

Virtualization: Planning the Full IT Lifecycle

An ENTERPRISE MANAGEMENT ASSOCIATES® (EMA™) White Paper
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Executive Summary

Some forms of virtualization in the IT environment have been in use for decades. However, in recent years, the number and type of virtualization technologies have greatly expanded and entered the mainstream. Virtualization in the IT environment can be applied to servers, storage, networks, applications, and other IT assets. Fundamentally, virtualization hides the physical characteristics of IT infrastructure resources from the way in which other systems, applications, or end users interact with those resources.

Virtualization produces many benefits for business and IT, including cost reduction, improved ROI, increased agility and responsiveness, reduced downtime, and even faster software development cycles. However, virtualization also creates some new challenges. Discovery, monitoring, problem resolution, change management, and other IT management processes are all impacted by virtualization. These processes and their supporting tools must be adapted to properly understand and control virtualized environments.

IT organizations need to have greater control of virtualization to overcome these challenges, and Business Service Management (BSM) is the way to gain that control. BSM is an IT management approach that IT organizations can use to establish infrastructure control and business alignment, especially in dynamic, virtualized environments. By creating a controlled environment with BSM, virtualization can be approached strategically and systematically rather than as a series of ad hoc projects.

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BSM helps IT organizations move from technology-focused IT management to end-to-end service management. IT services, built on both physical and virtual infrastructure, become the consumable units of value offered by IT in support of business performance. With the right vendor, a BSM solution addresses the management of the full service lifecycle and provides integrated tools that work across a broad range of virtualization technologies, on heterogeneous platforms, and from a variety of vendors.

Introduction

With widespread and growing adoption of x86-based servers in recent years, server virtualization has become the most commonly known form of virtualization. Enterprise Management Associates (EMA) defines server virtualization (also known as hardware emulation or as native, platform, system, or “Type 1” virtualization) as essentially a method of running multiple operating environments (Windows, Linux, UNIX, etc.) directly on top of a single bare hardware system. Fine-grained compute resources (CPU, memory, etc.) are shared, allowing multiple operating systems to run at the same time using only a single physical server. Operating system virtualization is similar, but runs the multiple operating environments (or “guests”) on top of a fully functioning base (or “host”) operating system, instead of directly on the bare hardware.

In contrast to the typical server and OS virtualization approach of dividing a shareable resource into several distinct components, virtualization can also be used to aggregate a number of physical resources into a single virtual resource. For example, in a grid computing environment, applications are able to simultaneously utilize the computing

resources of many different servers within the grid, while still viewing the grid as a single, albeit more powerful, server. In the case of a storage area network, many storage devices are aggregated, yet presented to servers and applications as a single, larger storage environment. Networks themselves are implicitly virtualized, as many connected resources share them to send information between several locations at the same time. Virtual LAN (VLAN) and virtual private network (VPN) environments make network virtualization explicit by essentially providing separate secured pathways within an existing network.

With all its advantages and potential returns, virtualization creates additional challenges by adding management complexity to already challenging IT environments.

Some of these forms of virtualization have emerged in recent years. However, the concept of virtualization has been around since the 1960s in mainframe and midrange system environments. The increased attention on virtualization comes in part from availability of viable technology for commodity x86-based servers and PCs. EMA research shows that up to 95% of all organizations are deploying virtualization. With a 20% growth rate, server virtualization is on the leading edge of these plans, but other forms of virtualization are just beginning to see demand increase. This widespread adoption started in test and development, but it has grown strongly in production environments as well. EMA research shows that while 79% of enterprises that have deployed virtualization use it for test and development, 74% of all enterprises with virtualization use it to support production applications.

In the end, virtualization is adopted not because it is exciting technology but for the tangible benefits it delivers. IT organizations cite a plenitude of results, including:

- Significant cost savings through reduced hardware spending
- Further cost savings through decreased power and cooling costs
- Reduced TCO via greater utilization of existing servers
- Quick rollout of new services and applications
- Increased responsiveness to changing business needs
- Reduced downtime and improved business continuity
- Faster software development

With all its advantages and potential returns, virtualization creates additional challenges by adding management complexity to already challenging IT environments. While virtualization can easily conceal underlying hardware differences, it actually exposes differences in management requirements. Consider the impact of rebooting a physical server that is running several virtual machines or of estimating needed server capacity that is shared across multiple operating system and application stacks. Each management process – including incident, problem, capacity, performance, availability, and service level management, as well as health monitoring, cost accounting, and financial management – may be impacted. The related management challenges often prevent virtualization from being fully adopted, optimally deployed, or approached strategically. Yet, those that can tame virtualization will reap the rewards.

Mastering Virtualization through BSM

Virtualization is here, it is real, and it must be embraced by IT organizations that wish to remain competitive. However, EMA research shows that the complexity of most virtualization deployments, and the significant skill and human issues created by virtualization, means that effective virtualization management is among the most critical elements for a successful virtualization strategy. To succeed, IT organizations must maintain control over their environments and ensure they are aligned with business objectives. With a BSM approach, IT organizations can gain that infrastructure control and business alignment, especially in dynamic, virtualized environments. Then, based on a controlled environment, virtualization can be approached strategically and systematically rather than as a series of ad hoc projects.

Business Service Management

EMA views BSM as a strategy to align IT and business goals by helping business managers understand how the performance, cost, and availability of IT resources affect and power their businesses. BSM joins the goals of IT and business, providing capabilities such as real-time monitoring of business service health and status, using tools designed to help organizations meet their corporate objectives and business goals. However, BSM is not just a toolset that can be purchased, but rather an approach to managing IT within the business framework. BSM itself is a combination of processes, best practices, multiple layers of management technologies, and a top layer that presents the status and results of business service quality to IT and non-IT executives.

Traditional approaches to IT management have focused on technology domains such as server, network, storage, and application. Since each of these domains requires in-depth knowledge and training, some level of technology specialization within IT is appropriate and also helpful. For instance, a server administrator does not generally have the expertise required of a network engineer to design comprehensive firewall rules that ensure secure network access. In fact, IT operations departments typically structure their organizations around the same domains. This helps them achieve desired levels of focus and economies of scale when addressing each fundamental type of technology. Even the management tools used by these teams are specific to their technologies.

Virtualization fosters an even greater need for improved management strategies, IT processes, and tools.

BSM takes a different but compatible approach to IT management. It acknowledges the existence and need for technology specialization, yet focuses on an end-to-end service view rather than technology domains. With BSM, the unit of value delivered by IT to the business is the IT service that, in turn, is comprised of infrastructure components such as applications, databases, hard drives, and servers. In this way, IT hides the technical complexities of the infrastructure, and end users receive and consume services that are designed to directly support business needs.

A simple example of an IT service is the e-mail service. When taking a BSM approach to an e-mail service, the IT organization looks at the e-mail service health from end to end. Rather than just looking at the infrastructure components of the service, the overall health and performance of e-mail are monitored and maintained. Rather than optimizing

CPU utilization for the e-mail server or disk space usage for e-mail folders, the collective goal of the IT teams is to ensure appropriate cost and quality of the entire e-mail service. This involves using interdependent IT processes such as incident, problem, and change management to address the complete lifecycle of IT services.

In order to raise the focus of IT management to end-to-end services and deliver those services in support of business needs, even without virtualization, there is clearly a need for BSM. However, virtualization fosters an even greater need for improved management strategies, IT processes, and tools. Adopting BSM for virtualized environments helps make virtualization operationally ready.

Approaching Virtualization Strategically

In order to get the most out of virtualization, IT organizations must approach it strategically. This means going beyond deploying virtualization in test and development environments and beyond isolated virtualization projects. It means reaching an optimal mix of physical and virtual resources, rather than a mix that is arrived at by accident or default. As a set of technologies that can impact nearly every aspect of IT, virtualization requires a strategic, holistic, big picture view.

If you are moving virtualization into a production environment, you are not alone. Adoption of virtualization is increasing rapidly and moving more to production environments. EMA research shows that deployments for production use cases – including production application servers, database servers, middleware, and more – are increasing.

Currently, between 25% and 74% of virtualization deployments are in support of such production systems. EMA believes virtualization is fast approaching the tipping point where deployment in production environments outstrips deployment in test and development environments. IT organizations are already going well beyond file and print servers to critical application servers and I/O intensive database servers in their production deployment. These uses of virtualization are indeed production ready; however, manageability of critical production resources is far more impactful than in test and development environments.

EMA research has also found that IT organizations are moving beyond single technology deployments of virtualization.

EMA research has also found that IT organizations are moving beyond single technology deployments of virtualization. When asked which server virtualization products they are planning to implement, over 80% of respondents indicated they were deploying or planning to deploy VMware ESX or VMware Server, but many were simultaneously planning to deploy other server virtualization products as well, such as Microsoft's Hyper-V and Citrix XenServer. Indeed, leading IT organizations work to deploy an optimal mix of virtualization for their particular needs. Yet many IT organizations don't go far enough and fail to realize the benefits of strategic virtualization. A well-planned and executed virtualization strategy provides greater economy of scale for training and does not require separate management of physical and virtual resources.

Starting with a focused virtualization project is certainly acceptable. IT groups may achieve some quick wins and gain experience for more complex and rewarding projects down the line. But ultimately, IT needs to look at virtualization holistically and take a long-term view. After all, the "Wild West cowboy" approach may work with limited deployments, but it will fail miserably if applied to complex, business-critical production environments.

A Closer Look at Virtualization Challenges

Rather than working to ensure appropriate levels of server capacity utilization, IT organizations have tended to purchase additional servers. As server prices declined over many years, it appeared less expensive and less risky to simply purchase more servers and perhaps over-provision a bit. However, it was eventually realized that the indirect costs – management, power, cooling, data center floor space, maintenance, and support – could easily exceed initial server purchase prices. This leads to what is commonly referred to as “server sprawl,” and also to follow-on server consolidation projects to reduce that sprawl.

A key component for implementing server consolidation is virtualization. In server consolidation, fewer, yet more powerful, servers running multiple guest systems through virtualization replace the multitude of commodity servers. While this resolves many of the issues caused by server sprawl – by reducing power, cooling, floor space, and hardware maintenance costs – it actually adds complexity to IT management. Yet once again, IT teams are tempted to simply deploy more virtual servers, which can lead to a related form of sprawl, virtual server sprawl. IT groups need appropriate processes to avoid this potential side effect, as well as to manage the additional complexity of virtual environments.

At the same time, existing IT management processes themselves are impacted by virtualization. Here are some of the IT processes and their related challenges:

- Service monitoring – harder to accurately detect and measure because virtual resources are so rapidly deployed, consumed, and destroyed
- Incident and problem management – relationships between physical and virtual components not always understood, making root cause analysis slower and more complex
- Capacity, performance, and availability management – requires performance metrics that account for the differences in physical versus virtual environments and resource constraints due to resource sharing
- Cost accounting and financial management – inconsistent software vendor licensing schemes in virtual environments obscure license management and compliance; virtual system usage harder to measure, making chargeback more difficult

In addition to management processes, IT management tools are also impacted by virtualization. In many cases, tools must be updated with significant enhancements to handle the differences in virtual technologies. All components in the IT infrastructure need to be managed. For virtualized environments, this means managing across multiple layers of virtualization complexity, including three areas of complexity that EMA has identified as being most problematic:

- Platforms – Windows, UNIX, Linux, z/OS, etc.
- Technologies – OS, server, storage, network, grid/cluster, etc.
- Vendors – VMware, Xen, Sun, IBM, etc.

IT organizations need to select integrated BSM tools that cover the full service lifecycle, from planning to deployment to ongoing management.

EMA has found that 98% of enterprises implementing virtualization do so using multiple platforms, multiple technologies, and multiple vendors. In order to manage services from end to end, management tools are required to address each of these multiple layers of complexity.

BSM Provides a Solution

BSM addresses IT management holistically and provides a controlled IT environment so virtualization can be approached strategically. Unfortunately, rather than adopting the comprehensive approach to IT management offered by BSM, some organizations purchase a single “virtualization management” tool that turns out to address only a thin slice of the problem. For example, by purchasing virtual-aware monitoring software, IT gains insight into where virtual machines are deployed and how they are performing. However, this does not address many of the other steps in the service management lifecycle, including controlled deployment, change control, and problem resolution.

Instead, IT organizations need to select integrated BSM tools that cover the full service lifecycle, from planning to deployment to ongoing management. Those tools must be virtual-aware and, collectively, capable of addressing all layers of heterogeneity – platforms, technologies, and vendors. For additional clarity, consider the BSM approach to turning up and managing a new virtualized business service for order management in this example:

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Planning

- Through automated discovery, gain an understanding of existing infrastructure, including virtual components and their dependencies. The relevant findings include an IBM mainframe with direct connectivity to SAN environment and several available x86 quad-core servers, all connected over VLAN.
- Based on service level requirements, including capacity and performance, determine physical server, hypervisor, and guest machine requirements. Be sure to understand and adjust for the constraints imposed through resource sharing on x86 and mainframe servers.
- Utilize planning and portfolio management tools to determine costs, understand unique license management and compliance aspects of virtualization, and seek approval for new service rollout.

Service Delivery

- Configure new partition on mainframe running zLinux, establish access to SAN storage, deploy and configure Oracle DB.
- Deploy ESX server image and patches to two of the x86-servers.
- On one of the x86-servers, create a guest virtual machine and install Windows operating system and patches. Configure appropriate VLAN membership. Install and configure the order management application software. Create an identical virtual server (virtual machine and software stack) on the x86-server by cloning the first virtual server.

- Clone two more virtual servers on the other x86-server. Configure individual identities for each of the four virtual servers via names and IP addresses.
- Adjust network access and security settings. Configure load balancers to distribute load across the four virtual servers.

Tight Integration between Service Delivery and Service Support

- Initiate discovery process to capture new components and dependencies and update CMDB.
- Notify operational management tools to begin monitoring the service and infrastructure components.
- Enable requests for access to the new order management service via service catalog.

Service Support

- Utilize virtual-aware, CMDB-integrated tools for monitoring service levels. Continuously monitor and measure performance and availability because of the dynamic nature of service usage and impact on virtual components. Capture IT metrics and translate to business metrics. Report on service levels and business performance indicators.
- Initiate incident through service desk if unexpected service levels or trends are encountered. Service desk understands end-to-end service view, existence of virtual servers, and their dependencies on the physical infrastructure.
- Integrate service desk with change control to ensure any proposed fixes are reviewed, approved, and implemented correctly. Service desk and change control systems are aware of dependencies and impacts via CMDB. Related tools update CMDB after changes.
- Based on ongoing service performance and dynamic service demand, optimize infrastructure configuration to most appropriately balance business requirements and cost. If needed, application or service management teams may provision an additional virtual server.

By focusing on end-to-end services, BSM is able to map the virtualized infrastructure to services, and then manage and automate those services to ensure they meet the needs of the business. Driven by IT and business alignment, robust BSM implementations address management of the full IT service lifecycle. Virtual machines are provisioned to support services and approved as part of the new service approval process. Updates or changes to the IT environment – including the virtualized environment – flow through the same change review and approval processes. With BSM, the same processes manage both the physical and virtual infrastructure. And with proper vendor selection, the same data repositories and tools are also used to manage both of these environments.

BMC Software's Approach

BMC provides BSM solutions to help organizations manage IT services and technology, both physical and virtual. Many of the company's industry-leading BSM solutions have been extended with specific capabilities designed to understand, manage, and control virtual environments. Based on proven technology built for physical environments, these are integrated, enterprise-wide solutions for best-practice operations management of virtualized environments.

BMC solutions control the full lifecycle of virtualized enterprise IT infrastructure and services – from planning to deployment to ongoing management, across a broad range of virtual and physical technologies, platforms, and vendors.

BMC solutions control the full lifecycle of virtualized enterprise IT infrastructure and services – from planning to deployment to ongoing management, across a broad range of virtual and physical technologies, platforms, and vendors. With BMC Virtualization Management Solutions, IT gains control and reduces risk in order to confidently virtualize production environments in addition to development and test labs. By ensuring physical and virtual infrastructure is operationally ready, IT organizations can exploit virtualization to quickly roll out new services and respond quickly to changing business needs.

BMC solutions also help organizations understand and plan around the performance impact of virtualization. Rather than expensive trial and error during pre-production testing – or worse, in production deployment – BMC offers capabilities that are used before implementing virtualization projects. These capabilities can also be applied to existing physical environments in order to plan for optimal server consolidation.

By managing end-user performance for applications running on virtual infrastructure, BMC solutions enable IT organizations to anticipate capacity issues and respond to them before anyone notices.

BMC solutions look beyond planning, deployment, and ongoing management to promoting Green IT. Through optimal resource utilization, energy use from power and cooling is greatly reduced. By improving server utilization, fewer servers need to be purchased and ultimately disposed. Ultimately, Green IT supports lean IT, which means cost reduction, not only through reduced energy and server purchase costs but also through reduced maintenance, support, and real estate costs.

EMA Perspective

To gain the full benefits of virtualization, IT organizations must approach it strategically. Approaching management of virtualized environments through BSM not only helps take the risk out of virtualization, it enables the full service lifecycle to be addressed. BMC has a leading BSM portfolio that broadly and deeply covers the IT management needs of the most complex IT environments in the world. It has also been tuned to support the specific and challenging requirements of virtualized environments.

Virtualization must also be addressed broadly across the multiple layers of complexity. BMC has a well-earned reputation for openness across not only the IT infrastructure but with other management solutions as well. It was also early to understand and embrace the need to support an array of virtualization technologies from many vendors and across many platforms.

Virtualization is ready for production use, and IT organizations want and need to deliver the same quality of service for virtual and physical environments. They also want to work within the same processes and use the same tools. BMC's solutions have been designed with exactly these needs in mind. IT organizations depend on this combined and integrated approach to comprehensively manage end-to-end services.

BMC solutions enable IT organizations to move beyond the fear of deploying virtualization in business-critical production environments. They provide the tools and automation required to rapidly deploy virtual server infrastructure in response to changing business requirements. These solutions help IT organizations master virtualization so they can begin to reap the rewards. With BMC, lean and Green IT can be achieved by designing and implementing an environmentally efficient infrastructure using the least amount of resources. This leads to reduction in capital expenditures as well as expense reduction from lower energy and maintenance costs.

BMC's broad portfolio and extensive capabilities for virtual environments enable IT organizations to build end-to-end management solutions and approach virtualization strategically. As a leader in BSM, BMC solutions should serve well as the core of most any IT organization's virtualization strategy.

About BMC Software

BMC Software is a leading global provider of enterprise management solutions that empower companies to automate their IT and align it to the needs of the business. Delivering Business Service Management, BMC solutions span enterprise systems, applications, databases and service management. For the four fiscal quarters ended March 31, 2007, BMC revenue was approximately \$1.58 billion. For more information, visit www.bmc.com

About Enterprise Management Associates, Inc.

Founded in 1996, Enterprise Management Associates (EMA) is a leading industry analyst and consulting firm dedicated to the IT management market. The firm provides IT vendors and enterprise IT professionals with objective insight into the real-world business value of long-established and emerging technologies, ranging from security, storage and IT Service Management (ITSM) to the Configuration Management Database (CMDB), virtualization and service-oriented architecture (SOA). Even with its rapid growth, EMA has never lost sight of the client, and continues to offer personalized support and convenient access to its analysts. For more information on the firm's extensive library of IT management research, free online IT Management Solutions Center and IT consulting offerings, visit www.enterprisemanagement.com.

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