



Effectively Managing Change Across the Data Center

By BMC Software and Enterprise Management Associates

Table of Contents

- EXECUTIVE SUMMARY 1

- ABSTRACT 2

- PROBLEM: RELIEVE THE PRESSURE OF ONGOING CHANGE 2

- REALITY: PREPARE FOR EMERGING TECHNOLOGIES 3

- STRATEGIES FOR SUCCESS: HOW TO CONTROL CHANGE 4
 - Step 1: Assess the Situation 4
 - Step 2: Address the Problems 5
 - Step 3: Automate Data Center Management Processes and Activities 6
 - Step 4: Achieve Improved Visibility 6
 - Step 5: Maintain a Single Source of Accurate Information 6
 - Step 6: Establish Process Controls 7
 - Step 7: Achieve Streamlined Interaction with Other IT Disciplines 7

- CASE STUDY ON THE VALUE OF AN INTEGRATED SOLUTION 8
 - Solving the Problem 8
 - Results 8

- CONCLUSION – ENTERPRISE MANAGEMENT ASSOCIATES PERSPECTIVE 9

Executive Summary

The demands for change in the modern data center increase continually, and those demands differ between business needs and IT needs. The business wants compliance with new regulations, faster response to market requirements, expanding capabilities and the highest quality service. IT demands up-to-date systems and applications, deployment of new and complex technologies, greater controls for security and risk management, and increasingly efficient use of the IT operating budget.

Data center change is a double-edged sword. It drives new business and delivers new competitive advantages; it keeps your systems and your data secure; it reduces your operating costs and lets you do more with less. However, without proper management, data center change can also cripple your business, lose customers, crash your systems, destroy your data, and cost you more than you can imagine. For IT managers, failure to manage change can result in an increasingly fragile data center infrastructure, overloaded systems that fail to meet SLAs, spiraling resource costs, and business owners breathing down your neck for changes you cannot deliver. For business owners, it can mean slow systems and increasingly intense competition, which have you apologizing to customers, losing business to a competitor because of poor service, and suffering an unresponsive data center that does not give you the services you need to do business.

Fortunately, you *can* manage data center change effectively, in a way that enables change to help, rather than hurt, your business. An integrated solution for change management combines best practices like the IT Infrastructure Library (ITIL®) with a configuration management database (CMDB) which has both intelligent and predictive technologies to help you to thrive in a rapidly changing IT-driven business environment.

This paper outlines some of these strategies and gives you specific, measurable, achievable, relevant, and timely advice on how to:

- > Assess your situation
- > Address the problems
- > Automate change processes
- > Improve visibility
- > Establish the single source of accurate information
- > Establish process controls
- > Streamline interaction with other IT disciplines

These incremental strategies, drawn from established best practices, will allow you to integrate data center change as a standard operating procedure, making your organization more agile and effective, while reducing the potential for risk and maintaining data center infrastructure stability.

Abstract

As an IT professional, you face a dilemma. Your business customers' survival, and yours, depend on the ability to adapt to a continually changing business environment. That adaptability, however, relies heavily on how rapidly the IT staff can change the IT infrastructure; yet change certainly can be a major contributor to infrastructure instability.

Because the data center plays a pivotal role in delivering business services, the data center staff does much of the "heavy lifting" in implementing infrastructure changes. Best practices in change management require structured processes and documentation that are perceived to add overhead. The challenge requires you to maintain a delicate balance between responding to your customers' needs for change and your need for control in implementing change without disrupting business services.

Today's automated approaches to change management help address both sides of this challenge, relieving much of the administrative overhead, while addressing change-related risk and improving the productivity of data center personnel and technologies. This paper describes a holistic, integrated approach to change management that integrates and optimizes three components: processes, activity, and information and data.

- > **Processes** – This includes change management, release management, and other related processes, with the processes increasing predictable outcomes.
- > **Activities** – Activities, which increase productivity, include installing memory in a server or provisioning new servers. Many of these activities can be automated.
- > **Data** – This includes configuration data, service definitions, and contract information. Success is measured by accuracy, accessibility, and whether the data is current.

The recommendations in this paper will help organizations improve the management of infrastructure and application changes in the data center, embrace and benefit from new technologies, reduce costs, and be more responsive to business requirements. The paper also includes a case study

of a data center team that saved several million dollars by improved server utilization, implemented a successful integrated change management solution, adopted highly agile virtualization technologies, and increased its responsiveness to the business.

Problem: Relieve the Pressure of Ongoing Change

Both business and technology issues drive change in the data center infrastructure. The business side requires new and enhanced applications and services to address changes in the business environment — for example, expanding the computing capacity to support a new marketing campaign, or managing compliance reporting with evolving government regulations. The technology side requires a continuing barrage of changes that include operating system patches, and adding new database versions, networking and storage software, and hardware. This also includes frequent application updates that can often introduce complex dependencies to other infrastructure elements. Pressures to adopt new technologies, such as virtualization to increase IT resource and cost efficiencies, have intrinsic, dynamic change elements as part of their very nature.

Failure to keep up with change could have serious business consequences. It could cost your enterprise millions in lost business, increase the risk of regulatory noncompliance, and open up your data center to serious security threats that could topple operations or compromise corporate or customer data.

Complex data center infrastructures are comprised of a variety of components — servers, network components, databases, enterprise applications, mainframes, and legacy components. Extensive dependencies among these components mean that a change in one component will likely have far-reaching effects on others. Even with vendor consolidation and standardization of configurations, the extensive heterogeneity and distributed nature of the data center is expected to accelerate, further complicating change management.

Reality: Prepare for Emerging Technologies

You must also be prepared to take on changes to exploit new, emerging technologies and architectures. These changes bring with them significant business benefits such as increased business agility, lower IT costs, and increased return on IT investments. An automated solution should be able to handle changes to your current infrastructure and manage the changes needed to accommodate future technologies and architectures.

An adaptive infrastructure should provide the ability to adapt and change in real time. This represents a new distributed computing model, where infrastructure is shared across customers and dynamically optimized to achieve end-to-end service levels at the lowest price. Adaptive infrastructures provide automatic, just-in-time delivery of computing resources based on changing workload and operating conditions.

Emerging technologies offer greater business agility by enhancing the ability to adapt quickly to changing and unpredictable business requirements and workloads. These technologies can also help improve the performance and availability of business services, increase resource use for greater ROI, and lower data center operating costs.

The adaptive infrastructure concept necessitates major changes in infrastructure architecture and technology that will be implemented in the data center. One enabling technology for the adaptive infrastructure, *server virtualization*, permits the decoupling of physical and logical servers by allowing multiple server images (called virtual servers) on a single physical server, with each virtual server appearing to the environment as a separate server. Virtualization will allow the data center to significantly reduce the number of physical servers required, resulting in lower operating costs of everything ranging from hardware, software licenses, and management personnel to facilities, power, and cooling. However, without proper management solutions, administration costs may in fact increase due to the complexity of this additional layer.

Implementation of these new technologies and architectures places an additional and significant burden on data center staff. These technologies and architectures necessitate major infrastructure changes, and to ensure

successful implementation may require the help of professional services from various third-party vendors. However, it is critical that you implement these changes while still delivering current business services at agreed upon levels. What's more, you need to do it while continuing to implement the huge volume of changes required by your existing data center infrastructure.

The impact of these new technologies does not end with their implementation. They can significantly raise the penalties for failed changes. One of the main goals of these technologies is to improve resource use and increase ROI—in other words, do more with less hardware. However, consolidating more business services into fewer resources increases both the risk and the potential impact of resource outages. Business service performance and capacity risks are increased due to contention for newly shared resources.

Business service availability risks increase because more applications are hosted on any single given resource. For example, multiple business services that experience peak demand at the same time now compete for a shared resource, resulting in missed service levels. Or, an outage in a server that is hosting multiple virtual servers will take down all the services hosted by that server. Therefore, it is important to understand the resource requirements over periods of time for the applications running on the virtual servers, in order to create a low-risk migration plan and to build policies for dynamic resource allocation in the virtual environment. Understanding the current and future capacity requirements is key to minimizing the impact of change while migrating to the virtual environment.

These fluid environments will, by their very nature, require configuration changes in an even more dynamic fashion. It is quite probable that, initially, your servers will be reconfigured for multiple different applications and purposes several times per month. Ultimately, as IT gains confidence in using automation technologies more pervasively, the servers will be reconfigured as frequently as every hour, or possibly even more often. This type of rapid, automated change will obviously create an urgent need for change management and tracking, both for internal purposes (e.g., to diagnose impact to business services) and for external purposes such as compliance.

Strategies for Success: How to Control Change

Many enterprises currently approach change management ineffectively. In many cases the change process is not formalized, the data for making the right decisions is too dispersed, and many activities are performed manually — which is both error-prone and difficult to test. In fact, failed changes are a major source of outages, which cause serious consequences to the business, including financial loss, tainted company image, and reduced employee productivity. Adding to the problem is that manual activities are difficult if not impossible to audit, raising the risk of noncompliance with government auditing regulations.

Because of the major impact that changes can have on the business, an important step is to take a critical look at your current change management process from a business perspective and determine how you can improve it. You cannot rectify all discovered problems at once. Instead, you should take an incremental approach to improving your change management process.

The following sections present some major points to keep in mind as you determine where and how to make improvements.

Step 1: Assess the Situation

First, you need to assess the current state of your change process. A good reference to use in the assessment is a guide published by the Institute of Internal Auditors called “Global Technology Audit Guide, Change and Patch Management Controls: Critical for Organizational Success.”¹ The guide was written specifically for auditors to use in evaluating compliance with government regulations with respect to change management, but it also applies in the context of this paper.

Table 1 summarizes the guide’s list of the main symptoms and indicators of poor change management, control failures, and organizational level issues.

The presence of these risk indicators can have severe impact on the business. For example, unauthorized changes can result in failure to comply with government regulations. Unplanned outages in internally facing applications can drag down employee productivity. Unplanned outages in customer-facing applications, such as an e-commerce Web site, can result in lower customer satisfaction and lost revenue. Delayed project implementations can result in loss of competitive advantage. Moreover, a low change-success rate drags down the productivity of the IT staff, by creating extra work.

¹For a copy of the “Global Technology Audit Guide, Change and Patch Management Controls: Critical for Organizational Success,” please visit www.theiia.org.

Top five risk indicators of poor change management	Symptoms and indicators of control failures due to poorly controlled IT changes	Organizational level indicators for which IT may have systemic change-management-control issues
<ol style="list-style-type: none"> 1. Unauthorized changes (above zero is unacceptable) 2. Unplanned outages 3. Low change-success rate 4. High number of emergency changes 5. Delayed project implementations 	<ul style="list-style-type: none"> > Unavailability of critical services and functions — even for short periods of time > Unplanned system or network downtime — halting execution of critical business processes (i.e., coordinating schedules with suppliers and responding to customer orders) > Downtime on critical applications, databases, or Web servers, preventing users from performing their critical tasks > Negative publicity and unwanted attention from the organization’s board of directors 	<ul style="list-style-type: none"> > IT staff spends the majority of time on operations and maintenance (>70 percent), instead of helping the business in deploying new capability > There is failure to complete projects and planned work (due to high amounts of firefighting and unplanned work) > IT management is being awakened in the middle of the night regarding problems > IT staff turnover is high > Adversarial relationships may exist between IT support staff, developers, and business customers (internal or external), usually over poor service quality or late delivery of functionality > Too much time is required for IT management to prepare for IT audits and remediate the resulting findings

Table 1. The main symptoms and indicators of poor change management

Step 2: Address the Problems

Once you have made an assessment, you can address the found problems. The “Global Technology Audit Guide” also provides guidance on where to begin. The guide defines five steps that immediately improve change management processes. Table 2 summarizes these steps.

To make improvements, you should establish consistent, repeatable change processes that permit you to effectively measure and control changes to the data center infrastructure. This includes changes occurring now as well as changes necessitated by new architectures and technologies. Establish process workflows in a variety of areas, including:

- > **Change request initiation and approval** – Establish workflow that includes automatic routing of change requests for approvals. Workflow should keep things moving throughout the approval cycle and permit the delegation of authority.
- > **Change planning, scheduling, and implementation** – Establish priorities and processes for distributing patches and upgrades. The processes should maximize use of the maintenance window.
- > **Risk Assessment** – Contemplated changes should, in advance, be subjected to business capacity management,

evaluating their impact on service levels, operational performance and availability, and the IT resources needed to sustain these changes. Factors that should also be considered are the type of change, the affected configuration items, the time of the change, and the tracked record of a similar change performed on other systems.

- > **Business continuity** – Have processes in place to permit the data center to recover quickly in the event of problems (ranging from the corruption of a critical database by a “misbehaving” application to a natural disaster such as a flood shutting down a data center). Include backup and restore processes as well as disaster recovery processes. Put in place accelerated processes for small changes and those related to emergencies.

Processes should be based on best practices to ensure their efficiency and effectiveness. The IT Infrastructure Library (ITIL) framework — worldwide the most widely accepted approach to IT service management — provides a strong foundation for establishing best-practice IT processes. ITIL encompasses incident, problem, change, release, service desk, service level, capacity, availability, finance, and business continuity management disciplines. For more information on ITIL, please visit www.ogc.gov.uk.

Action	Observations
> IT management should enforce zero tolerance of unauthorized changes	> Use preventive and detective controls to achieve and sustain this objective, ensuring that all production changes can be reconciled with authorized work orders
> Continually monitor the number of unplanned outages, an excellent indicator of unauthorized change and failures in change control	> Detective controls and root-cause analysis can help uncover where process gaps allowed for unauthorized or unplanned changes
> Reduce the number of risky changes by specifying well-defined and enforced maintenance windows for change and freeze activity	> This action can maximize stability and productivity during production hours
> Use change-success rate as a key IT management performance indicator	<ul style="list-style-type: none"> > Where changes are unmanaged, unmonitored, and uncontrolled, change-success rates are typically below 70 percent > Each failed change creates potential downtime, unplanned and emergency work, variance from plans, and business risk > Increasing the change-success rate requires effective preventive, detective, and corrective controls
> Use unplanned work as an indicator of effectiveness of IT management processes and controls	> High-performing IT organizations spend less than 5 percent of their time on unplanned work, while average organizations often spend 45 to 55 percent of their time on unplanned (and urgent) activities

Table 2. Five action steps to improve the change management process

Step 3: Automate Data Center Management Processes and Activities

Failure to respond quickly to changes could jeopardize competitiveness or leave security holes in a time of fast-moving technology threats. At the same time, you must ensure that changes are not made without adequate control. Best-in-class IT organizations understand that the failure to control changes in the data center will result in increased overall IT management costs and could result in outages of critical business services. The increase in IT costs isn't limited to just the data center, but will most definitely impact other IT areas such as the service desk, which would receive additional call volume due to system issues.

Failure to plan the performance and capacity aspects of every change results in only one of two possibilities: significant waste of scarce IT resources (capital expenditure, operation expenditure, and personnel), or failure to meet business service levels. Finally, inadequate change controls could result in regulatory noncompliance. One thing to keep in mind when implementing change control is to ensure that the controls make sense from a business and compliance perspective and do not create unnecessary obstacles to the responsiveness of the data center staff.

One way to achieve a balance between responsiveness and control is to automate change processes and activities wherever possible. Automation increases speed and efficiency and frees up much of the time the staff currently spends on repetitive tasks. It also helps provide process consistency based on standardized, best-practice processes. Consistency reduces the number of change errors that could cause outages that interrupt the delivery of critical business services.

Automating the distribution and installation of software updates and patches ensures that they all are installed consistently and that all installation attempts are accounted for, including those that fail. Automating the sequencing of new software releases from the test to the production environment enables them to be introduced in a disciplined way that does not jeopardize business continuity. In addition, automating the capacity management and resource provisioning processes ensures that the right resources are brought online when needed to provide optimum efficiency, agility, and service levels.

Step 4: Achieve Improved Visibility

To assess change impact quickly, the data center staff needs visibility into the complex data center IT infrastructure. This requires a solution that provides a consolidated view of all assets, their configurations, and their physical and logical

dependencies. To improve change planning and maximize efficient use of maintenance windows, the staff also needs to know what changes are in the pipeline, through a consolidated view of all planned and in-process changes.

For maximum efficiency, the data center staff needs to prioritize change activities based on their business impact. This requires a solution that permits modeling of the infrastructure components to the business services they support. For example, a model would indicate which components support specific SAP modules.

To optimize cost efficiency of configuration-related changes, the staff also needs to be able to understand the performance aspects of the considered changes — how much and what type of capacity will be required to successfully balance service levels and budgets — before changes are authorized under change management processes.

It is also important to report on business service levels, before, during, and after changes are implemented, to facilitate cross-organizational stakeholder alignment and support for change-related activities. For optimal alignment, these reports should be able to detail “actual” versus “planned” service level performance and associated resource utilization. Finally, the solution should provide tracking and reporting of change activities to enable better-informed change planning, facilitate audits for regulatory compliance, monitor the effectiveness of change management, and identify problem areas.

Step 5: Maintain a Single Source of Accurate Information

One of the key requirements for change management is access to a configuration management database (CMDB) that contains comprehensive and accurate data about the IT infrastructure environment. This data includes the assets deployed (hardware, software, and network components), their locations, their configurations, and their associated users (employees, business partners, customers). What differentiates a CMDB from other “asset stores” is the need to capture the physical and logical interrelationships of the assets, as well as the relationships of the assets to the business services they support. The ideal solution should provide automatic discovery to populate the CMDB and update it each time a change is successfully implemented.

The CMDB provides a data source for generating the views of the IT infrastructure that the data center staff needs for change planning and management. What's more, the CMDB provides a single, consistent, and accurate source of data for other groups, both inside and outside of IT, that need

this information. As part of the extended CMDB, as shown in Figure 1, the capacity management database ensures that all performance and capacity information related to infrastructure-related assets is managed and leveraged in the appropriate context.

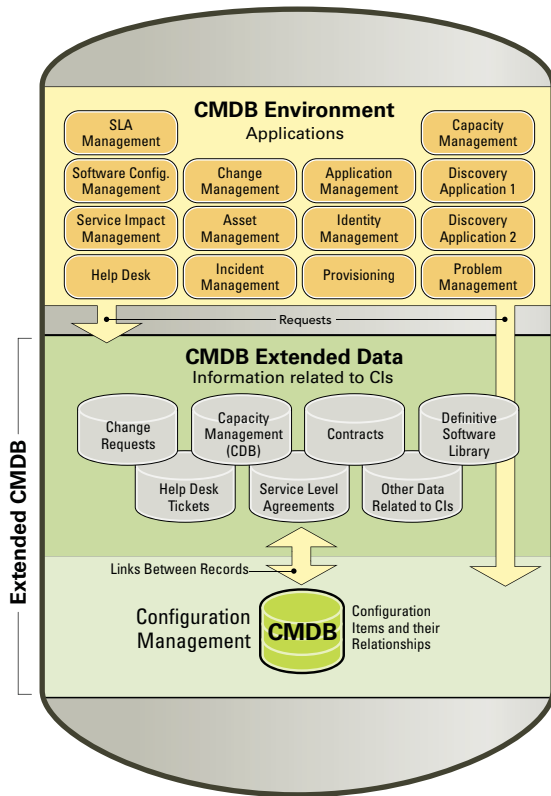


Figure 1. Configuration management database, the environment, and extended data

Step 6: Establish Process Controls

One of the most important functions of a change management solution is to establish control over change activities. This can be accomplished by enforcing policies that define processes such as change requests and approval workflow, authorization of staff members to implement changes, and deployment of standard configurations. Controls reduce the risk of outages due to poorly planned or unauthorized changes, and reduce the risk of noncompliance with government regulations.

Look for a solution that helps maintain an optimum balance between control and responsiveness. It should maintain control without getting in the way of the data center staff responding to customer needs. For example, operating system upgrades or significant patches require a number

of steps and approvals before being deployed. These processes require strict controls, especially on systems that support critical business services. However, lesser changes, such as small application patch updates or peripheral hardware changes, require minimum processing and need less overhead to support responsiveness.

Step 7: Achieve Streamlined Interaction with Other IT Disciplines

By selecting a change management solution that integrates with other IT service management solutions — such as asset management, incident and problem management, and distributed systems management — IT organizations can streamline the interaction of the data center staff with these disciplines. The CMDB provides the ideal point of integration, in that it provides a single source of accurate information for all disciplines.

Here are just a few examples of the value of this integration:

- > **Incident and problem management** – Keeps the incident and problem management team up to date on successful change completions. In addition, the incident and problem management staff can directly enter change requests and view change status directly from the incident and problem management solution.
- > **Capacity management** – Enables the performance analysis and capacity planning staff to be up to date with current configuration information, and ensures that all planned changes are subjected to capacity planning for advanced performance and capacity-risk evaluation. The capacity planning staff initiates change requests for changing configuration to address performance issues and recommending upgrades or new purchases.
- > **Asset management** – Keeps the asset management team up to date on infrastructure changes by automatically updating the CMDB whenever a change is successfully completed.
- > **Performance and availability management** – Enables the distributed systems management team to stay in the loop on changes that involve servers and mainframes in the data center and clients on the distributed network.
- > **Identity and access management** – Provides install, move, add, and change functions that require close coordination of change and configuration management and identity management processes to ensure smooth provisioning and access to resources and applications.

Case Study on the Value of an Integrated Solution

Think of the massive changes, the growing complexity of the data center infrastructure, and the need to implement new, potentially disruptive technologies and architectures. Now, consider the catastrophic business consequences of failed changes. Additionally, changes should be implemented in close coordination with several other functions in IT, including application development, asset management, capacity management, incident and problem management, distributed systems management, and security management. Manual change processes are no longer adequate. What is required is an integrated change management solution. The case study below discusses the business value of an integrated approach.

One IT organization with multiple, business-critical applications, was interested in significantly reducing its IT operational expenses while increasing its business agility to more rapidly and efficiently bring to market several new online applications. Lacking comprehensive, integrated change management and other associated ITIL disciplines (such as asset management and capacity management) the organization's previous business and IT "methodology" was to simply purchase, implement, and deploy dedicated physical servers for each application "cluster." Each new application from the business units generated a manual purchase order to the CIO for another "set of servers," resulting in massive over provisioning of their industry-standard rack server application environments.

Driven to find the appropriate balance between cost efficiency and business agility, a new CIO asked a few simple questions: "How many servers do we have, what do they do, who owns them, what are they doing now, and how many will we need? I'm not approving anymore hardware acquisitions until I have these answers, and a process defined that ensures that, in the future, I will know this in advance."

Solving the Problem

This organization then undertook the phased implementation of an integrated and automated approach with the following steps:

- > Implemented organizational commitment to a comprehensive change management process built around a comprehensive, single source of accurate information, a CMDB
- > Followed an "IT audit" that automatically discovered server (hardware resources) and software configurations, which were then populated into the CMDB

- > Baselined its current performance and utilization, and generated a set of reports correlated with the asset management database, allowing the CIO to quickly identify a large set of underutilized, underperforming server assets (This step alone *yielded several million dollars* by finding hundreds of completely unused servers, deferring by more than a year the need to purchase additional systems.)

Results

The magnitude of this finding increased the organization's pursuit of comprehensive and integrated change management. Part of the newly implemented change management process was a mandate that all future server purchases would be subject to capacity management, for modeling both necessity and cost effectiveness. The underutilized resources "discovered" earlier were repurposed to be hosts for virtualization of the application-hosting environment. Using knowledge gained by a newly adopted capacity management process, the virtual environments were correctly sized to support business requirements, reducing business-service capacity risk.

Orchestration and provisioning policies and automation were implemented to automatically create and bring online virtualized, application-hosting environments, and migrate to the new virtual environment the existing online applications hosted on physical servers. Change management processes, coupled with software configuration management processes, ensured that correct software images and patch levels were automatically managed and tracked. This was done one application at a time, in a modular fashion, with the changes in configuration reflected back into the CMDB for continual asset management and change management.

Application environments were configured to be dynamically provisioned in real time to leverage shared pools of server resources, automatically and under intelligent business policies. When a new server was required to support spikes in business demand, the customer's implementation would provision a new server, configure it with the appropriate software (including respective patch updates), and bring it online in time to ensure ongoing delivery against service level agreements (SLAs). When demand needs had passed, the extra resource capacity was "de-provisioned" back into a shared pool for use by other application environments. This incremental, integrated approach not only delivered immediate cost savings — it also accelerated the adoption of highly agile virtualization technologies, while simultaneously lowering business risks.

Conclusion — Enterprise Management Associates Perspective

Data center staff is at the center of the action when it comes to maintaining business agility. This brings with it a daunting challenge. They must implement a continual barrage of changes in a timely fashion, to a complex infrastructure, and must do so without interrupting the delivery of critical business services at agreed service levels. Compounding this challenge, they must manage this changing environment while simultaneously increasing their financial and operational efficiencies, and continually driving cost out of the environment. The stakes are high because failure to meet the challenge has disastrous business impact.

It is too risky to continue to rely on manual change processes. IT managers should seek a change management solution that helps data center staff to rise to the challenge in a way that balances responsiveness with control. Such a solution not only lets data center staff respond quickly to today's change requirements, but also positions the entire organization to take advantage of tomorrow's technologies.

With the right change management solution in place, data center staff will add significant value to the business, driving competitiveness through business agility, and leveraging new technologies for greater business advantage.

BMC® Software offers change and configuration management solutions that can help the data center staff manage change more effectively. For more information, please visit www.bmc.com.

About Enterprise Management Associates, Inc. (EMA)

Enterprise Management Associates, Inc. is the fastest-growing analyst firm focused on the management software and services market. EMA brings strategic insights to both vendors and IT professionals seeking to leverage areas of growth across e-business, network, systems, and application management. Enterprise Management Associates' vision and insights draw from its ongoing research and the perspectives of an experienced team with diverse, real-world backgrounds in the IT, service provider, ISV, and publishing communities, and is frequently requested to share their observations at management forums worldwide.

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