Introduction

Over the last ten years, virtualization has become a mature technology, with growing adoption rates by organizations of all sizes. In fact, more than 50 percent of all global server workloads run on a virtualized infrastructure - and the trend continues to grow, according to Gartner analysts. But are these organizations truly maximizing the benefits of virtualization within their virtual and cloud environments?

Keeping in mind the benefits of virtualization, such as increasing agility while cutting cost and complexity, this eBook explores industry best practice in operations management for virtualized environments. This encompasses performance, availability and capacity optimization. Most importantly, this guide will help you recognize where virtualization’s dynamic properties go beyond the limits of traditional, siloed management tools. Understanding and managing the implications of virtual and physical infrastructure by adopting solutions that simplify and automate operations management is critical to realizing the full benefits of virtualization.

Performance Management: Holistic Visibility and Awareness

IT operations performance management focuses on the collection monitoring and analysis of performance metrics. These metrics can tell you whether a system component is up and running (available), or if the component is behaving in an abnormal way that impacts its ability to function correctly. The challenge facing IT professionals running virtualized environments is that traditional performance management tools are siloed and tied to static, physical infrastructure. These tools are incapable of providing accurate, actionable information of how applications and systems are behaving in dynamic virtualized and cloud environments.

Best Practice No.1: Take a Holistic Approach

Effective performance management first requires a more comprehensive view of the behaviors going on inside a system. A running workload requires processor attention, memory for execution space, some quantity of storage and network connectivity for communicating with clients and other servers. However, casual monitoring of raw metric data can quickly turn into a full-time job as an environment’s interdependencies increase. An integrated, holistic approach is needed to identify how behaviors at one level impact operations at another. You could find that it’s possible to reduce diagnostics and problem resolution time by as much as 26% when you adopt such an approach.

1 Gartner "Magic Quadrant for x86 Server Virtualization Infrastructure", by Thomas J. Bittman, George J. Weiss, Mark A. Maguire, Philip Dawson, June, 2012

2 The Benefits of VMware’s vCenter Operations Management Suite, Management Insight Technologies, September, 2012
Performance Monitoring on Physical vs Virtual Machines

On a physical machine, resources are dedicated to a single workload and those not used by the workload sit idle. Thus, a single view of the workload is sufficient.

In virtual machine environments, determining where resources are being consumed is a bit more difficult. Processor cycles not consumed by the first virtual machine might be used by the second, or they might be completely unused. The same holds true for memory, storage, and networking resources. Thus, a single view approach is insufficient and a hypervisor management tool is needed.

Best Practice No.2: Increase Visibility with Dynamic Thresholds

In the modern IT environment, consumption of capacity resources can be measured with the help of integrated monitoring tools. From a position inside a computer instance, these tools convert the behaviors they see into numbers. Those numbers can then be compared with known thresholds to identify when a workload is attempting to do too much, or its hardware resources are in too short a supply. Traditional monitoring tools use static thresholds to alert you of every possible CPU or memory level being crossed. In fast-changing virtual environments, these alerts could be false positives and not trigger when they should. Virtualization-aware tools learn the behavior of your environment and adjust thresholds dynamically, resulting in 10x fewer alerts.

IT Operations experts suggest that average processor utilization across all IT workloads, across all industries, lies somewhere between 5% and 10%.

Best Practice No.3: Improve Situational Awareness

Measuring performance from an individual virtual machine’s perspective tells only a part of the story. The hypervisor isn’t all-knowing or all-seeing. With your focus confined to a virtual machine’s operating system (OS) and its hypervisor, that view still misses a few key components of the overall virtual platform.

Storage and outside-the-hypervisor networking are two components being missed, as are the behaviors going on between hypervisors. Virtualization of mission-critical applications requires high availability and load balancing. It requires the elimination of single points of failure. It demands redundancy at every level to ensure component failure doesn’t mean system failure. Each of these interconnections on their own can be a contributor to performance problems, and each requires independent management and monitoring.

With dynamic management and monitoring tools, you can rely on one dashboard to help you achieve greater capacity utilization, consolidation ratios and hardware savings while reducing the time required for diagnosing and resolving problems before they impact your entire business.

Each interconnection also introduces yet another perspective on the resources that contribute to virtual machine demands. For storage, networking, hardware and the interconnecting fabric – consider how Figure 1’s ‘other’ layers can impact each other:

- Resource shortfalls can occur at the storage layer and have an impact on end users’ ability to access data
- The hypervisor might balloon out memory that’s being actively used by a needy virtual machine process
- The backplane of the switch being used for networking might become oversubscribed by storage traffic, reducing throughput for production networking

Figure 1: Performance monitoring on physical vs virtual machines.

Figure 2: Impact overview: improving situational awareness.
Capacity Management: Dynamic Balancing of Supply and Demand

As any virtual administrator knows, virtualization primarily concerns itself with four key resources: processing, memory, storage and networking. It’s the hypervisor’s job to abstract these key resources and make them available for co-located virtual machines. Each virtual machine demands a specific quantity of each resource at every point in time: A heavily-taxed database might need more, while a lightly-used IT file server might need much less, and so on.

Capacity management is concerned with ensuring enough resources are available (the supply) to meet the needs of these workloads (the demand). This activity is made challenging by the ‘messiness’ that’s intrinsic to virtualization: resources are used dynamically, virtual machines can be relocated anywhere, components are constantly being powered on and off. These combine to make the capacity management activity just as difficult as performance management when one has no tools to assist.

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Best Practice No.1: Simplifying by Abstracting

An important new best practice focuses on tools that simplify capacity management by abstracting the data as shown in Figure 3. Here, a virtual environment’s innumerable metrics have been replaced by representative values for each of the key resources. For each value, there is an assertion of the capacity of that resource in contrast with how much is currently being used.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Available</th>
<th>Consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>300 JJ</td>
<td>180 JJ</td>
</tr>
<tr>
<td>Memory</td>
<td>245 JJ</td>
<td>230 JJ</td>
</tr>
<tr>
<td>Storage</td>
<td>490 JJ</td>
<td>315 JJ</td>
</tr>
<tr>
<td>Network</td>
<td>185 JJ</td>
<td>77 JJ</td>
</tr>
</tbody>
</table>

Armed with this information, a virtual administrator can, at a quick glance, get an immediate view for where resources are getting low. In this example, processor, storage and network resources are sufficient to meet virtual machine demands. Memory resources, however, appear to be running out, as shown by the yellow indicator light.

Best Practice No.2: Forecast Future Demand

In a well-managed IT environment, you should never see a green indicator light go yellow or red. Proper planning involves acting before resources get low by ensuring more will arrive before they run out. Due to the dynamic nature of a virtual environment, intelligent and predictive planning is difficult to accomplish without tools to assist. Figure 4 shows one such visualization that illustrates a virtual environment’s memory consumption over time.

Graphs like these are necessary to show consumption trends over time. More important than the actual values is the graph’s red trendline. That trendline points to some future date when memory consumption can be expected to exceed available capacity. Capacity management is all about ensuring more resources arrive dynamically before that day comes.
Intelligent Performance and Capacity Management: New Best Practices

In a world where unlimited resource supply is now considered a waste of hardware investment, today’s virtual environments are striving to make best use of every dollar spent. That desire for optimization is causing a change to old ways of thinking. The challenge of having to manually correlate an ever-increasing volume of metrics using traditional, siloed management tools, can be overwhelming. Solutions designed inherently for virtual and cloud environments can deliver analytics and a comprehensive, integrated view to help simplify and automate operations management. Implementing such a solution that enables predictive and proactive performance and capacity management in your virtual environment is the new best practice.

Best Practice is the Foundation for VMware Solutions

VMware solutions use the power of automated performance and capacity management to help you proactively address IT issues before they impact the business. These products can protect your business by helping to meet service levels for both infrastructure and applications within a dynamic environment. They do so by leveraging logs and other data to generate the insight that detects and prevents issues before they occur.

By consolidating workloads and using built-in operations management to measure consumption, it’s possible to optimize IT operations by increasing efficiency and cutting costs. Most importantly, these tools can provide an end-to-end view across both physical and virtual infrastructure so that you can ensure compliance with IT policies, security and regulatory requirements.

Combine the visibility from operational analytics of VMware vCenter™ Log Insight™ with the insight into the capacity and performance of VMware vSphere® with Operations Management™ and you have a holistic view of the overall health of your IT infrastructure.

To discover how you can proactively manage and secure your IT environment with automation, while increasing visibility and control, read more about our VMware IT operations management solutions.

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