THOUGHT LEADERSHIP WHITE PAPER

Proactive Operations for the Modern Data Center

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

THE MODERN DATA CENTER 2

- From Static to Dynamic to Hybrid 2
- The Management Challenge 2

MEETING THE CHALLENGE 3

- Managing Business Services 3
- Managing the Dynamics of I.T. Supply and Demand 3
- Becoming More Proactive 4

BSM BRINGS THE MODERN DATA CENTER UNDER CONTROL 5

- Proactive Availability and Performance Management 5
- Capacity Optimization 6
- Configuration Automation 6
- Operational Support Analytics 7

REAL-WORLD EXAMPLES 8

- Global Managed Service Provider 8
- Global Consumer Products Company 8
- BMC Software 8

CONCLUSION 9

EXECUTIVE SUMMARY

A business organization is like a living organism. If it is to succeed and grow, the organization must be aware of and operate in harmony with its environment. IT is at the heart of most business organizations and, consequently, must deliver the services the business needs, when and where they are needed.

The business environment is complex and highly dynamic. It requires an IT infrastructure that is agile and can act in sync with the fast-moving business environment. To meet this requirement, IT organizations are transforming the model of the data center from one that is a static and dedicated resource, to one that is a highly dynamic and shared resource. Many businesses are actively considering the possibility of obtaining the required IT infrastructure and services from external providers. Technologies such as cloud computing, virtualization, and automation are enabling this transformation to the modern data center.

Delivering the right services at the right times is only part of the challenge. IT must deliver them at agreed-upon service levels, in a cost-effective manner, while maintaining compliance with internal policies and external regulations. Business users perceive IT through the services IT delivers. They are not typically concerned with the gyrations of the underlying technology that supports those services.

To meet the challenge, IT organizations must adopt a new, proactive approach to managing the complex and highly dynamic data center. This new approach requires the capability to gather, monitor, and analyze data to make both short-term and long-term predictions about the IT environment, and to move proactively based on these predictions. IT must understand the rhythm of its business and use this understanding as a lens through which to view and manage the continually changing IT environment. The lens filters out occurrences that are merely "noise" and separates changes that are part of the normal business rhythm from those that are not, thereby helping IT to manage the complexity of the modern data center.

This paper examines the data center's transition from a model that is static and dedicated, to one that is dynamic, shared, and multi-sourced. It discusses the need for proactive data center operations management and the requirements for success. Further, it describes how Business Service Management (BSM) will enable you to meet these requirements. BSM is a comprehensive and unified platform that helps IT organizations cut cost, reduce risk, and drive business profit by simplifying and automating IT. The benefits of BSM include increased efficiency, higher quality service delivery, continuous compliance, and lower costs. The paper concludes with real-world examples of companies that are leveraging BSM to manage their transition to the modern data center and the value they are already realizing.

THE MODERN DATA CENTER

Business and governmental organizations are by no means static entities. They are living organisms that continuously change. Change is driven by several factors, including well-established fluctuations in business demand and supply that generate peaks and valleys based on time of day, week, month, and year. They also include less predictable elements of the business environment, such as macroeconomic conditions, market competition, regulatory requirements, new supply options and cost structures, new product introductions, and promotional campaigns.

Because IT has become a business enabler, it is directly affected by changes in the business environment. Demands for IT service delivery are highly dynamic and vary widely, driven by the same factors that drive change in the business environment. New and updated services must be brought online, and services no longer used must be phased out.

Consequently, the IT organization must keep the IT infrastructure agile to meet the changing needs of the business. That means ensuring reliable, high-quality service delivery, despite highly fluctuating demands and alternative supply options. IT also has to maintain compliance with internal policies and external regulations. What's more, it has to do all this while keeping capital expenditures and operating costs in check.

FROM STATIC TO DYNAMIC TO HYBRID

The traditional approach to IT data center architecture is based on a relatively static model of dedicated resources and a "just-in-case" approach to capacity. This has resulted in server sprawl and an IT infrastructure that is difficult and expensive to manage. Consequently, IT organizations face high capital expenditures, high operating costs, and gross underutilization of resources. In fact, industry analysts report that most IT organizations achieve less than 10 percent average server utilization.

Now, more than ever, IT is under intense pressure to reduce costs while also improving service availability, performance, and delivery. IT organizations are responding by transitioning their data centers from the traditional, static, dedicated-resource model to a far more dynamic, shared model. This transition is enabled in large part by such technological innovations as cloud computing, virtualization, and automation.

In the modern model, the data center continuously responds and adapts to its changing environment, potentially leveraging a combination of internal and externally provided resources. Virtual resources appear, move dynamically among physical resources, and disappear. Capacity management changes from a just-in-case to a just-in-time model. These changes result in a dramatic decrease in the number of physical resources required, which increases resource utilization and reduces capital expense and management costs.

THE MANAGEMENT CHALLENGE

The modern data center introduces a much higher level of complexity and dynamism to service management. Virtual and cloud resources can be easily and quickly allocated. That means a large number of virtual and cloud resources to manage, typically far larger than the number of physical resources in the traditional static model. Due to the shared nature of virtual and cloud computing, there is also a significant increase in the number of end users and end points to monitor and manage. In addition, the IT infrastructure is changing at a high rate as virtual and cloud resources are continually being created, moved among physical resources, and retired.

The increase in the number of resources and the higher rate of change complicate management in just about all IT areas, including performance monitoring and management, incident and problem management, change management, configuration and release management, software license management, compliance management, and vendor management.

And yet, the biggest challenge of all is that most business applications still run in the non-cloud environment (or are transitioning slowly), and they must be managed along with the emerging dynamic cloud applications. In other words, IT is not just managing the cloud as a silo; it's managing the cloud in concert with the existing "plant" that the business runs on. A proactive operations platform can simultaneously watch both rapidly and less rapidly changing environments, automatically adapt to their patterns,

and manage issues proactively in a consistent way, from a service perspective. This drives better service delivery, reduces costs, and improves operational efficiency.

The traditional approach to service management is in large part reactive, built around functional silos and reliant on manual processes. It focuses on managing components of the IT infrastructure — both physical components (such as servers, clients, and network devices) and logical components (such as applications and databases) — rather than on delivering specific services.

Because of its reactive nature and technology focus, the traditional approach to service management cannot meet the requirements of the complex, fast-moving, modern data center, and that exposes the organization to higher costs and increased risk — performance and availability risk, cost risk, and compliance risk. A new proactive operations management platform is required to support rapid change in a complex environment, while minimizing cost and risk.

MEETING THE CHALLENGE

IT must make two major transitions in its approach to data center management: It must continue to move from a reactive to a proactive approach, and it must continue to take a service-centric approach.

MANAGING BUSINESS SERVICES

The value that IT contributes to the business is gauged by IT's enablement of the business. That includes not only IT's ability to deliver the right services at the right times, but also the ability to deliver them at the service levels required.

Business users are not concerned with the underlying technology that supports the services that IT delivers. When performing a transaction, business users don't care about the performance statistics of the individual technology components that contribute to the transaction service. Rather, they are concerned only with the overall time it takes to conduct the transaction.

As a result, IT must manage service delivery from the business users' perspective. To make this happen, IT must establish, monitor, and manage service levels that are meaningful to the business. This means that IT must understand the priority of the services as determined by their relative impact on the business. In addition, IT must understand the relationships between the services and the underlying IT infrastructure components that support those services — including the service impact of events in the IT infrastructure on service availability, performance, and delivery. This is exceedingly difficult to do in the modern data center in which the IT infrastructure is in a state of continual flux as virtual and cloud resources are created, moved, and retired.

MANAGING THE DYNAMICS OF I.T. SUPPLY AND DEMAND

The infrastructure of the modern data center continually and rapidly changes to meet changing business demand. That means a huge increase in the number of events generated. The increase could overwhelm the IT staff, which is already overburdened with fielding many events.

IT needs to understand which events are due to the normal fluctuation of the modern data center as it adapts to its changing environment. These events do not require immediate action. There is a rhythm that underlies this normal change. Employees begin and end work at approximately the same times each day. Different functions, such as accounting, purchasing, and sales, are usually performed on the same days each week or month. Many industries, such as retail, energy, transportation, and healthcare, have recurring seasonal variations. These rhythms are unique to each organization. By understanding the rhythm of the business, the IT staff can manage the IT environment more intelligently and effectively. Here's an example:

In a particular company, usage on an order-processing application goes up 40 percent on the second and fourth Friday of each month. These usage spikes are normal and recurring, and the underlying IT infrastructure can handle them without degradation, so IT does not have to respond to their occurrence. By understanding that this is a normal change, IT can set a baseline indicating that all fluctuations within a certain range are normal and do not require action. That's difficult to do, however, because of the complexity of underlying IT infrastructure and usage patterns in the modern data center.

Complicating the situation is the fact that the rhythms themselves may change over time. The company introduced a new product line that placed an additional burden on the order-processing application. This causes a 60 percent increase in workload on the second and fourth Friday of each month. This 60 percent increase now represents the new normal peak for that application.

Consequently, the IT staff cannot simply set static baselines, but rather must continually adjust the baselines to accommodate changes in normalcy over time. Setting and continually adjusting baselines manually is not practical in the complex and fast-moving modern data center.

BECOMING MORE PROACTIVE

The rate of change in the modern data center is much more rapid than in the static data center. This results in dramatically reduced action windows. In addition, issues have a far more serious impact on service delivery due to the shared resource usage. Each physical server typically hosts multiple virtual servers that may be running multiple applications and delivering multiple services. Consequently, a performance slowdown or outage in a physical server can disrupt all hosted services, thus causing a significant risk to the business, including lost revenue, lower customer satisfaction, and a flurry of calls to the service desk.

Acting more proactively requires the ability to anticipate problems based on observed conditions and to take action to prevent those problems. The situation is analogous to an airline that forecasts a storm in advance, redirects affected flights (either around the storm or to alternate airports), and reschedules those still on the ground in order to minimize customer dissatisfaction and avoid unnecessary costs.

Transitioning from a reactive to a proactive approach means shifting focus from improving mean time to repair (MTTR) to improving mean time between failure (MTBF). That requires the ability to make short-term predictions based on observed conditions and to act quickly based on those predictions. Here's an example:

The performance of a service running on a virtual server is slowing because of rapidly increasing usage. An additional increase in workload will cause performance degradation beyond agreed-upon service levels. IT needs to respond quickly, such as by deploying an additional virtual server to offload some of the workload or by moving the slowing virtual server to a higher-capacity physical server.

Being proactive also requires the ability to assess the effects of actions on service delivery before actually taking any action. In planning for virtualization or cloud configurations, for example, the IT staff should be able to simulate, in advance, the optimum mix of physical and virtual servers without having to actually build and test different combinations. As another example, in planning changes, the staff should be able to simulate the impact of multiple changes on service delivery as well as on each other, which is referred to as *change collision.*

The IT staff also must be able to make long-term predictions based on trend analysis and act on those predictions to stave off future problems. Here is an example:

By analyzing usage data, IT observes a growth trend in workload on a particular application. Further analysis shows that the growth will outstrip the capacity of the physical server hosting that application in about four months. With this advance knowledge, the staff can acquire and replace the server with a higher capacity server in time to absorb the increased usage.

Proactive operations management helps IT avoid many of the real-time execution problems of reactive management. The reactive approach is inefficient, costly, and introduces risk. One industry estimate shows that reacting to a high-priority problem after the fact typically triggers an "all hands on deck" exercise that involves a crew of about 14 IT staffers. These people all have different fragmented views of the IT infrastructure and may be using different tools. What's more, the staffers often rely on their own creativity to restore service quickly. In doing so, they may take out-of-band actions that are not in compliance with internal policies or external regulations. Such actions may result in unauthorized changes being made, changes being made by unauthorized personnel, and changes not being tracked for auditing purposes. Other industry experts have indicated that 40 percent of outages are caused by poorly configured changes, which often introduce more problems. By moving from a reactive to a proactive approach, IT can act more effectively, more efficiently, and in a compliant manner. The result is significantly improved service availability and performance at reduced cost and risk to the business.

BSM BRINGS THE MODERN DATA CENTER UNDER CONTROL

BSM provides an approach that enables IT to meet the challenge of service management in the modern data center. It supports a proactive and service-centric approach that is based on an understanding of the rhythm of the business. It accomplishes this through a prescriptive and incremental approach in four areas that are critical to successful Proactive Operations Management:

» Proactive availability and performance management
» Capacity optimization
» Configuration automation
» Operational support analytics

PROACTIVE AVAILABILITY AND PERFORMANCE MANAGEMENT

BSM permits a proactive availability and performance management approach that enables IT to avoid outages and maximize both uptime and efficiency. This approach includes the following:

» Predictive service impact analysis
» Predictive root-cause analysis
» Efficient problem isolation
» Virtualization and cloud-ready event management
» Preventive automation

Through comprehensive instrumentation of the IT infrastructure and applications, BSM provides early warning of issues that could disrupt services if not addressed immediately. This early-warning system is based on a real-time predictive analytics engine that does not simply flood the operations center with events. Instead, it takes into account the rhythm of the business, identifying system abnormalities and generating events only when system behavior falls outside normal operating ranges. It learns what is normal and automatically sets baselines accordingly.

In addition, BSM solutions automatically adapt to changes in normal behavior and reset baselines accordingly, continually tuning to the rhythm of the business. Consider the earlier example of the normal peak load on a server increasing from 40 to 60 percent due to the introduction of a new product line. The early warning system would automatically adapt to the new normal peak load of 60 percent.

The real-time predictive root cause and service impact analytics automatically analyze abnormalities and events to isolate the most likely cause(s) of a problem. By combining the early-warning system with both root cause and service impact analytics, IT operations gain early visibility into potential performance issues, with immediate knowledge of the impact on business services and the root cause of the problem, to include recent configuration changes within the IT environment. To accelerate problem isolation and avoid problem recreation, deep diagnostics are collected continuously for inclusion in root cause analysis.

The early warning system drives preventive automation that proactively processes events, enabling IT to address problems before they result in service degradation. Here's an example:

The proactive event management solution receives notification of a condition in a virtual server that could result in service dropping below agreed-upon levels. It automatically generates an intelligent incident ticket, notifying the service desk before users become aware of the problem. The ticket indicates the services affected and their business priorities, permitting the service desk to prioritize the response based on business impact. The ticket also includes the likely component causing the problem, enabling the service desk to assign the problem to the right resource for detailed analysis and repair. This wealth of information permits efficient problem triage and speeds diagnosis and resolution. In addition, based on service-to-user mapping information maintained in the CMDB, the service desk notifies affected users of the incident.

Because BSM treats virtualization and cloud computing as natural extensions to IT operations, virtual and cloud resources are managed with the same rigor and discipline as physical resources. By managing availability and performance across all enterprise resources, IT operations can maintain better control to ensure service levels are met.

CAPACITY OPTIMIZATION

The primary reasons for moving to the modern data center are multifold and include the following:

» Maximizing service performance
» Optimizing utilization of data center resource capacity
» Enabling IT to rapidly respond to changing business demands
» Eliminating server sprawl and all its related problems

Most IT organizations are approaching resource optimization in two steps. First, they consolidate workloads on existing physical servers. Then they virtualize certain workloads — or move them to the cloud — for further consolidation and increased agility.

The challenge is first to determine which workloads to put on which physical servers, then to determine which workloads to move to the cloud or virtualize, and finally to determine the optimal mix of cloud, virtual, and physical servers. Because of the daunting number of cloud/virtual/physical combinations possible, it is impractical to build and test each combination to determine the optimal mix.

Planning for the cloud, virtualization, and consolidation is not the only challenge. Once cloud or virtualization is implemented, IT has to minimize business risk by ensuring that service availability and performance continue to meet agreed-upon levels. BSM provides a solution for both planning and managing the consolidated, virtualized, and hybrid cloud data center.

BSM provides sophisticated analysis capabilities that permit IT to perform "what-if" analyses on various mixes of workloads on physical servers, and also of various mixes of virtual servers and physical servers. Consequently, IT can "test drive" various combinations in a simulation environment to determine the optimal combination. In addition, BSM also enables IT to manage the combined physical/virtual/cloud environment with a single, unified service management system. With BSM, IT can move into virtualization and cloud computing incrementally and with confidence, taking maximum advantage of in-place IT resources.

BSM also enables IT to continuously optimize IT infrastructure utilization and costs, allocating infrastructure capacity from a service perspective rather than a device perspective. Process automation, such as automatic provisioning, combined with dynamic baselining enables the BSM solutions to dynamically adapt IT infrastructure capacity to meet changing business conditions. As a result, IT organizations can maintain service quality in the face of continual change. In addition, IT can analyze workload patterns to identify trends and ensure that the right capacity is available in the future, when and where it is needed to accommodate growth.

With cloud and virtualization, it's increasingly important to include capacity planning in the day-to-day operation of the data center, so that IT can maintain optimum capacity utilization due to continuous change in the business environment. BSM solutions are available that monitor aggregate resource consumption data, down to the process level. These solutions collect data across all on-premise and off-premise IT resources, to include servers, networks, storage, applications, and facilities. With this information, the IT staff can quickly focus on the root causes of performance problems related to capacity. The staff can also identify processes that are consuming far more than their share of capacity, as well as find capacity that is no longer being used. In addition, with BSM data and analytics capabilities, IT can monitor consumption patterns to identify trends and determine where, when, and how much additional capacity will be needed in the future to accommodate growth.

CONFIGURATION AUTOMATION

The key to the modern data center is its ability to adapt rapidly to changes in the environment. In a complex and dynamic environment, maintaining configuration control is difficult but necessary to minimize risk.

The traditional approach, which uses a patchwork of data sources and tools and includes manual procedures, does not scale up to the volume and speed of change in the modern data center. This approach cannot handle the many changes involved in the required timeframes and often results in gaps in the span of control. These gaps may allow out-of-band processes to slip through, and that introduces the risk of costly downtime and loss of compliance.

Effective control of the complex modern data center requires automation, much like pilots require automation to help them maintain control of today's highly complex and fast-moving jetliners. BSM provides the needed control by automating end-to-end change processes. Automation is policy-based and subjects all changes to best-practice change, configuration, and release

management processes. Consequently, IT can maintain the necessary control to ensure continuous compliance without slowing down the speed at which the IT infrastructure can adapt.

BSM solutions apply exactly the right level of control to each change to ensure compliance with internal policies and external regulations, without overburdening the IT staff with unnecessary overhead. Here's an example:

The configuration management team receives an automatically generated change request to add a virtual server to supplement one that is approaching its capacity threshold. The automated process sees that this type of request has been pre-approved. It triggers the configuration and release management system to create and provision a new virtual server. The configuration and release management solution creates a new virtual server with a standard configuration stack (including configured performance monitoring), deploys the server, validates its successful deployment, and closes the change request. The process automatically tracks and logs all appropriate activities for auditing purposes.

Configuration automation solutions also automate the distribution of software updates and patches to servers, clients, applications, and network devices. They distribute the updates and patches, verify successful installation on all impacted devices, and report the results — performing all actions in a manner that is compliant with internal policies and external regulations. With configuration automation, all changes conform to internal policies and external regulations, so IT can manage more changes in less time while still maintaining continuous compliance.

Another important aspect of configuration automation within proactive IT operations is the ability to automatically feed change information into your performance management solution to provide knowledge of changes that may affect performance. Awareness of recent system changes can speed the time it takes to determine the impact changes may have on system performance and normal patterns of behavior.

OPERATIONAL SUPPORT ANALYTICS

To realize the full potential of the modern data center (improved service availability, performance, and delivery; reduced capital and operational costs; and minimized risk), it's important that IT management be able to do the following:

» Optimize asset and vendor spend
» Execute change with confidence
» Meet or exceed service quality commitments and continually improve service
» Maintain continuous compliance with software licenses, internal policies, and external regulations

Key to meeting these requirements is the ability to make accurate and informed decisions, and that means IT management must have ready access to comprehensive and accurate information. For example, change managers need a unified view of IT infrastructure components, their configurations, and their relationships to services. Change managers also need insight into the business impact of change and the effects of changes on each other. Compliance managers need information on compliance status and remediation.

Therefore, a comprehensive view should encompass all physical, virtual, and cloud resources, the business priorities of those services, and their service level targets. It also should maintain these views in near real-time, tracking dynamic changes as they occur. In addition, this same information must be actionable and presented in a way that is meaningful to managers. Managers also need analytic tools that enable them to distill the information into knowledge and quickly and easily drill down into top-level information when they need more detailed data.

In addition to operational data, BSM solutions maintain a wealth of decision support information integrated through a single source of truth: the configuration management database (CMDB). The solutions leverage the information to support decision-making. They deliver information through easy-to-read and meaningful dashboards and reports that provide an at-a-glance view of service quality across the enterprise. The solutions also provide an operations portal with cross-discipline key performance indicators (KPIs).

To the maximum extent possible, information in the CMDB must be automatically discovered and maintained in real-time. By combining an automated, periodic discovery capability with the ability to trigger real-time updates with configuration change events, the CMDB keeps itself continuously updated on changes in the IT infrastructure. This is especially important in the modern data center where changes are occurring rapidly.

In addition, BSM solutions provide needed analytics and tools for gleaning knowledge from the vast amounts of data available. These include analytics and tools for the following:

» Service impact analysis
» Change impact simulation
» Trend analysis
» "What-if" analysis to support cloud, virtualization, and data center consolidation planning and continuous capacity optimization

REAL-WORLD EXAMPLES

Many organizations are already transforming their data centers into modern data centers and enjoying the resulting benefits. Following are three examples.

GLOBAL MANAGED SERVICE PROVIDER

With thousands of servers worldwide, a global managed service provider uses proactive availability and performance management solutions for remote monitoring and management for its clients. The solutions provide rapid, low-cost deployment of new services. For example, transitioning clients to the company's monitoring service is fast, easy, and low risk due to automated provisioning and dynamic baselining. As a result, the company keeps both transition and ongoing administration costs low. It is also able to cut costs by allocating fewer, less-skilled support staff due to automated root cause analysis capabilities. Most important, it is able to differentiate its services by leveraging predictive analytics to become more proactive in managing and delivering new, improved services to its clients.

GLOBAL CONSUMER PRODUCTS COMPANY

With more than 50,000 employees worldwide and operations in more than 35 countries, a global consumer products company uses capacity management solutions to maintain the optimal use of capacity in its data centers. The IT staff leverages the detailed consumption data aggregated by the solutions to diagnose capacity-related application slowdowns. It also uses the consumption data to weed out malfunctions that consume capacity unnecessarily. In addition, the IT staff is using BSM analytics capabilities to plan the virtualization of the company's physical servers.

The results are compelling. The company achieved the following:

» Identified how to reduce consumption of CPUs on servers in its VMware farm that were running malfunctioning processes. IT is now reclaiming much of that capacity.
» Determined that it could virtualize 43 percent of the first 500 physical servers that it analyzed. At a cost of nearly $4,000 per physical server, that's a savings of about $850,000. By maintaining that same virtualization ratio (or better) across the remaining physical servers, the staff estimates a savings of about $3.8 million over 18 months.

BMC SOFTWARE

BMC's IT organization achieved significant benefits from virtualization, such as reducing costs through improved asset allocation. The company's initiative focused on employing state-of-the-art service request management, hardware virtualization, and system monitoring technologies to manage server and storage assets on a pooled basis. This approach created an in-house, on-demand, cloud computing environment that provided the BMC Research and Development (R&D) team with just-in-time access to the data center resources required to conduct product development projects.

With BSM solutions from BMC, the IT organization subsequently reduced the number of physical servers by almost 50 percent over two years. In addition, IT exceeded its productivity goal by managing everything in the infrastructure — spread across multiple geographies — as a single data center.

In 2008, reusing servers saved more than $5 million and reduced power consumption and floor space requirements by 20 percent. The financial payback of this investment in virtualization — approximately $2 million — was achieved in fewer than six months.

In addition, BMC's IT organization significantly improved its ability to meet service level agreements (SLAs) for making assets available for routine development requests. As a result, response times for the development environments became faster and more predictable.[1]

CONCLUSION

Innovative technologies such as cloud computing, virtualization, and automation have opened up a whole new model for the data center — the modern data center. By transitioning to the modern data center, IT organizations can deliver the right services to the right places at the right times in a rapidly changing business environment.

Like any technological innovation, however, the modern data center brings with it a management challenge. IT is faced with the challenge of ensuring service quality and maintaining continuous compliance in a much more complex and dynamic environment.

By enabling proactive operations, BSM and its supporting technologies help IT meet the challenge. With BSM, IT can realize the promise of the modern data center to achieve a previously unattainable level of value contribution to the business. At the same time, IT can reduce capital expenditures and lower operating costs. And that's not all. Implementing BSM now positions the organization to manage a seamless transition from enterprise to cloud computing.

For more information about BMC solutions for the modern data center, visit **www.bmc.com/proactiveoperations**.

ENDNOTES

1 Mark Settle, "Uncover the Benefits of Virtualization," BMC Software, 2009.

Business Runs on IT. IT Runs on BMC Software.

Business thrives when IT runs smarter, faster, and stronger. That's why the most demanding IT organizations in the world rely on BMC Software across distributed, mainframe, virtual, and cloud environments. Recognized as the leader in Business Service Management, BMC offers a comprehensive approach and unified platform that helps IT organizations cut cost, reduce risk, and drive business profit. For the four fiscal quarters ended September 30, 2010, BMC revenue was approximately $1.96 billion.

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