A New Approach to Managing the Challenges of Highly Virtualized and Cloud Environments
Executive Summary

To effectively deliver IT services within today’s highly virtualized and cloud environments, businesses must transform classic disciplines of operations management. What’s needed is an approach that simplifies management by embedding and integrating management capabilities into the virtualization and cloud platforms themselves.

In the cloud era, intelligent virtual infrastructure provides the foundation for faster, more agile and more efficient delivery of IT services and business applications. However, within virtual and cloud environments, the boundaries between operations and infrastructure management have blurred. As a result, managing these new environments using tools designed for physical environments creates operational and business problems—blocking the path to flexible, service-oriented cloud infrastructure.

This paper explores the need for a new management approach to meet the challenges that infrastructure and operations management teams face most often in today’s dynamic IT environments, such as:

- Performance and availability issues
- Capacity management and optimization
- Configuration and compliance issues
- Workload mobility and rapid changes in demand

This document provides an overview of the VMware approach to enterprise management. It also outlines the capabilities of VMware vCenter™ Operations Management™ Suite (“vCenter Operations”), a management solution that exemplifies the new cloud management approach by offering: comprehensive visibility, proactive management and intelligent automation for effective troubleshooting, root-cause isolation, and remediation of even the most complex scenarios.

As virtual environments continue to grow,
converge, evolve toward self-service private clouds and merge with public clouds, you need new capabilities to anticipate and overcome the challenges of the next stage of your virtualization journey.
Virtual and cloud infrastructure differ from the traditional physical architectures that preceded them in important ways. Traditional, siloed environments are built on tightly coupled applications and infrastructure dedicated to certain components and application tiers. The resulting rigid vertical stack offers limited flexibility and agility, and requires a complex stack of tools and equally complex set of processes to manage it.

In contrast, highly virtualized and cloud environments are characterized by abstracted resources, shared capacity and fluid configurations. Tools and processes designed for traditional architectures have difficulty managing this highly dynamic, constantly changing and interdependent environment. Virtual and cloud computing requires organizations to embrace a new management approach—one that is as agile, flexible and dynamic as their new IT infrastructure.

By converging and integrating the disciplines of performance, capacity and configuration management into a consolidated, context-sensitive, virtualization-aware solution, vCenter Operations offers IT a tool designed to take on today’s enterprise management challenges.
Chapter 1

The Need for a New Approach to Operations Management

Using yesterday’s solutions on today’s operations management challenges leads to costly and time-consuming business impacts across the entire organization.

Organizations that manage virtual and cloud environments using physical infrastructure practices and tools cannot deliver the cost efficiency or the quality of service and business agility their business customers expect. In fact, the organizational and business ramifications can be wide ranging and failure to transform your management approach impacts people across the entire organization.

Virtual and cloud environments have remapped the way infrastructure is organized. The boundaries separating operations and infrastructure management are less distinct as workloads no longer operate independently, but instead move within and between private datacenters and the public cloud.

Rebalancing and reconfiguration, autoscaling, and workload movement across pools of resources also occurs much more quickly in virtual environments than in physical environments.

For IT, both virtualization awareness and situational awareness are essential for quick problem resolution. Without it, administrators are forced to depend on rules of thumb, “tribal knowledge” and best guesses when hunting down issues, especially when it comes to configuration changes that can cause contention far from the problem’s source.

Another day-to-day challenge that crystallizes the inability of yesterday’s systems to successfully manage today’s virtual and cloud environments is false alerts from overly conservative thresholds or
“high normal” conditions.

Traditional static thresholds can’t adapt to rapid change in dynamic environments where workloads and infrastructure are interdependent. The resulting false alerts consume administrators’ time and focus with firefighting and manual attempts to set and reset threshold levels, reducing operational efficiency. False alarms also encourage resource over-commitment to accommodate high normal conditions, undermining virtualization’s cost-effectiveness. The net impact is wasted IT labor and budget.

These IT inefficiencies do not exist in a vacuum; in fact they ripple throughout the entire organization. Management becomes slow and costly because people and processes at the operational or administrator level can’t work at the speed and volume of events. The management of these legacy systems interferes with the resource optimization needed to meet budgets and service-level requirements set by IT managers or directors. At the business/CIO level, operations management issues show up as failures to maintain promised service levels and deliver economies expected from virtualization.

To alleviate negative business impact and drive IT efficiency, today’s virtual infrastructure requires a new, simplified approach to the traditional disciplines of operations management as well as the processes and the tools that support them.
Chapter 2

The VMware Approach to Simplifying Enterprise Management

VMware takes a comprehensive approach to simplifying virtual and cloud infrastructure complexity, based on embedded, integrated and converged management, as well as running IT like a business.

As the complexity of IT environments increases, so does the need for greater simplicity when it comes to managing them. VMware simplifies management by eliminating as many tasks as possible through automation, so that your IT staff and resources can be freed up to focus on activities with greater business impact.

VMware’s approach to enterprise management is based on three pillars:

• Embedded, integrated management
• Converged management
• Run IT like a business

Embedded, Integrated Management

Performance issues can originate from any component, virtual machine (“VM”), physical host or cluster. What’s more, the rate of change of workloads has outstripped the capabilities of traditional management approaches.

This requires management capabilities be deeply embedded into – and tightly integrated with – the virtualization and cloud platforms themselves.

VMware eliminates management wherever possible by embedding it into the VMware vSphere® platform – in effect, turning management into manageability. Examples of this include High Availability, Distributed Resource Scheduling,
Integrated management solutions leverage deep insight into virtualization to deliver solutions for security (VMware vShield™), business continuity (VMware vCenter™ Site Recovery Manager™) and automated operations (VMware vCenter Operations Management Suite).

Converged Management
Workload interdependence in virtual and cloud environments stymies the ability of specialized teams to address performance, capacity and configuration issues in isolation. Highly virtualized and cloud environments require integration of management disciplines and metrics for a holistic view of the health of virtual and physical infrastructures, and the tools to maintain it.

In operations, the disciplines of performance, capacity and configuration management are converging, necessitating greater collaboration between traditionally siloed IT teams. VMware facilitates this collaboration, for example, by providing a single dashboard that can be used by VI and operations administrators alike to look at health, risk and efficiency across your entire IT environment.

Run IT Like a Business
The pressure on IT to do more with less is a primary driver of virtualization and the move to the cloud. But IT has no comprehensive way to document its value and costs to business customers. Virtualization and the cloud require consolidated, end-to-end visibility into IT capital, operating and service costs so that business decisions can be made quickly and with transparency.

VMware IT Business Management solutions deliver complete, consolidated visibility into IT costs to help you make fact-based decisions aligned to business priorities. These solutions enable more effective engagement with business executives and line of business stakeholders through meaningful measurements and reports. They leverage vCenter Operations’ chargeback capability which meters the usage of infrastructure resources. VMware IT Business Management Suite includes solutions for IT financial management, service level management and vendor management, as well as private cloud self-service.
Chapter 3

An Integrated, Converged Approach to Automated Operations

The VMware vCenter Operations Management Suite offers the comprehensive visibility, intelligent automation and proactive management required by today’s complex and constantly changing IT reality.

vCenter Operations provides powerful visualization of performance, capacity and configuration issues and risks across your IT environment’s dynamic infrastructure stack, including storage and applications. It collects and analyzes performance data, correlates abnormalities and identifies the root cause of building performance problems. Automated correlation of health, performance and change events at the infrastructure and guest operating system level can be used to help pinpoint lingering performance problems.

The deep integration of vCenter Operations with VMware vSphere provides infrastructure context – connecting elements logically according to dependencies, peer relationships and interactions in specific virtual environments.

The solution learns normal conditions and cycles, and gauges departures from them to track trends and anticipate performance degradation, capacity shortfalls, and conflicting or noncompliant configurations.

The vCenter Operations Dashboard abstracts millions of metrics into health, risk and efficiency measures across the entire IT environment to help administrators manage overall system performance and ensure operational efficiency. These views give your administrators better visibility and actionable intelligence to quickly identify what’s causing current workload conditions as well as spot potential future problems, and find areas with inefficient use of resources.
vCenter Operations provides capacity planning, reporting and optimization views to help administrators deliver on performance SLAs while ensuring the efficient utilization of your infrastructure. It shows you the impact of capacity shortfalls on performance and identifies opportunities to increase VM density and reclaim excess capacity and idle VMs. Automated “what-if” scenario planning can also be used to plan and evaluate the effects of administrative actions. From a business point of view, this approach to capacity management is a major step toward IT as a service, delivered on demand, and helps determine the optimal configuration for ensuring service levels and operational efficiency.

This converged, integrated approach enables rapid problem resolution, higher quality of service with fewer incidents and less downtime of critical business application services. It allows you to be more proactive and enable optimal performance and resource utilization in the face of growing service level expectations and accelerating change.

**Comprehensive Visibility**

vCenter Operations offers visualization of the entire virtual infrastructure and applications, with views optimized for rapid resolution of a wide variety of problems. Features include:

- Cross-team views that integrate performance, capacity and configuration management data to isolate, analyze and remediate problems in real time, without delays and errors from cross-silo communications.
- Abstraction of data into health, risk and efficiency “supermetrics” that offer actionable intelligence to help your operations team identify emerging performance problems undistracted by static alerts and false alarms.
- Best-practices templates for security, hardening and regulatory compliance that give real-time visibility into complex states without cumbersome checklist- and spreadsheet-level management processes.
- Application awareness through application discovery and dependency mapping, so you can see what infrastructure elements support your business critical applications; this visibility helps you ensure service levels as well as facilitates the establishment of security trust zones and disaster recovery plans.
Intelligent Automation
vCenter Operations automates routine, yet difficult and time-consuming management tasks. It uses analysis and workflow based on a deep understanding of virtual architectures and processes to provide capabilities like:

• Correlation of information and events across management silos for quick resolution of issues whose causes and effects span traditionally separate management disciplines.
• Remediation to roll back configuration changes that create performance problems or exceptions to security policies or regulatory requirements.
• Event-triggered workflows to execute low-level management tasks in response to recurring events, with no administrative intervention.

Proactive Management
vCenter Operations anticipates emerging problems to provide the operations team time to identify, isolate, analyze and remediate issues quickly with features like:

• Self-learning analytics that track performance against a data-rich dynamic “normal,” for early warning of issues via smart alerts that minimize time wasted on false alarms.
• Continuous forecasting and “what-if” modeling of capacity to head off capacity shortfalls and support evaluation of alternative remediation steps, while maximizing efficient utilization of your virtual resources.
• Policy control over all elements of datacenter infrastructure—virtual and physical—for compliance with IT, industry and regulatory standards.
Chapter 4

vCenter Operations in Action: Use Cases and Processes

vCenter Operations with VMware vSphere—designed specifically for virtual and cloud environments—delivers a solution to your biggest infrastructure management challenges.

Efficient IT problem resolution is necessary in order to maintain service levels and cost effectiveness throughout the entire organization. To both expedite and improve the troubleshooting process, vCenter Operations with VMware vSphere provides you with the visibility and awareness needed to not only forecast issues but also surface root causes for quick problem resolution.

The following use cases demonstrate vCenter Operations’ integrated performance, capacity and configuration capabilities at work. The first three show how vCenter Operations can quickly identify a performance problem arising from a CPU, memory or storage I/O issue and drill down into its root cause to remediate it. The fourth shows how it can assess performance risk due to a capacity issue and optimize resource utilization.
Use Case #1: Debugging Poor Virtual Machine CPU Performance

Change is a constant in data centers, whether planned or completely unexpected. VI administrators need the ability to proactively solve for performance issues related to configuration changes. vCenter Operations Manager helps diagnose workload-related performance issues, perform root cause analysis, proactively single out looming problems and identify resource usage inefficiencies.

Watch this Video (http://www.vmware.com/go/vcopsusecase1)
Occasionally, over-consolidation or virtual machine sprawl can lead to memory or other resource contention and degrade overall system performance. vCenter Operations Manager provides easy to use dashboards and visual charts that help VI administrators pinpoint performance hotspots in the data center and determine how frequently these incidents occur so they can balance workloads across their data center resource pool.

Use Case #2: Debugging Poor Virtual Machine Performance Caused by Memory

[Image of vCenter Operations Manager dashboard with metrics for CPU and Memory]

Watch this Video (http://www.vmware.com/go/vcopsusecase2)
Use Case #3: Debugging Poor Virtual Machine Performance Caused by Storage I/O

Storage I/O is critical and a leading cause of performance bottlenecks in virtualized environments. vCenter Operations Manager offers in-depth visibility into data center elements including storage (IOPS, throughput, latency). This enables VI administrators to design their virtual data centers to effectively rule out or diagnose storage I/O contention and other storage-related VM performance issues.

Watch this Video (http://www.vmware.com/go/vcopsusecase3)
Use Case #4: Assessing Capacity Risk and Optimizing Virtual Infrastructure

Effective capacity management allows you to match the right amount of resources with the workload demand you’re seeing to maintain service health while eliminating overhead and waste. vCenter Operations Manager helps assess capacity risk, and identifies opportunities to reclaim unused capacity to optimize virtual resource utilization. It also simulates “what-if” scenarios to model the impact of capacity changes to the datacenter.

Watch this Video (http://www.vmware.com/go/vcopsusecase4)
Chapter 5
The benefits of an integrated, automated approach to operations management

vCenter Operations’ virtualization-aware, context-sensitive, proactive analytics and automated tools help streamline processes, improve efficiencies and deliver on SLAs.

Organizations that make the transition to this new class of management tools can expect improvements in:

- **Efficiency** with routine tasks being completed and issues resolved in less time.
- **Span of control** with administrative staff accomplishing more within the constraints of currently available resources.
- **Cost-effectiveness** due to improved staff and resource utilization leading to reduced operational expenditure.
- **Quality of service** because routine issues are resolved quickly with automated assistance.
- **Availability** because issues are resolved “on the fly” without planned downtime and before they raise risks of service interruption.

- **Compliance** with event-based actions and workflows that prevent or quickly resolve issues that might otherwise compromise policy or regulatory compliance.
- **Planning** via “what-if” scenarios to ensure future capacity needs are met while optimizing capital expenditure and operational efficiency.

In addition to these benefits for the business as a whole, management staff will often see improvements in their ability to manage their time and professional growth. Firefighting an endless list of routine issues is replaced by proactive, high-level administration with automated support.
Virtual and cloud environments will continue to grow in scale and complexity, outstripping the capabilities of manual processes—even those augmented by automated troubleshooting, analysis and remediation tools. Our vision for the management end-state includes:

- **Extensive automation** with embedded problem-solving and management expertise at each layer to optimize virtual and cloud environments.
- **Intelligent policy management** that provides services’ performance, compliance and security, for self-service with complete control.
- **Management and cloud interoperability** for freedom of choice among service providers using an open, standards-based approach that allows applications to move across private and public clouds.

As you continue on your virtualization and cloud journey, VMware vCenter Operations Management Suite together with the VMware portfolio of enterprise management solutions can help you proactively manage the evolving needs of your IT environment by:

- Continuing to embed management capabilities in the infrastructure platform, thereby turning management into manageability and freeing staff from routine tasks to focus on activities with higher value to the business.
- Continuing to converge, adding security, compliance and business-process layers to virtual infrastructure and applications.
- Evolving toward self-service and IT business management, so business owners can select services with capabilities, performance and compliance that match their requirements, while understanding the true cost and value of the

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**Conclusion**

As a new computing paradigm, cloud computing is still in its early stages of development, and its benefits are only just beginning to be realized. At VMware, we are already preparing vCenter Operations for the emerging future state of IT.
Incorporating public cloud services such as infrastructure and software as services, when they suit business objectives—without surrendering visibility or control.

And at the end of the day, that's the kind of IT solution enterprises need. A solution to help you deliver on your SLAs for business critical applications, enable continuous compliance with operational and regulatory requirements, and optimize resource utilization and streamline operational costs. In other words, an operations management solution designed for today that's ready for tomorrow.

**Take the Next Step**

Try VMware vCenter Operations Management Suite for yourself. Download your 60-day trial at [www.vmware.com/go/try-vcenter-ops](http://www.vmware.com/go/try-vcenter-ops)

For more information on vCenter Operations or any of our other solutions, please visit [www.vmware.com](http://www.vmware.com).