

Automated Platform Management in a Virtualized World

Executive Summary

Server virtualization has brought significant efficiencies to IT operations, but at the cost of new challenges in monitoring the health of running virtual machines, analyzing data, alerting staff in case of a problem, and performing standard and exceptional administrative tasks. These challenges are growing as virtualization takes an increasingly central role in IT. System administrators are investing more time and effort into ensuring the proper operation and health of VMs, yet lack tools comparable to those available for physical servers.

This problem is compounded by the reactive nature of many IT departments. The added complexity of separating physical servers from server loads adds still more to the typical IT workload, requiring that IT devote resources that it doesn't have to address this technology.

The growing complexity and lack of resources necessitates changing the way IT operations are commonly performed. Tools and strategies that accelerate and automate IT activities reduce the workload inherent in a virtualization strategy, while also enabling IT professionals to get ahead of the curve and begin a march to a higher level of operational maturity.

Virtualization Becomes Ubiquitous

Server virtualization is one of the keys to dramatically improving the efficiency and flexibility of IT operations today. Virtualization enables dramatic server consolidation, greatly reducing hardware requirements and power usage. It also decouples applications from physical servers, giving IT enormous flexibility in scheduling applications for execution when and where they are needed, rather than where the server is located.

Today, the role of IT is changing dramatically, as setting up and configuring physical servers is being replaced by managing a larger number of VMs across a smaller pool of more powerful hardware. The shift is occurring rapidly, as more and more servers are virtualized to consolidate and rationalize physical resources. IT professionals are now spending significant amounts of time provisioning servers, managing the movement of VMs across physical servers, and manually monitoring the health and performance of applications and operating systems running within the virtualized infrastructure.

The advantages of virtualization are driving the popularity of its adoption in the enterprise. According to industry analyst Forrester, more than one-third of enterprise IT shops have implemented X86-based server virtualization, while nearly two-thirds are expected to do so by 2009. The Forrester study also notes that enterprise IT departments have virtualized about 24 percent of servers today, and that number is expected to grow to 45 percent by 2009.

However, the rush toward virtualization has also highlighted some of the drawbacks of this strategy. Probably the most apparent drawback is "VM sprawl," the proliferation of virtual machines across servers without regard to function, organization, or management. VM sprawl results in significantly less efficient use of hardware resources, as VMs are loaded and removed from servers haphazardly, without regard to a schedule or computing requirements.

Occasionally, a VM is created for a specific and limited task, but once that task is complete, often the VM is left running and forgotten, creating an “orphan” that simply consumes resources.

In addition, part of that sprawl is likely to come from outside of the datacenter entirely. In many cases, both operational and support departments have their own servers and IT resources for specific applications, or because they are geographically remote.

VM sprawl is further complicated by the inability of most existing monitoring and administration tools to analyze and diagnose the health of both physical and servers together. Traditional monitoring systems have challenges understanding the dynamic nature of the virtual infrastructure. This can come in the form of real-time physical resource re-provisioning as well as the ability to migrate VMs across physical hardware without end-user impact using Live-Migration technologies. System administrators are forced to manually examine individual VMs to diagnose and fix problems not only through traditional means within the operating system, but also by understanding and analyzing the hypervisor layer itself.

Over the last several years, IT professionals have responded to rapidly growing enterprise computing requirements by gradually replacing manual tasks with automated systems and scripts that monitor, analyze, diagnose, and alert with limited human intervention. While in the early stages, automation has the potential to enable IT departments to become proactive in predicting and avoiding problems.

The rapid growth of virtualization has forced IT to revisit the issue of automation in monitoring and diagnosis. Few manual technical approaches are transferable to virtualized servers, and the increased workload requires new tools and processes. Yet if administrative processes did not exist or were not mature with physical servers, it is unlikely that such processes can be quickly and easily developed for virtualization. In fact, the latter is often the most common scenario. Without sufficient automated solutions and processes for managing a physical computing environment, adding complexity in the form of automating virtualized servers and applications will degrade any existing degree of effectiveness.

As with physical servers and their workloads, IT professionals have to ensure the health and operational performance of virtualized workloads. Without a history and culture of effective use of monitoring and administration solutions, automation, and well-defined processes, being able to monitor, predict, and proactively respond to real or potential problems is a challenge. To grow still further and be able to provide the business with service level agreements and new approaches to addressing business problems, IT staffs have to analyze data provided by operations monitoring.

A Virtualization Maturity Model

In order to assess the ability of an IT organization to manage server virtualization operations, it is possible to incorporate a model that looks at the maturity of the processes surrounding IT in general and virtualization in particular. Gartner has devised just such a model that defines five phases of maturation.

Level 0 – Chaotic. The initial or Chaotic level effectively means that there are no defined processes in place to operate virtualized servers. Problems are dealt with as they arise, in different ways by different staff. There is little or no documentation on individual problems and solutions provided. The IT staff “wings it.”

Level 1 – Reactive. The Reactive level has defined processes in place only for VM failure or other serious issue. The IT staff does minimal monitoring and no advance preparation for contingencies or failures. Optimization of operations and normal maintenance are rarely done.

Level 2 – Proactive. At the Proactive level, IT staff has defined processes for all anticipated failures and other issues. Further, the staff also monitors system and application health and performance, analyzes trends, predicts problems, and sets thresholds for diagnosis and corrective action. The staff also has defined and mature processes for change management for the computing environment.

Level 3 – Service. At the Service level, IT staff has a deep understanding of quality of service and the costs and benefits of different levels of service. IT is able to deliver service level agreements (SLAs) on computing to its user entities, and to monitor those agreements for compliance. Further, it can take corrective action when not in compliance.

Level 4 – Value. The Value level integrates IT with business into a single conceptual entity that works together to meet the organizational mission. IT becomes a critical element in business planning and execution.

Gartner notes that the majority of IT organizations are at Level 0 or 1, in that they lack processes, and address issues as they arise, rather than plan and execute daily operations and contingencies according to those plans. The administrative tools that are available are used to alert and diagnose symptoms rather than determine root causes. In most cases, the IT staff knows that it should be creating repeatable processes and becoming more proactive, but finds itself too busy fighting fires to do so.

Virtualization of servers and server workloads adds to this challenge. Virtualization means that there is no longer a one-to-one relationship between physical box and application component executing on that server. Instead, that relationship is one-to-many, which means that IT doesn't necessarily know which load is running on which physical server at any particular time. That compounds the time and effort needed to identify problems in running applications and diagnosing and fixing those problems.

Without well-defined processes and supporting tools for matching server loads to physical servers, and monitoring VMs across physical servers, IT faces the prospect of spending still more time fighting fires, rather than reaching higher levels of maturation.

From Physical to Virtual

The key to taking full advantage of server virtualization is to enable IT departments to increase their overall level of maturity from 0 or 1 up to one of the higher levels. As long as IT staffs spend all of their time fighting fires, it's not possible for them to engage in the planning and preparation required to become more proactive and better able to support the business in quantitative ways.

This increase in maturity level must apply to both an organization's physical and virtualized environments. As enterprises increasingly move to VM-based servers and server loads, IT departments cannot afford to have a drop-off in productivity associated with the separation of physical and virtual servers.

IT personnel have to get ahead of the curve by collecting and analyzing data while fighting those fires, and use that data to reduce the likelihood of failures in the future. That step cannot be taken without comprehensive ways of engaging the environments, collecting operational data on details of environment and application execution, and feeding back those results into better practices and policies for system management.

Management and automation solutions for both physical and virtual environments enable IT staff to turn manual and ad hoc processes into automated, consistent and repeatable workflows, while at the same time accelerate both problem solving and normal maintenance activities.

Ultimately, IT departments require a lifecycle management approach to physical and virtual systems. This includes building environments according to defined best practices, determining quantitative measures of environment health, applying monitoring solutions to collect and analyze data to support those measures, and examining trends to be able to make predictions on future health of the environment, and needs that may support that health.

Predictions of future performance, capacity, and availability are critical because they enable IT to plan and execute according to predefined and approved strategies. Installation of a new rack of servers is the result of interpreting trends, applying budget priorities, examining tradeoffs, making purchasing decisions, and implementing solutions on a schedule, rather than dropping all other activities and buying more hardware to deal with an immediate problem.

Ideally, monitoring solutions should be unobtrusive in the environment, and provide accuracy across both physical and virtual platforms. Further, such solutions should offer a range of options for the data elements collected, the frequency and granularity of collection, and the ability to combine discrete data elements into higher value information. They should also provide out-of-box options for analysis and reporting, as well as the ability to customize both. While there are likely to be tradeoffs in these characteristics, IT should have the flexibility to configure monitoring and analysis in the exact way that best meets its unique environment as well as its maturity level.

Workflows play a key role in managing an IT lifecycle. By being able to effectively monitor system health and collect and analyze data on operations, IT can define processes that combine multiple data collection and analysis activities into a single workflow that requires little

intervention, such as being presented with a recommendation and being asked to approve it. In addition to automation, workflows also provide discrete checkpoints for specific aspects of system health and performance.

Working the IT Maturity Model

As IT departments analyze their requirements in a virtualized server environment, it is worthwhile to map those requirements back to the Gartner maturity model. This is important in ensuring that a particular solution does not preclude the ability to become more mature and proactive in IT processes.

IT departments at level 0 need tools with two fundamental characteristics in order to both successfully identify and address problems today while also planning to progress up the maturity scale. First, the tools must accelerate their ability to find and fix problems on a daily basis. They must serve to free up time that IT departments can use to increase their maturity levels and thus increase their value to the business. Second, any tools must provide IT departments with the head start needed to begin planning and management at the higher levels of maturity.

Further, the focus of IT departments should be on the business value and business flexibility of their activities. Finding and fixing server and application problems, as important as it may be, doesn't add value comparable to the effort expended. And such activities don't improve the ability of the business to respond to rapid changes in the competitive landscape.

At level 0, for example, tools can add business value by predicting system needs and potential problems, so that the staff can begin to get ahead of the fires and plan to devise processes to deal with them. At level 1, IT departments can use the data generated by tools to analyze trends and feed back into nascent processes to make them more robust and functional. Once processes are optimized, it becomes possible to grow into higher levels of maturity on the Gartner scale.

One way to address today's needs for getting control of virtualized environments, while providing the data and analysis necessary to add maturity to IT processes is automated platform management. The platform concept applies to both physical servers and VMs that run on those servers. This foundation helps IT departments at all levels of the maturity hierarchy. For those at level 0, it helps establish a way to collect fundamental data on the health and operation of virtualized servers. For those at higher levels of maturity, automated platform management helps fine-tune policies, provide for self-service and administration, predict and diagnose causes of failure, and prepare for high availability of VMs, applications, and data.

Specifically, at level 1 of the maturity model (Reactive), VM monitoring solutions requires that failure data be summarized and categorized in order to provide a basis for developing standard procedures for addressing similar issues in the future. By having standard practices published and in place, IT professionals can more easily identify a problem and fix that problem in a defined way. Productivity improves, as does uptime. This is also a critical part of being able to

grow to subsequent maturity levels. To scale the IT organization, you must first establish procedures and build systems to get predictable outcomes.

At level 2 (Proactive), further analysis of failure data is required to feed back causes of failure into better ways of running physical servers and the virtual environment so that those failures are less likely to occur. In addition, data on normal operations and system and VM health must be collected and analyzed in order to understand in a quantitative way what constitutes a healthy environment.

At level 3 (Service), IT uses its deep understanding of environment health to deliver SLAs and other guarantees to the business it serves, enabling the business to make better assumptions concerning its own products or services.

Level 4 (Value) enables the business as a whole to take the next logical step and work together with IT as a partner in improving efficiency and developing new products and services.

The goal is to achieve both automation and provisioning of the virtual environment, by being able to collect, consolidate, and analyze data on the health and operation of virtualized servers, and by ongoing monitoring and management of the environment based on a deep understanding of the behavior and performance of virtualized servers over a long period of time. In effect, you are creating a closed loop between the data and analysis of the health of the virtual environment, and corrective action applied to that environment. By doing this, it not only reduces costs and increases consistency, but enables users to serve themselves.

Solutions for monitoring and managing both the physical and virtual environments are essential to this understanding by enabling the correlation of application performance data and events from the entire application infrastructure and point the IT staff to the true root cause of a problem. The result is higher availability, faster and more reliable diagnosis and addressing of failures, and better overall service to the business.

Conclusions

Automating and provisioning virtualized servers is the key to improving the maturity of IT operations. The practice of automated platform management makes this possible through the use of tools that collect and analyze data and provide the understanding necessary to do less fire fighting and more planning and execution based on value to the business. Overall, automated platform management enables IT departments to reduce costs while improving availability and performance of virtualized servers, making processes more mature and predictable.