

Dell IT Designs an

Enterprise Monitoring Infrastructure

Using Microsoft Operations Manager 2005

Microsoft® Operations Manager (MOM) 2005 provides scalability, failover, integration with Dell OpenManage™ Server Administrator, and other features enabling it to serve as the foundation of a global Microsoft Windows Server® OS–based enterprise monitoring infrastructure. Using MOM 2005 along with Dell™ PowerEdge™ servers, Dell PowerVault™ storage, Dell OpenManage Server Administrator, and BMC software, the Dell IT group developed a robust infrastructure to support more than 24,000 servers worldwide.

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When the Dell IT group, after years of supporting increasing revenue and unit shipments, assessed its environment to determine how to streamline server monitoring, it recognized the potential benefits of introducing additional centralization and standardization. Its goal was ensuring server stability across the enterprise while maximizing the return on investment in the monitoring infrastructure. After considering a number of possibilities, Dell IT ultimately chose a system based on Microsoft Operations Manager (MOM) 2005.

Global monitoring challenges

Initial Dell IT assessments of its monitoring environment revealed several problems with the existing infrastructure:

- The various environments, which involved numerous systems and products, could not scale to support

the entire enterprise, and a transition to a centralized model would require tripling the largest monitoring system's capacity.

- The agent health monitoring was not robust enough to alert support personnel when server monitoring on specific agents failed.
- The environment scale, involving tens of thousands of servers spread across the globe, increased the difficulty of applying consistent systems and practices.

After assessing these problems, Dell IT determined that to implement an efficient global infrastructure, it would need to create consistency in monitoring standards, design a solution capable of accommodating complex support groups and processes with seemingly contradictory requirements, and integrate the numerous server monitoring systems then in use. Dell IT subsequently conducted a

formal product evaluation and identified several requirements for a proposed monitoring application, including the following:

- **Scalability:** The application would need to scale well to monitor tens of thousands of servers. An application requiring a large, costly, complex infrastructure or incapable of delivering standardized rules to large groups of servers could become too unwieldy for support teams to manage, increasing the risk of system instability.
- **Extensive feature set:** The application would need to support hardware failure detection, monitoring with Microsoft Windows® OS event logs and Performance Monitor, monitoring of common Microsoft Windows Server OS-based applications, custom monitoring with common provider interfaces such as Windows Management Instrumentation (WMI), and robust agent health features to alert support teams when monitoring on critical servers fails. Discovery capabilities were also essential, to help ensure comprehensive server coverage and reduce the need for human involvement when beginning monitoring.
- **High availability:** The application would need to support high-availability features such as clustering and agent failover, so that support teams could still monitor revenue-affecting outages following a failure.
- **Flexibility and ease of use:** The application would need to be flexible enough to accommodate individual exceptions to common thresholds or parameters, and possess customizable interfaces and consoles for distribution to regional support teams. Ease of use was necessary to help minimize operational overhead.

Infrastructure foundation: MOM 2005

Dell IT selected MOM 2005 as the foundation of its monitoring infrastructure because it met the most requirements of any candidate product. In terms of scalability, for example, a five-server MOM management group could support up to 4,000 monitored servers, which would allow a relatively small number of management groups to manage the global Windows Server environment. Dell IT also added extra management groups to help support disaster recovery and accommodate future growth.

MOM 2005 possesses a number of other important features. With the addition of the Dell management pack (MP) and Dell OpenManage Server Administrator agents on Dell PowerEdge servers, it can provide extensive information on hardware events such as drive and fan failures, memory errors, and temperature problems, and administrators can calibrate and suppress alerts to provide support groups with an appropriate level of instrumentation. MOM provides straightforward monitoring with Windows event logs and Performance Monitor, and enables administrators to use scripts and

Feature	Previous infrastructure	MOM 2005-based infrastructure
Maximum number of managed agents	5,000	More than 24,000
Servers required to support maximum capacity	76	24
Attributes-based rule deployment	No	Yes
Global reporting	No	Yes
Global standards	No	Yes
Automated deployment based on asset management database	No	Yes
Monitoring and performance data encryption	No	Yes

Figure 1. Comparison of previous Dell IT monitoring infrastructure with Microsoft Operations Manager 2005-based infrastructure

compiled code for custom monitoring using providers such as WMI as well as Microsoft Visual Basic®, Microsoft Visual Basic .NET, C#, and other languages. MOM also supports high-availability features such as agent failover and Microsoft SQL Server™ clustering.

In addition, MOM can provide the flexibility and ease of use Dell IT requires. MOM MPs for a wide variety of applications, including SQL Server 2005, Microsoft Exchange Server 2003, Microsoft SharePoint® Portal Server 2003, Microsoft Windows SharePoint Services 2003, and Citrix MetaFrame XP, allow Dell IT to extend its investment in MOM to other applications in the future. And the MOM Administrator and Operator consoles enable regional Dell IT teams to create custom views showing only the servers, alerts, and severities relevant to their role. Figure 1 summarizes some of the advantages the MOM 2005-based infrastructure offers over the previous Dell IT monitoring infrastructure.

Management groups

The Dell IT monitoring infrastructure is based on MOM 2005 management groups, which consist of a MOM database and one or more MOM management servers (see Figure 2). Each management group is a distinct entity that is unaware of other management groups. Although multitiered options exist that can unify multiple management groups, the Dell IT requirements would test the sizing guidelines that make these options feasible.

Dell IT created three types of MOM management groups:

- **Production:** These groups monitor production systems and are configured with high-availability features and the stringent parameters and thresholds required by Dell production

environments. Dell IT chose a five-server design for these management groups to help provide high availability along with sufficient capacity to support a management server failure.

- **Disaster recovery:** These groups are designed to provide minimally sufficient monitoring if an entire production data center or management group fails or becomes unavailable; they do not contain high-availability features, but do contain the same rules and thresholds as production server management groups. Including limited capabilities in these management groups helps reduce overall infrastructure costs.
- **Non-production:** These groups manage non-production environments such as development and testing servers, which Dell IT does not manage as rigorously as production environments. Including reduced high-availability features and lower parameters and thresholds enables support teams to appropriately prioritize alerts from these environments, helping reduce overall infrastructure costs.

Each production management group includes three management servers and a cluster of two database servers. The three production management servers are Dell PowerEdge 2850 servers running Windows Server 2003 Enterprise Edition. These servers comply with MOM sizing guidelines to support 2,000 agents each; by allotting three management servers to support a maximum of 4,000 agents, the management group can use the MOM management

server failover feature to accommodate the failure of one management server without affecting performance.

The MOM database is hosted by a cluster of two Dell PowerEdge 6850 servers running Windows Server 2003 Enterprise Edition clustering services. These two servers function in an active/passive configuration to help ensure that the MOM database is available even in the unlikely event of a complete server failure, and they share a storage area network (SAN) based on Dell PowerVault storage to help provide optimum database read/write performance.

Figure 3 shows the global Dell IT monitoring infrastructure deployment, which consists of two production, two disaster recovery, and two non-production management groups in the Americas region; one production and one disaster recovery management group in the Asia Pacific and Japan region; and one production and one disaster recovery management group in the Europe and Middle East region.

Management packs

A substantial part of implementing the Dell IT monitoring infrastructure consisted of globally standardizing OS and server hardware monitoring. Two primary MOM 2005 MPs enable this monitoring:

- **Windows Base OS (Server) 2000 and 2003 MP:** Provides parameters and thresholds for monitoring Windows Server-based systems
- **Dell MP:** Enables MOM to detect Dell OpenManage Server Administrator-based hardware alerts for events such as voltage probes and disk failures

Dell IT selected and calibrated the relevant settings and alerts in each MP, then exported them—the Dell implementation of the Windows Base OS MP, for example, included monitoring for problematic event IDs, performance counters, and other key performance indicators such as CPU utilization. (“Server down” alerts, generated when a server suddenly fails catastrophically or becomes unavailable, are provided by the MOM management servers independent of any MP.) These exported MPs represent the standard copy of the monitoring rules, become part of the Definitive Software Library, and are subsequently distributed globally to Dell IT servers without regard to server purpose. Limiting the number of alerts helps support groups effectively manage their environments without the distraction of non-actionable alerts, and MOM consoles enable teams to further instrument monitoring for specific applications or services.

Dell IT also utilizes other MPs, including the SQL Server MP, and plans to introduce MPs for Exchange Server 2003 and the Microsoft Active Directory® directory service in the future.

Consoles

MOM 2005 includes two main consoles: the Administrator console and the Operator console. The Administrator console enables

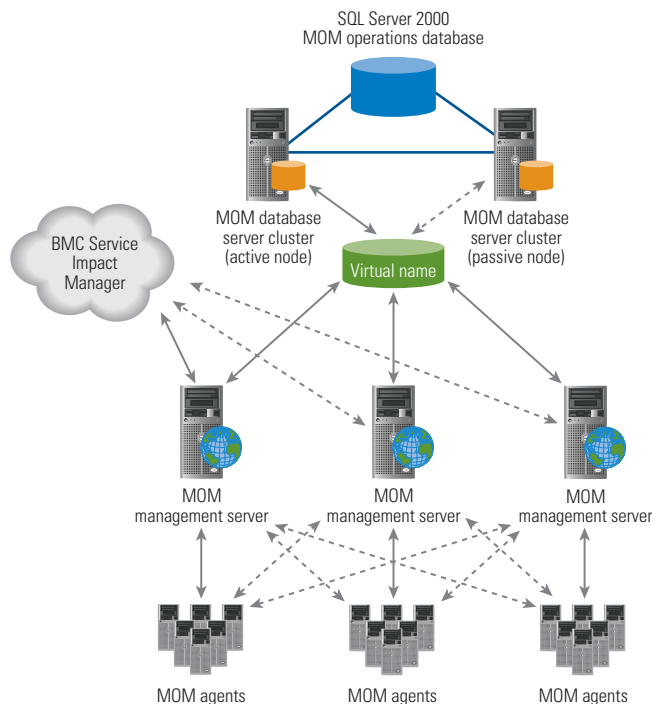


Figure 2. Dell IT monitoring infrastructure based on Microsoft Operations Manager 2005 management groups

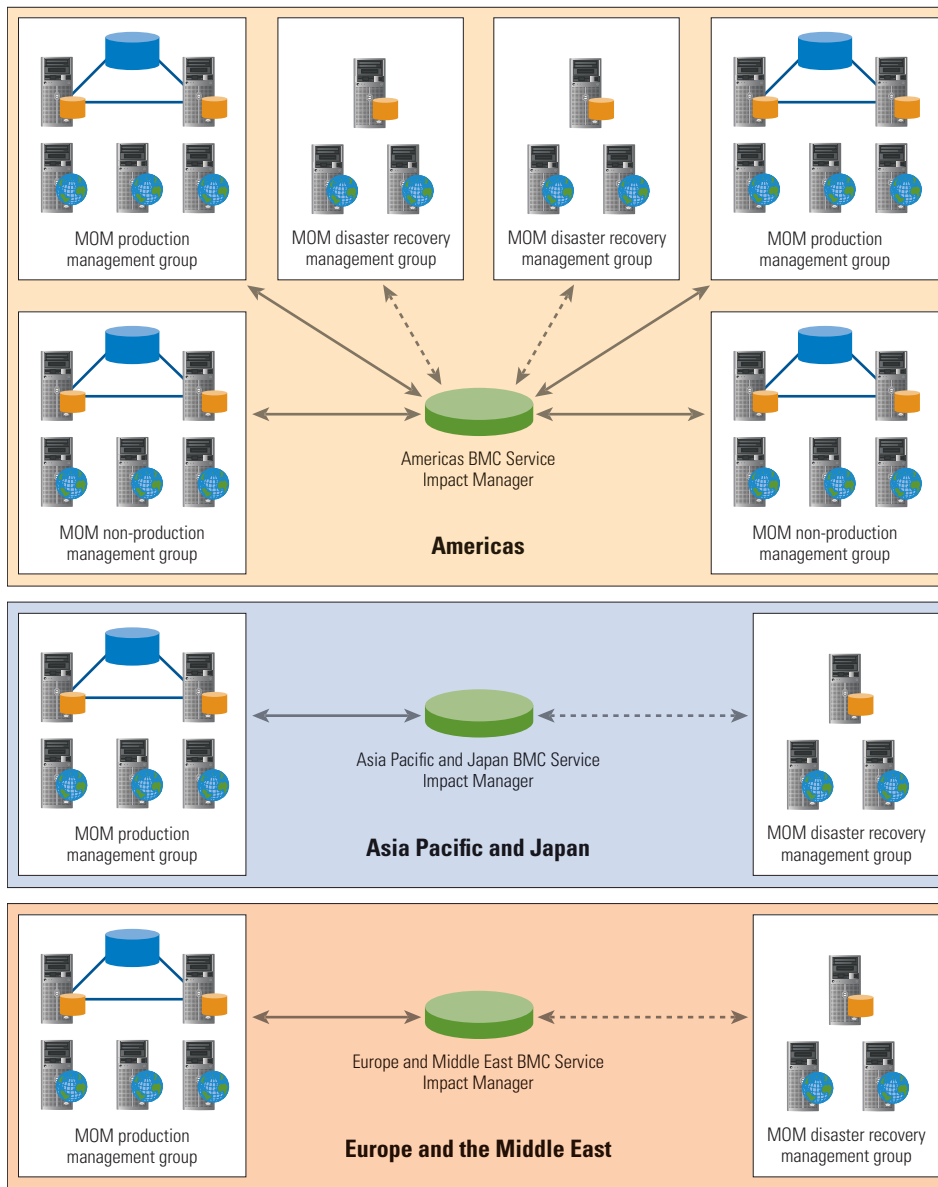


Figure 3. Global Dell IT monitoring infrastructure deployment

support groups to create new monitoring rules for parameters and thresholds, providing the flexibility to create overrides and consolidate rules into rule groups for mass distribution to agents. Support groups can also use this console to create tasks for gathering data on agents and to create custom console views to adapt the Operator console to specific needs.

The Operator console is a Web-based interface that allows support groups to view detailed information on MOM alerts and notifications. Because Dell IT support groups use the BMC Remedy Action Request (AR) System as their primary ticketing console, they use the Operator console mainly to view additional detailed information or troubleshoot problematic systems. Although the

Operator console provides fewer features than the Administrator console, its Web-based interface has the advantage of allowing access from anywhere on the Dell IT network.

Supporting infrastructure elements

To provide functionality not provided by MOM 2005 alone, Dell IT also included several other elements in its infrastructure design, including BMC Service Impact Manager (SIM) for event correlation and BMC Remedy AR System for ticketing, BMC Impact Database Gateway for event reporting, custom configuration reporting software, and custom integrated server discovery and asset management software.

BMC Service Impact Manager and Remedy Action Request System

SIM is the Dell IT standard for automatically creating trouble tickets from monitoring applications and sending them to AR System. Neither Microsoft nor BMC provides specific software to allow the integration of MOM 2005 with SIM, but they do provide application programming interfaces (APIs) to support the development of custom software. To help meet its schedule demands, Dell IT purchased an off-the-shelf product connector, the Seamless Technologies Integration of BMC Impact Manager to MOM, and included it in the management group design. This connector,

based on the SIM API and MOM Connector Framework (MCF), essentially adds an event response type that forwards the configured event to SIM, which then applies the processing rules and sends the appropriate trouble ticket to AR System.

Two management servers in each management group run the connector in an active/passive configuration. A monitoring system generates alerts if the connector fails, and allows support personnel to manually fail over the connector. Every IT region has its own SIM instance to process events for that region, which are also sent to a global SIM instance in the Americas. Each management group has at least one primary connector and one backup connector to that region's instance.

Processing events in a middleware system such as SIM enables Dell IT to correlate events across monitoring applications. SIM also allows the inclusion of logic in ticket creation, enabling different levels of severities and different types of tickets based on a set of criteria known as the event condition formula. This feature builds on the ability of MOM to detect and generate alerts for errors by providing extensive flexibility in how such errors are translated into trouble tickets and presented to support groups.

BMC Impact Database Gateway

For event reporting, Dell uses BMC Impact Database Gateway, which offloads configured events from SIM into a database and enables powerful reporting and data-mining capabilities. Because Dell IT integrates MOM 2005 with SIM using the Seamless Technologies product connector, reporting events originating from MOM is straightforward. BMC Impact Database Gateway is used to capture events from the global SIM instance and archive them into a global centralized database to provide a single source for relevant global event data. Dell IT configures events requiring reporting to be forwarded by each regional SIM instance to the global instance.

Custom configuration reporting software

A hierarchical MOM 2005 management group design using the included MOM-to-MOM Product Connector can provide a straightforward way to manage an entire environment from a single console, but the scale of the Dell IT infrastructure does not allow such a design. The management groups are therefore unaware of each other, making locating and managing individual agents a daunting prospect.

Dell IT determined that custom software was necessary to help simplify configuration reporting across management groups, and developed a collection of applications and Web interfaces using the MOM Software Development Kit (SDK) and .NET platforms such as C# and ASP.NET for this purpose. Dell IT used the MOM SDK—which provides a collection of classes and methods for accessing MOM 2005 management groups, servers, and databases—to create a single Web portal that could retrieve the configuration for any agent in the global environment regardless of management group.

Custom integrated server discovery and asset management software


Although MOM 2005 includes substantial server discovery capabilities, none are well suited for the scale of the Dell IT environment—an unqualified discovery process could cause problems for wide area network (WAN) links and small, remote sites. Dell IT developed custom integration software that uses the MOM manual installation file, `manualmc.txt`, to enable a separate application to discover servers present only in the asset management database

system that also include the appropriate rule sets according to the class of server. The class of server is determined by values in BMC Remedy Asset Management Application records.

The `manualmc.txt` file helps provide detailed control over which agents a particular management group monitors, a feature Dell IT used to develop a middleware application to determine the server placement based on asset management database fields, server load, and so on. The application contains logic for geographic placement, server role determination, and load balancing based on records in the Asset Management Application implementation and data obtained using the MOM SDK, and can also remove monitoring for decommissioned servers without requiring support group intervention. In addition, the MOM SDK gathers installation failures and reports them centrally in the same Web portal, providing information such as server name, management group, and failure code along with a reason for the failure.

Integrated global monitoring using MOM 2005

Large-scale enterprise environments often cannot take advantage of off-the-shelf products—and operations that are straightforward to achieve in small environments can require complex, rigorous deployments in large ones. MOM 2005 provides the scalability and features to serve as a solid framework for large-scale enterprise monitoring. It also provides formidable and robust application interfaces, such as the MOM SDK and MCF, which allow it to scale to large server environments using common development platforms.

The Dell IT global monitoring infrastructure demonstrates that these interfaces can allow MOM 2005 to scale effectively to large Windows Server environments. Combined with Dell PowerEdge servers, Dell PowerVault storage, Dell OpenManage Server Administrator, and BMC software, this infrastructure enables Dell IT to effectively monitor its global Windows Server environment. 

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