



Seven Requirements for Balancing Control and Agility in the Virtual Environment

By BMC Software and VMware

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Executive Summary

It's no surprise that the dynamic nature of a virtualized data center environment presents management challenges that are new and sometimes different from a purely physical environment. With virtualization comes a higher level of speed and flexibility, creating the need for a more disciplined approach to service management — an approach that has more effective processes and controls. But control must not come at the expense of agility. IT has to keep the IT infrastructure agile to meet changing conditions in today's technology and business environments.

Control and agility appear to be in direct opposition. In fact, in many organizations, two groups have arisen: virtualization advocates who strive for agility, and process advocates who champion greater control. IT needs to strike the optimum balance between control and agility, and bring these two groups together.

In the nonvirtualized environment, solutions streamline and automate many change and configuration management processes. These solutions give IT greater visibility and control of the IT infrastructure while still permitting the level of change necessary to ensure agility. So how does IT optimize and leverage the processes and solutions used in the nonvirtualized environment to meet the requirements of the virtualized environment? BMC and VMware have joined forces to provide an answer to that question. The two companies have developed an approach to service management in the virtualized data center that enables IT to strike the optimum balance between control and agility. This paper describes that approach.

The paper discusses the agility enabled by virtualization and the resulting control challenges. It presents a way to meet those challenges and describes seven major requirements for success. The paper reviews how the BMC/VMware approach helps IT ensure control over the virtualized data center and maintain compliance with corporate policies and government regulations. It describes how available Business Service Management (BSM) solutions support the approach. Finally, the paper includes change scenarios frequently encountered in the virtualized environment and explains how the approach deals effectively with them.

Agility Versus Control

Many IT organizations are deploying virtualization technology, or they plan to in the near future. The benefits are many, including:

- > Reduced costs because fewer physical resources are purchased, managed, and supported
- > Lower space, power, and cooling requirements
- > Higher resource utilization, contributing to higher return on investment (ROI)
- > Increased reliability of application deployments through checkbox services for resource commitments, high availability, and disaster recovery
- > Flexibility and choice in selecting and standardizing the optimum hardware and operating platforms

In addition, virtualization greatly increases IT's ability to respond rapidly to changing conditions in the technology and business environments, permitting an unprecedented level of agility.

The Need for Agility

As Figure 1 illustrates, both external and internal factors are driving the need for rapid and continual change in the IT infrastructure. The IT organization must ensure the agility of the IT infrastructure to meet this need.

A major agility-enabling factor is the ability to dynamically allocate and reallocate data center resources to the services that need them. In the nonvirtualized environment, these resources include physical components, such as servers, storage devices, and network devices — none of which are very agile. Most physical servers can run only a single instance of a single operating system, such as Windows®, Linux®, or UNIX®, limiting flexibility. Adding new physical servers involves a time-consuming cycle of purchasing, provisioning, testing, and installation. Changing or adding applications to a physical server also is time-consuming and typically requires manual actions.

The virtualized environment, which includes both physical and virtual machines, is far more flexible, and hence, more agile. Each virtual machine runs a single instance of a single operating system. But that's where the similarity between physical and virtual machines ends. Multiple virtual machines can run on the same physical host server, yet appear to the environment as separate physical servers. Each virtual server can run a different operating system. In addition, the resources of the physical host server, such as CPUs and memory, can be dynamically allocated across the hosted virtual machines.

It's easy to provision and clone virtual machines, and to move them among physical servers. These actions can be performed at the touch of a button or automatically. As a result, virtual machines have far less inertia than physical servers, permitting a far more dynamic and agile IT environment.

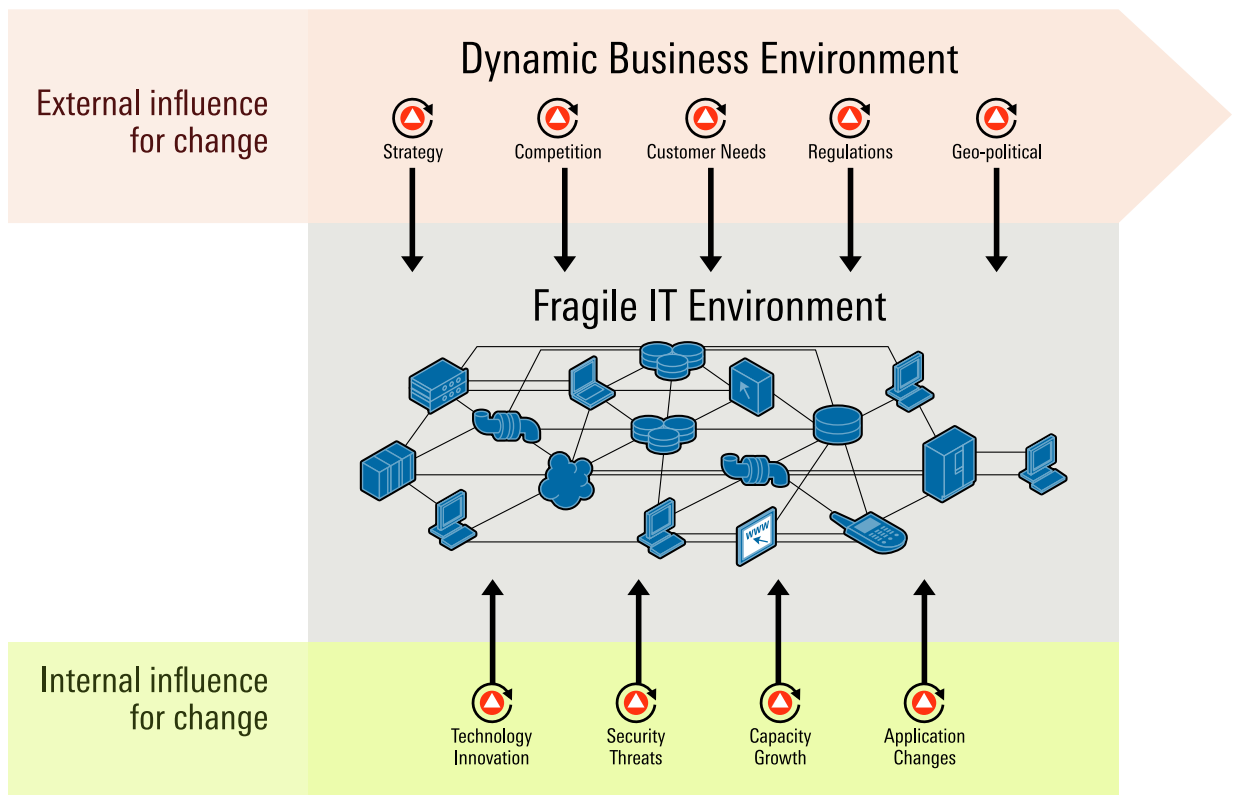


Figure 1. Factors driving change

Increased Agility Presents Control Challenges

Uncontrolled, the agility of the virtualized environment can increase risk, such as the risk of service disruption and the risk of noncompliance with corporate policies and government regulations. To minimize risk, IT must establish and maintain effective control of the virtualized environment. That presents new challenges.

One such challenge is to prevent virtual server sprawl. Without the proper process controls, IT organizations may experience the proliferation of virtual machines without a proper understanding of the ownership, accountability, and usage requirements of the machines being deployed. In a recent Gartner survey taken during its 2007 Data Center Conference, the respondents named “controlling virtual machine sprawl” as their biggest challenge to managing server virtualization environments. (See Figure 2.)

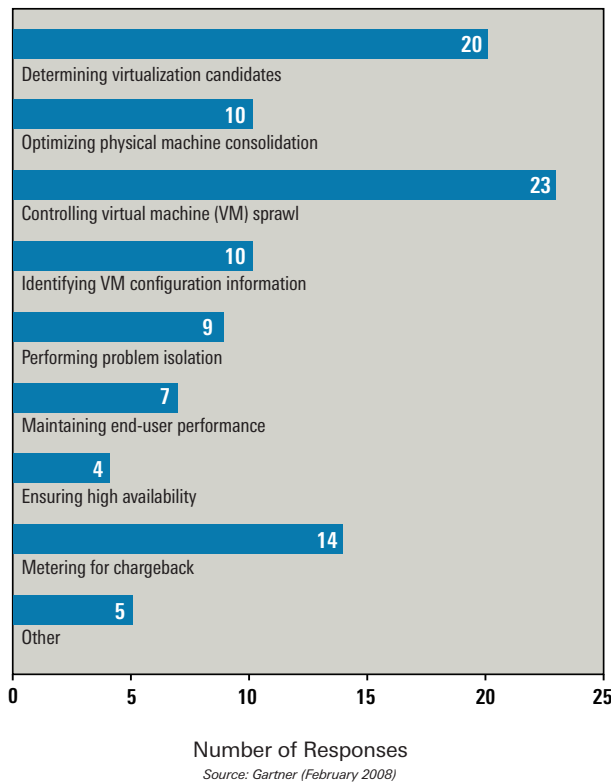


Figure 2. What is your biggest challenge with respect to managing server virtualization environments?

Virtualization amplifies the need for effective change control processes. It's common industry knowledge that the vast majority of system downtime is the result of unmanaged changes to the IT environment. Because far more changes are happening in the virtualized environment, the risk of failed changes is even greater. Moreover, in the virtualized environment, each physical server may be hosting multiple virtual machines, so a failure in a physical server may have

far greater consequences. As a result, control is more critical in the virtualized data center.

Many IT organizations are grappling with change control in the virtualized environment. This is evidenced by another question in the Gartner survey cited previously. Recipients were asked what actions would require a change request with regard to their virtual server environment. The most frequent answer to this question was, “We have not established formalized processes for this yet.” (See Figure 3.)

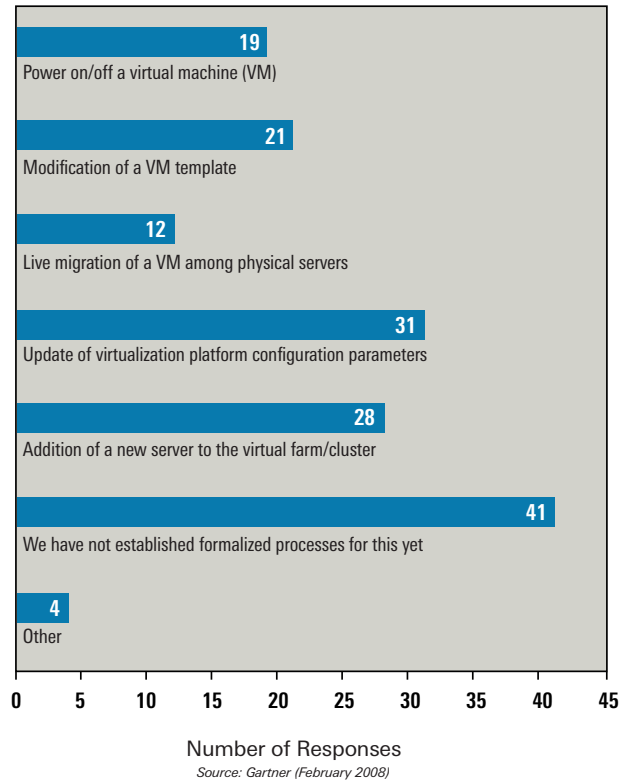


Figure 3. Change request actions

Unmanaged changes can result in mistakes that create security holes and raise the risk of noncompliance with corporate policies and government regulations. The inability to achieve and demonstrate control puts an organization at risk for costly and time-consuming regulatory audits. If an IT audit reveals a lack of necessary controls, this failure must be reported on a company's annual report. The Gartner research note stated that “... one of the best methods to reduce the number of mistakes is via a robust change management regime.”²

Simply applying the same change and configuration control processes currently in place for physical servers, however, is not a viable approach. This would severely impact agility because many of the change and configuration management processes currently in place are not optimized to address the dynamic nature of the virtualized environment.

Achieving a Balance Between Agility and Control

IT must achieve a balance between control and agility. (See Figure 4.) Too much control results in lack of agility; too little control exposes the organization to risk.

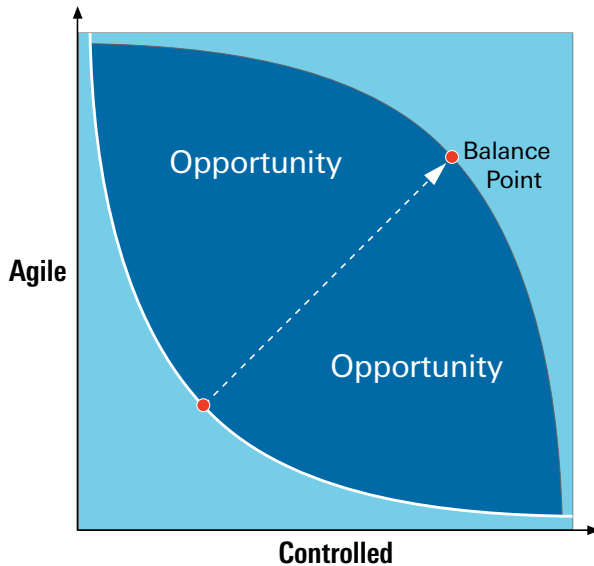


Figure 4. Control versus agility

IT organizations have been striving to balance control and agility long before virtualization technology came onto the scene. To gain control, many IT organizations have implemented change and configuration control processes based on best practices, such as those outlined in the IT Infrastructure Library (ITIL®) guidelines. These practices include the following:

- > Standardizing on fewer asset types
- > Locking down the production environment
- > Tracking and testing changes before release to production
- > Limiting the number of people who can make changes to the production environment

IT organizations have deployed change and configuration management solutions to enforce the use of best-practice processes. The solutions also support agility by streamlining and automating many of the change and configuration management processes.

Now, IT organizations want to take full advantage of the increased agility offered by virtualization technology, yet they want to maintain at least the level of control they have established in their previrtualized environment. As a result, they must reconcile the seemingly conflicting goals of gaining maximum agility while still maintaining control.

Agility advocates argue that too much control limits agility. Control advocates argue that too little control exposes the

organization to risk, such as the possibility of service disruptions and noncompliance with corporate policies, government regulations, and industry standards. By balancing agility and control, IT organizations can address the concerns of both these groups.

Seven Requirements to Achieve Balance

VMware and BMC have worked together to develop an approach that enables IT to strike the optimum balance between agility and control. This approach has been designed to meet seven major requirements.

1. Address All Types of Change

Two characteristics define the type of change activity, regardless of whether the change is made manually or automatically. The characteristics are whether the change is planned or unplanned, and whether the change is authorized or unauthorized.

- > **Planned:** Anticipated and scheduled in advance, such as the manual provisioning of a new physical server or an update to a server operating system
- > **Unplanned:** Possibly anticipated but not scheduled in advance, such as making an emergency manual fix to restore a failed server
- > **Authorized:** Properly approved and, if manual, performed by a person authorized to make the change
- > **Unauthorized:** Not properly approved or, if manual, performed by a person not authorized to make the change

These characteristics result in four different types of changes: unplanned/unauthorized, unplanned/authorized, planned/unauthorized, and planned/authorized. The BMC/VMware approach addresses all four types.

2. Intelligently Employ Best-Practice Processes

BMC's focus on managing IT according to business priorities utilizes best-practice change and configuration management processes, such as those outlined in ITIL guidelines. It is also based on proven IT governance practices, such as those described in the Control Objectives for Information and related Technology (COBIT). These processes minimize risk, such as the risk of service disruption due to failed changes and the risk of noncompliance with government regulations. According to IDC, "In companies adopting ITIL or other best practice frameworks, incorporating the virtual infrastructure into the process workflows will be crucial."³

The BMC/VMware approach optimizes these processes for the virtual environment. The result is a single, integrated set of processes and controls to handle all changes, whether they are to physical or virtual resources.

The approach does not apply the same processes in the same way to all changes. Instead, the approach optimizes the processes for the type of change being implemented because different types of changes require different levels of control, auditing, and reporting. The level is determined by three primary factors:

- > **Type of change:** A change to add and provision a new physical server requires a level of control, auditing, and reporting that is different from the level required for the automatic movement of a virtual server from one physical host to another.
- > **Corporate policies and government regulations:** A change to a server running a financial application has more extensive regulatory implications than a change to a server running a graphics program used in the marketing department.
- > **Business impact:** A change to a server running a customer online ordering application has greater business impact than a change to a server providing online benefits information to employees.

By intelligently applying exactly the right level of control, auditing, and reporting to each change, the BMC/VMware approach strikes the optimum balance between control and agility. It allows IT to exploit the full agility offered by virtualization, while at the same time minimizing risk.

3. Manage by Exception

The BMC/VMware approach is based on the principle of management by exception. This principle has worked quite well in event management, and there is a great deal of similarity between event management and change management in the virtualized environment.

In event management, it is physically impossible and also unnecessary for the IT staff to intervene in each and every event. Rather than simply flood the operations console with events, events are managed by exception, requiring the IT staff to intervene only when necessary. Service management solution vendors, such as BMC, have developed event management systems that have built-in intelligence. These systems filter, process, correlate, prioritize, and, in many cases, remediate events automatically according to pre-approved policies. The system alerts the IT staff to only those events that require staff attention, maximizing efficiency. It also enriches events with relevant information to facilitate handling, and tracks and logs events as required for regulatory compliance and auditing.

As in event management, it is physically impossible and also unnecessary for the IT staff to intervene in every change in the virtualized environment. For example, many changes made automatically by VMware VirtualCenter do not require

IT staff intervention. These changes are covered by policies that have been pre-approved. IT staff can then focus on the changes that require attention — in other words, they can manage by exception.

4. Provide a Comprehensive, Near-Real-Time View of the IT Infrastructure

To effectively manage the virtualized environment, the IT staff must have a comprehensive, accurate, and current view of the IT infrastructure that reflects all changes — in near real time. This includes changes to virtual as well as physical resources.

BMC solutions maintain change information in a configuration management database (CMDB). The BMC Atrium CMDB uses this information to show the physical and logical relationships of all resources, as well as the services they support. For example, it shows which virtual machines are currently running on which physical host servers, and which virtual machines are supporting which applications and services. In addition, the BMC Atrium CMDB shows all planned changes and maintains a historical record of all changes made to each resource.

This comprehensive and near-real-time view enables IT to determine the impact of a change on the overall IT infrastructure and on business service delivery. In addition, the IT staff can see a record of all changes made to each resource, so the staff can relate problems to recent changes, speeding problem resolution.

5. Automate and Integrate Wherever Possible

The BMC/VMware approach automates change processes wherever possible to enable IT to maintain control without hindering agility. It leverages available BMC solutions that automate change processes in the physical environment. It optimizes these solutions for the virtualized environment and integrates them, out-of-the-box, with VMware control points for virtual machines.

Integration extends the sphere of control of the BMC solutions to include changes made through VMware — whether these changes are performed manually by the VMware administrator or automatically. The result is a single change and configuration management system that encompasses all changes. As a result, the IT staff works with a single set of processes and supporting solutions, simplifying management and reducing training requirements.

In addition, integration leverages an important capability already provided by the BMC solutions: the ability to consolidate change management processes across IT disciplines, eliminating the inefficiencies created by management silos.

6. Address Server Sprawl with Change and Configuration Management Processes

To control server sprawl in the physical environment, many IT organizations have established processes that govern the change and configuration of physical servers. The BMC/VMware approach optimizes these processes to also govern the change and configuration of virtual machines. This ensures that all changes to both physical and virtual machines are performed with adequate knowledge and control, eliminating both physical and virtual server sprawl.

7. Accommodate Heterogeneous Environments

Heterogeneity is a fact of life in almost all data centers and is expected to remain so well into the future. The typical data center includes physical servers that are hosting virtual machines and those that are not. It also includes a wide variety of operating platforms, such as Windows, Linux, and UNIX servers, as well as mainframes. The BMC/VMware approach accommodates this heterogeneity.

Applying the Approach

BMC and VMware have already taken the first major step in integrating VMware technology with BSM solutions from BMC. The objective of this first step is to make the BSM solutions immediately aware of all changes made to virtual machines — either manually or automatically — including provisioning, cloning, and moving virtual machines.

The integrated solution provides built-in intelligence that analyzes changes and takes action automatically and selectively, using best-practice change management processes. It applies just the right level of control to each change and requires IT involvement only when necessary. The solution documents changes where required, remediates changes where necessary, and tracks and logs all changes for audit purposes.

To provide near-real-time visibility of the changes made by VMware technology, the combined solution automatically updates the BMC Atrium CMDB. Each time a change is performed through VMware, the VMware system triggers BMC Discovery to scan the environment and automatically updates the BMC Atrium CMDB.

BMC Discovery also periodically scans the IT environment to detect any unreported changes made outside the purview of either VMware or the BMC solutions. This automatic discovery alerts the BMC solutions to any detected changes, triggering whatever remediation actions are necessary to deal with the unreported changes.

Future integration will address additional types of changes made by the VMware administrator through VirtualCenter. This includes changes made to the VMware physical

environment, such as adding a new ESX host, upgrading an ESX host, or setting up a new resource pool. It also includes changes made to VirtualCenter policies by the VMware administrator.

This section presents four frequently encountered scenarios in which changes are made to virtual machines. It discusses how the BMC/VMware approach ensures that each change scenario is handled in the appropriate manner with the right level of control.

Change Initiated by VMware High Availability (Unplanned/Authorized/Pre-approved)

VMware High Availability solutions provide effective management of applications running in virtual machines. If a physical server failure occurs, VMware High Availability automatically restarts the affected virtual machines on other production servers that have spare capacity.

In this scenario, an ESX host fails in the middle of the night. VMware High Availability automatically restarts the virtual machines that were running on that physical server on another physical server. The change is unplanned, but pre-approved through VirtualCenter policy.

According to best practices, this type of change requires a documented request for change and proper approval of that request for audit purposes. However, the change request and approval process can be performed after the fact, without violating policy or regulatory requirements. The filing of the change request provides notification to the change management staff that the change has occurred, and it ensures the availability of an audit trail.

Here's how the system manages this type of unplanned change:

- > Upon completion of the restart, VirtualCenter alerts BMC Run Book Automation that the change has been performed.
- > BMC Run Book Automation checks with BMC Remedy Change Management to determine if the move was planned, sees that there is no valid change request for this change, and determines that this is an unplanned change that requires a change request and approval.
- > BMC Run Book Automation opens a change request in BMC Remedy Change Management to document the change. It populates the request with the description, action, configuration items (CIs), and other information regarding the change, such as the user ID of the person making the change and the event details.
- > BMC Remedy Change Management routes the change request to the appropriate managers for approval, after the fact. This action is necessary to meet regulatory requirements.
- > BMC Run Book Automation triggers BMC Discovery to

run a rescan, which updates the BMC Atrium CMDB with the new virtual server location.

- > When BMC Run Book Automation verifies that the change has been approved (all required approvals gathered), it sets the task completion status within the change request to "closed."

Change Initiated by a VirtualCenter Administrator (Unplanned/Unauthorized)

Using VirtualCenter, an IT staff member manually provisions a new virtual server on an existing ESX host. The change is unplanned, and the staff member is unauthorized to make this type of change.

Here's how the system manages the change:

- > VirtualCenter notifies BMC Run Book Automation that the change has been performed.
- > BMC Run Book Automation checks with BMC Remedy Change Management for planned changes and finds that no corresponding change request has been filed.
- > BMC Run Book Automation immediately triggers the execution of any necessary actions as specified by the corresponding policy. Some possible actions include:
 - Open an incident in BMC Remedy Service Desk that specifies the change description, action taken, CIs affected, and other pertinent information regarding the change. The incident can spawn a change request for tracking and audit purposes, if required.
 - Notify the appropriate people, such as the VMware administrator, of the change.
 - Execute a remediation workflow, if necessary.
- > BMC Run Book Automation triggers BMC Discovery to run a rescan, which updates the BMC Atrium CMDB with the new virtual server and its location.

In any case, the system documents the change for tracking and audit purposes.

VMware DRS Policy-Driven Change (Unplanned/Authorized/Pre-approved)

VMware Distributed Resource Scheduler (DRS) continuously monitors utilization across resource pools and automatically, intelligently, and dynamically allocates available resources in the pool among the virtual machines. Allocation is based on predefined policies and rules that reflect internal mandates and external regulatory requirements. The resource pool includes physical resources, such as host servers and their internal resources (CPUs and memory, for example), storage devices, and network devices. It also includes virtual resources.

In this scenario, VMware DRS detects that a virtual server cannot gain the resources it needs from its physical host ESX host. Through VMotion, VMware DRS migrates the

live virtual server to another ESX host (within the resource pool or cluster) that has greater available capacity. The change is unplanned and pre-approved (authorized by VMware DRS policy).

Here's how the system manages the change:

- > VirtualCenter migrates the running virtual machine across the resource pool or within the cluster.
- > VMotion alerts BMC Run Book Automation about the move.
- > BMC Run Book Automation determines from its policies that this type of move does not require a change request to be filed and does not require additional change approval.
- > BMC Run Book Automation triggers BMC Discovery to run a rescan, which updates the BMC Atrium CMDB with the new virtual machine location.

Change Initiated by BMC Remedy Change Management (Planned/Authorized)

In this scenario, the IT staff enters a request for a new virtual machine in BMC Remedy Change Management, which automatically routes the request for approval. When it has gathered the required approvals, BMC Remedy Change Management triggers BMC Run Book Automation and BMC BladeLogic Operations Manager to implement the change. Since the request is associated with the deployment of a virtual machine, these solutions work in conjunction with VMware Lifecycle Manager to submit the task to the administrative team. Using policies defined specifically for the virtualized environment, Lifecycle Manager intelligently and automatically builds and configures the virtual machine and ensures it is placed on the correct set of virtual infrastructure resources. These predefined rules ensure virtual machines are always provisioned and configured consistently, and the combination of the BMC and VMware solutions reduces the risk of unapproved configurations being deployed into the environment.

Here's how the system manages this type of change:

- > The IT staff enters a change request in BMC Remedy Change Management to create a new virtual machine. The change request is populated with the description, action, CIs, and other information regarding the change, such as the user ID of the person making the change and the event details.
- > BMC Remedy Change Management automatically routes the change request to the appropriate managers for approval. This is necessary to meet regulatory requirements.
- > When it has gathered the necessary approvals, BMC Remedy Change Management triggers BMC Run Book Automation and BMC BladeLogic Operations Manager, which initiates a request to the virtual infrastructure administrator through VMware Lifecycle Manager to properly build and deploy the new virtual machine.

- > When the virtual machine is available, BMC Run Book Automation notifies BMC Remedy Change Management that the change task is complete and provides information about the location and name of the newly provisioned virtual machine.
- > BMC Run Book Automation triggers BMC Discovery to run a rescan, which updates the BMC Atrium CMDB with the new virtual machine information.
- > BMC Run Book Automation sets the task completion status within the change request to “closed.”

Contain, Comply, Improve, and Save

By applying the BMC/VMware approach, IT can achieve the optimum balance between control and agility in the virtualized environment. This approach contains the proliferation of virtual machines, preventing virtual server sprawl. It also applies exactly the right level of control, auditing, and reporting to every change, ensuring that IT maintains continual compliance with corporate policies and government regulations — without limiting agility.

The optimum balance between control and agility enables IT to continually improve service and significantly lower costs. According to IDC, deploying ITIL-based process improvements for a virtual infrastructure translates into an average annual cost savings of \$100,000 to \$200,000.⁴

Conclusion

By taking the approach developed by BMC and VMware, IT organizations can achieve the optimum balance of control and agility, tapping the full potential of virtualization technology while still maintaining and demonstrating control.

IT can move faster and with greater flexibility — without increasing risk. That means serving more business users with greater speed and responsiveness. Both IT and the end users benefit. IT reduces costs and aligns more closely with the business, contributing greater business value. Business users gain the competitive edge of an agile and stable IT infrastructure that can deliver the services they need, when and where they need them.

End Notes

1 Gartner, Inc. Data Center Conference Survey: Addressing the Operational Challenges of Virtual Server Management, Cameron Haight, February 27, 2008.

2 Ibid.

3 Stephen Elliott, IDC, “Virtualization: The Big Picture,” *VIEWPOINT: Focus on Managing Virtualization*, BMC Software, 2008.

4 Ibid.



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About VMware

VMware (NYSE: VMW) is the global leader in virtualization solutions from the desktop to the data center. Customers of all sizes rely on VMware to reduce capital and operating expenses, ensure business continuity, strengthen security, and go green. With 2007 revenues of \$1.33 billion, more than 120,000 customers, and nearly 18,000 partners, VMware is one of the fastest-growing public software companies. VMware is headquartered in Palo Alto, California, and on the Web at www.vmware.com.

About the Authors

Kia Behnia, Chief Corporate Architect, CTO Office, BMC Software

Kia Behnia is responsible for leading the design of BMC Atrium, the industry-leading, service-enabling architecture for Business Service Management from BMC. He was previously CTO for the change and configuration products at BMC, and CTO for Marimba, Inc., which was acquired by BMC. Prior to joining Marimba, he served as a senior member of the technical team for Tivoli Systems, Inc. Behnia has more than 15 years of experience in the management of distributed systems and databases. He holds a bachelor's degree in computer science from the University of California at Davis.

Erik Wrobel, Director of Product Management, VMware

Erik Wrobel is responsible for defining the product strategy for the Virtual Infrastructure Management products. Prior to joining VMware in 2006, he held product management and engineering positions at BMC Software, Remedy, and SimulTrans. He has an MBA in international management, is a Certified Enterprise Architect, and is ITIL foundation and practitioner certified.

Additional Contributors

The following individuals also contributed to this white paper:

Mike Adams, VMware

Brian Emerson, VMware

Andrea Hite, BMC Software

Scott Sloan, VMware

Darius Wallace, BMC Software

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