

<https://www.microsoft.com/en-in/evalcenter/evaluate-system-center-technical-preview>