



How far will you take virtual?

In-Guest Monitoring With Microsoft® System Center

Microsoft | Virtualization

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Introduction to In-Guest Monitoring

As organizations incorporate virtualization into their IT infrastructures, they have access to new capabilities that can increase efficiency, flexibility, and application uptime. To fully benefit from these new capabilities, organizations require monitoring software that fully integrates virtualization capabilities. Microsoft® System Center is an example of software that fully integrates virtualization monitoring and management into existing monitoring capabilities. With System Center, organizations gain the ability to fully integrate virtualization as a core capability in a dynamic, self-managing IT infrastructure.

System Center includes the ability to monitor and manage IT services in the datacenter, including server-based applications, as well as hardware, hypervisor, and operating systems software. Without monitoring software that has visibility into the entire IT infrastructure from the hardware to the application level, organizations are lacking a crucial tool for infrastructure management. In environments that use virtualization, this shortcoming is exacerbated. Because server virtualization often increases complexity, effective management of a virtualized environment demands a single tool that can show cause-effect relationships between physical hosts, virtual machines, and applications. Microsoft System Center is the only monitoring tool that can provide this level of comprehensive monitoring.

Monitoring and management software supports two goals: 1) Responding to and recovering from service interruptions as quickly as possible; 2) Helping make datacenters as efficient and cost-effective as possible. In many cases, server workloads will be run in virtual machines (VMs) in order to increase datacenter efficiency and application uptime. Monitoring and management software delivers value in direct relationship to its ability to help IT staff both respond to service interruptions quickly and maximize datacenter efficiency, regardless of whether workloads are run directly on physical servers, or within VMs.

If an organization uses VMs in its IT infrastructure, the monitoring and management software must effectively administer all parts of the IT services infrastructure, across both its physical and virtualized components. As monitoring information gathered from multiple sources becomes more integrated and consolidated, IT staff can become more effective in their ability to respond to service interruptions quickly and maximize datacenter efficiency. Microsoft System Center is the only comprehensive monitoring and management software that effectively includes all parts of the IT services infrastructure.

For the purposes of this document, the IT services infrastructure can be categorized into the following layers: hardware, hypervisor, operating system, and application. The hardware layer includes server, networking, and storage hardware. The hypervisor layer includes events, configuration, and performance data related to Hyper-V® or a VMware hypervisor. The operating system layer includes Windows Server® and other operating systems. And the application layer includes events, configuration, and performance data related to applications like Microsoft Exchange Server, Microsoft SQL Server®, or line of business (LOB) applications built on SQL Server, Exchange Server, or built from scratch.

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Monitoring and management software that does not combine information about hardware, hypervisor, operating system, and applications into a single console, or that shows causal relationships between components, will be less effective in helping IT staff both respond to service interruptions quickly and maximize datacenter efficiency. In particular, monitoring and management software that does not have deep visibility into the application layer will be missing vital information that could otherwise help maximize uptime. Monitoring tools that only inspect the operating system and hypervisor layers can miss vital application-layer warnings that can quickly escalate into service outages that effect users. And monitoring tools that do not illustrate causal relationships between layers of the IT infrastructure will provide less value than those that do.

When multiple monitoring or management tools from different vendors are used, several problems become blocks to efficient and cost-effective management. In the event of a service interruption, IT Pros may require multiple tools to gather information about why and where the service interruption has occurred. Resolving the service interruption may require yet another tool or user interface. The more quickly an IT Pro can respond to a service interruption, the more productive users can be and the greater uptime can be.

Multiple monitoring or management tools also increase complexity, which arises from trying to obtain useful monitoring data from different sources across your IT infrastructure. Furthermore, correlating these data from multiple sources is time consuming and inefficient, leaving IT Pros to do more guesswork. In addition, the process of obtaining troubleshooting data from multiple tools, as well as from hardware and applications vendors, increases the amount of time it takes to respond to the underlying problem. What is needed is a comprehensive, single-vendor monitoring and management solution that covers monitoring from the physical layer, across hypervisors and the operating system, as well as applications and similar workloads.

Microsoft System Center helps solve this problem. It combines visibility into the hardware, hypervisor, operating system, and applications layer with a single console interface that illustrates relationships between layers of the IT infrastructure, along with insight into end-user experiences or system-related transactions, to help IT staff maximize both uptime and datacenter efficiency.

In-Guest Monitoring

Consumers of IT services interact directly with applications. While IT staff often focus on the availability and performance of supporting infrastructure like server hardware, networking, and storage, application users are concerned only with application availability and performance. For this reason, effective monitoring of the IT services infrastructure must include application-level monitoring. Microsoft System Center in-guest monitoring provides deep visibility into the application layer of an IT services infrastructure. System Center provides highly extensible monitoring and management of hardware, hypervisor, operating system, and application layers for both Windows Servers, Windows clients, VMware hypervisors, and partner hardware solutions like Storage Area Networks (SANs). Competing management and monitoring solutions like VMware vCenter do not provide deep visibility into the applications running within VMs.

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A comprehensive monitoring and management tool must include in-guest monitoring capabilities. Without in-guest monitoring, IT staff will receive notification of application outages or performance problems from users rather than from their monitoring software. This forces IT staff into a reactive stance, which does not facilitate good service uptime levels. In addition, precursor conditions that can lead to an application outage can easily be missed by monitoring tools that only view host memory and CPU utilization or a simplistic VM heartbeat. Only comprehensive in-guest monitoring will provide information about these precursor conditions. With the information that in-guest monitoring provides, IT staff can more effectively maximize server uptime and efficiency, regardless of whether applications run in VMs or on physical servers.

The use of VMs can greatly increase datacenter efficiency and flexibility. The main method by which VMs do this is increased server consolidation. A side effect of increased server density is increased complexity. Physical servers generally use a naming convention that provides the information required to identify the role and physical location of a server. Although VMs can be named to provide useful information about their role, their physical location can easily change when a VM migrates to a new host server. If monitoring software does not have visibility into both the application layer and the hypervisor, the relationship between host server and application can be confused. When the relationship between host server and application is unclear, solving application performance and availability problems becomes much more complex.

Microsoft's Implementation of In-Guest Monitoring

Microsoft System Center is the only management and monitoring tool that uses in-guest monitoring to provide full visibility into all IT services infrastructure layers. System Center does this by fully integrating System Center Virtual Machine Manager (VMM) and System Center Operations Manager (Operations Manager). This full spectrum of information shows important causal relationships between infrastructure components.

Operations Manager uses data from VMM to provide a single interface for monitoring multiple infrastructure layers. Operations Manager collects a rich array of information from hardware, operating systems, and applications. All of this information is shared between VMM and Operations Manager through the System Center Data Access service. VMM is able to combine its native knowledge of the virtualization infrastructure with information gathered by Operations Manager to provide a complete view of the IT services infrastructure, including host hardware, storage, the hypervisor, operating systems and applications. In addition, VMM provides comprehensive virtualization management capabilities to ease tasks like new VM provisioning, physical to virtual migrations, and day-to-day VM administration.

Because System Center has access to the full range of information necessary to monitor an environment, IT Pros can use a single management infrastructure for all system monitoring tasks. This simplifies the system administrator's role and reduces their workload. The alternative to using System Center for monitoring an environment is to use multiple monitoring tools from several different vendors. While this approach may

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obtain much of the information needed for complete system monitoring, it fragments this information across several monitoring tools with different databases, user and application programming interfaces, and data collection agents.

This fragmentation of information increases the difficulty of problem analysis and resolution. In addition, multiple monitoring tools force IT Pros to become knowledgeable in several vendors' tools, rather than one. This creates an extra cost and an extra impediment to speedy problem resolution. Using multiple monitoring tools may also create a split between the management of physical servers and virtual servers. This split often translates to increased training and other personnel-related costs because virtualization expertise tends to consolidate in organizational silos rather than being distributed among IT staff. System Center enables a single view that includes both physical and virtual servers. This helps organizations better integrate virtualization by treating it as a standard task and skill for Windows administrators.

System Center Simplifies Problem Identification

In addition to providing complete environment monitoring in a single set of tools, System Center also allows IT Pros to accurately target which layer a problem is occurring in. Because PRO-enabled management packs can operate at any layer, VMM and Operations Manager have visibility into all layers of the IT services infrastructure from the hardware through the hypervisor and operating system to the application layer. The comprehensive collection of information provided by System Center simplifies the process of identifying problems by helping IT Pros see cause-effect relationships between the multiple layers of the IT services infrastructure.

For example, if a Storage Area Network (SAN) failure caused a virtualization host outage, multiple VMs would also become unavailable. With monitoring tools that do not have in-guest monitoring, the virtualization management staff would know that multiple VMs are unavailable, but they may have no knowledge of which applications were affected by the outage. Likewise, the IT staff responsible for managing the applications would know that there are multiple application outages, but they would have no information that explains the root cause of the outage. System Center would illustrate the causal relationship between these two events, thereby reducing the effort required to generate an accurate and useful diagnosis of the underlying problem. Using Operations Manager's Diagram View, a System Center user could see a graphical illustration of the relationship between the application outages and the underlying SAN failure. The availability of causal information in System Center dramatically enhances problem resolution.

By contrast, VMware's monitoring tool vCenter lacks in-guest monitoring capabilities. Instead, vCenter relies on packet inspection of network data to and from applications running within a VM. This approach provides less value for scenarios that use both physical and virtual machines because applications running on physical machines are not monitored. In addition, vCenter does not gather information directly from applications. While vCenter does gather information about current application performance, throughput, and latency, vCenter does not have visibility into many in-guest conditions that ultimately lead to an application outage.

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System Center Speeds Problem Resolution

Because VMM and Operations Manager have extensive visibility into the operating system and application layers, problems that do not yet affect user application availability or performance can be identified before they do disrupt availability or performance. For example, a monitoring solution that has visibility into only the hypervisor will be unable to warn administrators about a SAN condition that threatens failure. System Center has visibility into the all layers of the IT infrastructure and would create a warning about the SAN condition. An administrator could then take action before the SAN condition becomes an application outage that affects users.

Virtually any event on the hardware, hypervisor, operating system, and application layers can trigger an alert in System Center. The table below describes some examples of system components and the type of events that System Center can monitor:

Component	Example System Center Events
Network IO	Network utilization greater than 90%
Storage	Hard drive failure
Space shortage	Partition has less than 10% free space.
Hardware	Power supply failure ¹
Overheating	Fan failure ¹
Component Failure	Web server offline
Software triggers flagged by Apps, etc.	SQL Server not configured to autogrow

Competing monitoring products like VMware vCenter are limited to monitoring the health of virtual machines and the hypervisor host. They get most of their VM and host health by monitoring basic heartbeat information, memory utilization, CPU utilization, and application performance over the network. Without incorporating additional third party solutions, vCenter is limited to providing information that facilitates only a reactive management style. If an application problem does not create problem indicators such as high CPU or memory usage, an outright VM failure, or high application latency, vCenter will not provide a notification for system administrators. Instead, the notification will come from users, who are affected by the resulting application outage.

Performance and Resource Optimization (PRO)

While organizations cannot maximize datacenter efficiency and uptime without comprehensive in-guest monitoring, implementing changes based on monitoring data and best practices continues to be a significant

¹ May require proprietary management pack from hardware vendor

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component of IT staff workload. In addition, the monitoring data should encompass the entire infrastructure, including application data so that optimization efforts can encompass the entire infrastructure and not just the hypervisor layer. Performance and Resource Optimization (PRO) is a feature of System Center that automates VM changes based on the results of comprehensive monitoring data and best practices. PRO completes the monitoring and management cycle by taking issues that occur anywhere in the IT infrastructure and recommending a resolution. The resolution can be manually or automatically implemented, and virtualization hosts can be grouped to allow either manual or automatic PRO implementation based on the level of human interaction needed for each host.

For example, PRO can initiate a VM live migration from one host to another in response to a wide variety of issues. Poor application performance, excessive CPU power consumption, hardware failures, or other non-hypervisor related factors are examples of conditions that PRO can respond to either manually or automatically.

PRO provides an open and extensible framework for the creation of management packs for virtualized applications or associated hardware. In building these PRO-enabled management packs, IT Pros and partners can easily create tailored solutions that offer the issue-resolution capabilities of PRO. In addition, System Center currently offers over 20 management packs that provide a wide range of monitoring and issue-resolution capabilities, with more packs coming out every day.

From the System Center operator's perspective, the VMM management console will show a PRO tips window listing all outstanding PRO tips. If PRO has been configured to automatically implement tips, the resolution recommended by each PRO tip will be automatically implemented and the result of the PRO tip will be available for subsequent review. If manual PRO tip implementation is configured, the operator will be able to view the PRO tip and choose whether to implement the recommended resolution or not. This provides great flexibility for organizations to choose the amount of automation that the organization may desire, whether across the entire infrastructure, or even on an individual host basis.

Microsoft partners incorporate deep product and process awareness of their solutions in their PRO-enabled management packs. Partner-provided management packs include rules and policies that PRO will act upon in the event of poor performance or a pending failure. With these pre-determined watch points and resolution steps, PRO can react dynamically to adverse situations and avoid poor system or IT service performance or worse. Utilizing PRO's real-time monitoring and remedial capabilities allows organizations to maximize server uptime and efficiency with lower cost in terms of staff effort and hours. Organizations can also reduce training time because PRO tips provide a just-in-time recommended solution for infrastructure subsystems that a given IT team member may not have specialized expertise in.

For more information on specific PRO-enabled management packs that are available, please visit:

<http://www.microsoft.com/systemcenter/virtualmachinemanager/en/us/pro-partners.aspx>

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Microsoft Server Management Suite

The Microsoft Server Management Suites provide an easy and economical way for customers to get the entire System Center server management solution for servers across their datacenters and IT environments. The current offerings are the System Center Server Management Suite Datacenter and the System Center Server Management Suite Enterprise.

- System Center Server Management Suite Datacenter: Includes the main System Center Products. It is licensed per processor and provides rights to manage an unlimited number of operating system environments (OSEs) on a single physical server.
- System Center server Management Suite Enterprise: Includes the main System Center Products and allows for per device licensing of up to 4 operating system environments. It is recommended for licensing of physical boxes and servers with light virtualization loads.

The System Center Server Management Suite Datacenter license is more cost-effective to both acquire and maintain when compared to competing solutions. See the following link for more information:

<http://www.microsoft.com/virtualization/en/us/cost-savings.aspx>

Conclusion

System Center gathers more information than other monitoring solutions because it can monitor a broader array of hardware and software components through Microsoft and partner-provided management packs. The comprehensive information gathered by System Center illustrates causal relationships, which speeds problem identification and resolution. With System Center, IT staff can use a single console to analyze and take action on information from server hardware, Hyper-V and VMware hypervisors, operating systems, and applications. This wide array of performance and troubleshooting information in a single console increases the efficiency and speed of problem resolution. IT staff can gain additional efficiencies by focusing their training and expertise on a single tool with an interface that leverages their existing Windows interface expertise.

Microsoft System Center provides true end-to-end visibility of the IT services infrastructure, delivering comprehensive monitoring and management for environments regardless of whether they use VMs or not. By providing strong in-guest monitoring capabilities, System Center provides organizations with the information they must have to maximize service uptime and datacenter efficiency.