

Integrated Infrastructure and Performance Management for Virtualized Environments

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Executive Summary

Challenge

Enterprises, government agencies and service providers are increasingly employing virtualized environments to decrease costs, consolidate data center space and reduce environmental impacts. The implementation of virtual machines within the IT infrastructure allows for more efficient use of physical servers, which reduces capital expenses along with power and cooling requirements. However, the use of virtual servers also increases the management challenges associated with maintaining infrastructure reliability and ensuring service-level agreements. For peak efficiency, the new environment requires the use of integrated tools that can proactively manage infrastructure fault, performance and capacity issues within hybrid environments combining both physical and virtual environments.

Opportunity

With the addition of CA Virtual Performance Management to CA Spectrum® Infrastructure Manager and CA eHealth® Performance Manager, IT organizations can use proven management tools for both their physical and virtual infrastructure. The CA tools, which are designed for multivendor, multiplatform environments, simplify infrastructure management by providing a comprehensive view of all physical and virtual components. With these CA solutions, IT professionals can employ a rich set of infrastructure and performance management features to handle the nuances of their virtualized environment, including visibility into the logical grouping of resources, fault isolation and performance monitoring across physical and virtual machines, and the ability to track in real time the migration of virtual resources between physical servers.

Benefits

The CA infrastructure and performance management solutions allow organizations to reduce costs, increase IT efficiency and ensure quality of service within networks using virtual servers. CA Spectrum and CA eHealth let IT organizations gain the financial and environmental benefits of a virtualized network environment while maintaining the ability to automatically monitor and respond to infrastructure and performance issues. With these CA solutions, organizations can leverage their existing investments to support the successful delivery of IT services without increasing costs. CA Spectrum and CA eHealth, along with CA Virtual Performance Management, are part of a comprehensive set of CA tools for managing virtual environments, which helps ensure that IT professionals don't need to master an ever-wider array of stand-alone applications.

Challenges of Managing Virtualized Networks

Server virtualization technology recently achieved mainstream status. Furthermore, its deployment within IT organizations is accelerating rapidly. According to industry analysts, 30 – 40% of non-desktop IT infrastructure will be virtualized by 2010, which is up dramatically from the 5% penetration reported in 2006. These adoption rates are not surprising, because virtualization helps IT reduce hardware costs, data center real estate and energy use.

The widespread adoption of virtual servers based upon x86 platforms can be considered the latest wave of network virtualization technologies. An earlier wave was the replacement of traditional point-to-point technologies, such as Frame Relay and ATM, with virtual private networks (VPNs). Another wave was the adoption of technologies that facilitated redundancy and failover of network functions, such as Virtual Router Redundancy Protocol (VRRP described in RFC 3768) and Hot Standby Router Protocol (HSRP described in RFC 2281).

Each of these previous virtualization technologies provided cost benefits by letting organizations use their resources more efficiently. But these technologies also created their own unique set of management challenges for enterprises, government agencies and service providers, which CA Spectrum Infrastructure Manager and CA eHealth Performance Manager have successfully addressed.

Likewise, the adoption of virtualized servers has created unique management challenges, including the following:

- Managing physical and virtual resources
- Building an accurate topology map
- Responding to resource movement
- Accurate fault determination
- Effective performance monitoring
- Maintaining critical business services
- Using information wisely
- Anticipating future trends

The Challenge of Managing Physical and Virtual Resources

Virtual technology vendors usually provide at least a basic set of tools that can perform some of the management tasks for the virtual environment. For example, these tools can show performance information, such as CPU and memory utilization, for both the host machines and their various guest machines. And technologies such as VMware Distributed Resource Scheduler and Sun Fair Share Scheduler can shift virtual machines to other physical servers to compensate for overutilization of CPU cycles, storage capacity or other performance variables.

However, the vendor-provided management tools are often only focused on their specific virtual environment. For true infrastructure and performance management of the entire network environment, an IT organization needs an integrated set of tools that can manage both its physical and virtual components. And it needs a system that is equally adept at managing hardware and software from many different vendors. The last thing a system administrator needs is additional tool sprawl in which there are distinct tools for each technology or vendor.

The Challenge of Building an Accurate Topology Map

In the traditional, static model of dedicated servers and devices, IT had immediate knowledge of which computers were running which applications. In fact, they could easily label each server, switch or router to understand its function.

In the dynamic, virtualized model, the same physical component may contain numerous virtual machines that serve a variety of different functions. Now, applications can be running on virtual machines within various physical servers, and these virtual machines can move to a different physical server at a moment's notice. Therefore, an infrastructure management system must be able to create and maintain an accurate model of the physical systems and their guests, as well as their relationships to the physical network. It must also be able to maintain accurate historical reporting as the virtual machines move to different physical hosts.

In fact, the problem has become more acute recently, because some products, such as the latest versions of VMware vCenter Server, no longer provide SNMP access to a rich set of management information, making it difficult for third-party management systems to determine the location and status of the virtual machines. Therefore, an effective management system must provide a method for discovering all the nuances of the virtual environment and ascertaining its status if it is to generate and maintain an accurate topology map of both physical and virtual environments in addition to providing an accurate view of the historical performance.

The Challenge of Responding to Resource Movement

In addition to discovering an initial topology map, effective enterprise management software must be able to handle the change from a static to a dynamic resource model in which virtual machines can shift locations depending upon demand, capacity and performance issues. This has complicated the management challenges of maintaining accurate topological maps and historical performance reporting required to deliver reliable business services in a timely manner.

With technologies such as VMware Distributed Resource Scheduler or Sun Fair Share Scheduler, virtual machines and individual applications can rapidly move from one host machine to another. This requires that a management system quickly detect any changes in the virtual environment to ensure that the topology map is not out of date almost immediately and the performance reporting tool is able to correlate performance metrics as the virtual guest moves from one physical host to another. The complexity of responding to movement dictates that an effective management system is aware of these VM movements and provides a continuous method of discovering and updating the topology and the performance relationship of guests to hosts.

The Challenge of Accurate Fault Determination

Given the complexity of modern IT infrastructure, IT personnel need a system that intelligently determines the root cause of a fault. It does no good for a management system to trigger an almost infinite number of alarms that are all based upon one event. Responding to tens or hundreds of alarms without an intelligent system that provides actionable information by pinpointing the primary cause will confuse operations staff and delay corrective actions.

Therefore, a key component of any management system should be an effective root cause determination system that can distinguish between the primary fault and all the symptomatic events that were generated by the originating fault.

To accurately determine the cause of a failure, the management system must have a full understanding of the network topology, the relationships and dependencies between the different devices, or in the case of a virtual environment, different resources, and the ability to determine the current status of each of these elements. With the addition of virtualization technologies, the system must now be aware of the dependencies of each of the virtual machines on particular physical servers, and the ability to adjust its object model to account for the migration of VMs between servers based on business priorities.

The Challenge of Effective Performance Monitoring

An effective management system must be able to distinguish between transitory spikes and significant, repetitive performance issues, and only create alarms for systemic issues that signify true problems. To determine the difference between random noise and significant performance issues, the system needs to establish relevant baselines that are based upon the historic ebb and flow of the organization's hourly and daily activity.

Organizations do not place uniform demands upon their infrastructure throughout the day or the week. A DHCP server is overly busy at the start of a business day issuing IP addresses to everyone logging onto the network; a scheduled backup routine will cause regular, predictable stress on the network; and certain websites see a steady uptick in activity as schoolchildren or college students get out of classes. So, a high level of utilization at one time might be more worrisome than a similar usage at a different time. Therefore, a performance management system should be able to distinguish between spikes in usage that occur because of time of day or day of the week.

Because the demands on physical and virtual servers can vary greatly by time of day and day of the week, the system must be able to learn the normal usage patterns and then compare the current situation to the expected behavior for a particular hour of day or day of week. This adaptive thresholding, which learns from historical experience, provides useful metrics for infrastructure performance and identifies abnormal behaviors that can indicate potential problems that are impacting service or have the potential to do so.

A comprehensive insight of performance across physical and virtual machines also enables IT organizations to analyze utilization trends and make future decisions about virtual infrastructure capacity and how best to optimize utilization of virtual infrastructure and improve ROI.

The Challenge of Maintaining Critical Business Services

Understanding the overall reliability and performance of the network and its systems is only one aspect of infrastructure management for many organizations. Most organizations have a set of business functions that are more critical than others. For example, a company that depends upon Internet sales might define its website as one of the most critical business functions supported by the IT department, while a hospital might be most concerned with maintaining access to patient records.

In an entirely physical world, a critical business function, such as the customer service center, can be provisioned with its own set of servers, routers, switches and interfaces. And if it is extremely critical, it can be overprovisioned to help ensure continuity. In this traditional model, it is comparatively simple for an infrastructure or performance management system to define, map and understand the required components and their relation to the delivery of a specific business service.

The complexity of defining business services increases with the move from a static to a dynamic environment. In the previous model, the components required for any particular business service were defined as physical entities. Now, with the advent of virtualization and automatic provisioning of virtual servers, the components can change at a moment's notice yet they still need to be associated with a particular business service. Thus, a management system must provide a dynamic modeling capability that can track the assets required for delivering individual business services.

The Challenge of Using Information Wisely

An effective infrastructure management solution should provide clear on-screen graphics and a wide variety of predefined reports that can inform and guide IT professionals as they work to ensure service and reliability.

Historical data, whether on-screen or in a printed report, is one of the most useful tools when analyzing individual devices associated with an incident or problem. Furthermore, historical data combined with "What If" scenarios are essential tools for effective capacity planning. Accurate information is one of the best ways to demonstrate an IT department's business value, especially when applied to operating and service-level objectives.

The Challenge of Anticipating Future Trends

Virtualization has followed a steady trend to reach the current generation of managing virtual servers and virtual machines. While IBM pioneered virtualization technology within the mainframe environment and VMware popularized its wider use in distributed environments, other major technology companies, including Microsoft, Citrix and Sun, have also developed virtualization products. In addition, industry- and company-specific standards continue to evolve. Thus, an infrastructure management solution should provide the ability to work with all significant vendors and any newly adopted standards.

In addition, organizations need management systems that can embrace newer generations of virtualization. Already major network equipment vendors, such as Cisco, are developing a new generation of virtual routers and switches. This means that IT organizations need to work with tool vendors that offer a complete virtualization strategy and a commitment to continuously expand their management toolset to handle new technologies and providers. Ideally, management tool vendors should have a close working relationship with the equipment vendors, so they can easily support new technologies as they come along.

The CA Spectrum and CA eHealth Opportunity

CA Spectrum Infrastructure Manager and CA eHealth Performance Manager have established a successful track record of effectively handling infrastructure and performance issues within large, complex IT environments. These two products simplify the IT management task and lower costs while helping to ensure reliability and quality of service (QoS).

In combination with CA Virtual Performance Management (CA VPM), these two products extend their proven capabilities to handle the increased complexity of virtualized server environments. Their ability to provide a unified management platform for the entire systems environment simplifies the management chore. Best of all, their ability to manage the physical and virtual technologies from multiple vendors with a single set of tools helps IT professionals lower the cost of management tool ownership.

CA Spectrum and CA eHealth offer a number of important features, including:

- Automated topology mapping
- Automated root cause analysis
- Proactive performance management
- Business service modeling and monitoring
- Informative report generation
- Multivendor support

Automated Topology Mapping

The issues involved in maintaining an accurate topology map grow significantly more complex within a virtualized environment, where a single physical server may host many different virtual machines. And topology maps of virtualized systems have to be updated in realtime, because applications and virtual machines can quickly shift from one host machine to another in response to application demands or capacity utilization policies. In addition, recent virtualization trends make it more difficult to do SNMP polling of the guests and host machines.

Because the latest version of VMware vCenter Server no longer enables the SNMP agent to be polled, CA eHealth and CA Spectrum must provide an alternative method to determine the network topology. CA VPM accomplishes this by placing a lightweight software agent on the vCenter to extract the relevant information from the ESX servers and their virtual machines. By working with this agent, the CA solutions are able not only to capture a rich set of health, performance and availability metrics, but also to receive migration updates to enable the creation of accurate topology maps.

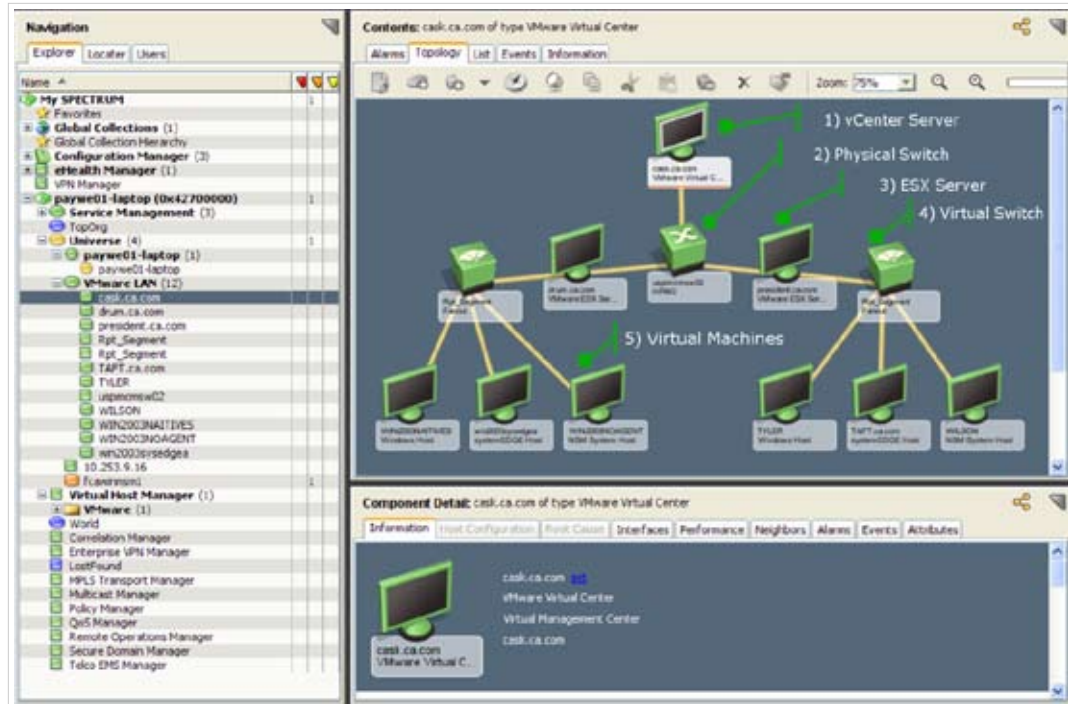


FIGURE A — Topology Map of Virtual Environment

CA software leverages patented CA AutoDiscovery technology to automatically identify all systems and network assets and build an accurate topology map of both physical and virtual elements.

In addition to understanding and depicting the relationship between the hosts and guests, the CA map represents the relationships between physical servers, server clusters, business services and the overall virtual center manager. The map includes Layer 2 and Layer 3 IP services along with all network devices down to the physical and logical port and circuit level for LANs, WANs, and wired and wireless environments.

In addition, the maps can visually depict each of the defined business services, allowing IT personnel to easily determine the elements that are required to maintain those services. This capability makes it easier for IT personnel to respond to infrastructure or performance issues created by an individual resource or by a combination of resources that comprise a critical business service.

Automated Root Cause Analysis

CA Spectrum is renowned for its root cause analysis (RCA) capabilities that help IT professionals troubleshoot and remediate issues impacting the complex infrastructure typically deployed by organizations today. In combination with CA VPM, CA Spectrum now performs the same intelligent RCA within the virtual environment as within the physical environment.

This RCA functionality is based upon CA patented inductive modeling technology that uses a sophisticated system of models, relationships and behaviors to create a software representation of the infrastructure.

The CA solution lets IT professionals quickly respond to the primary cause of an incident, as opposed to dealing with alarms on tens or hundreds of network elements that were impacted by the initial fault. For example, if a router fails, CA Spectrum will trigger an alarm on the router, suppress all the downstream alarms, and report these dependent events to a Management Lost Impact file that can provide additional information for IT professionals.

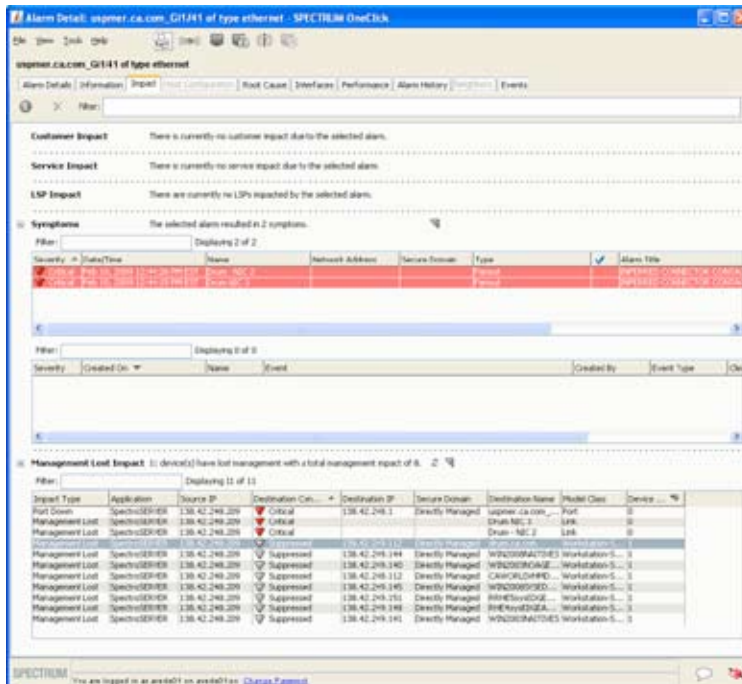


FIGURE B
Root Cause Analysis Within
A Virtual Environment
Showing Primary Cause
and Impacted Devices

The CA solution automatically troubleshoots issues by correlating and interpreting a set of symptoms and events to pinpoint the underlying cause and generate an actionable alarm.

Likewise, in a virtual environment, CA Spectrum will recognize the relationships between physical servers and their virtual machines. For example, if an ESX server hosting 10 virtual machines goes down, the system will generate an alarm on the physical server, but it will suppress alarms for all the associated virtual machines and only report these events as symptoms of the root cause.

Proactive Performance Management

A management system that triggers an alarm every time CPU, storage or I/O usage spikes would create an almost infinite number of alarms without indicating whether this is a transient event or a sign of impending failure and disruption of service.

Within a virtualized environment, the situation becomes more complex, because the system needs to measure the performance of both the physical and virtual machines. And, to understand virtual machine performance, the system needs to know how much of the host's resources are assigned to each of its guests, which can change over time. In addition, a guest or application can move to another host in response to unusual demands.

CA eHealth minimizes the number of false alarms caused by transient spikes by providing proactive intelligence that is based upon two primary algorithms — Time over Threshold and Deviation from Normal. These intelligent algorithms and numerous variations on them allow CA eHealth to understand normal behavior, and therefore generate an alarm only when abnormal behavior occurs. The intelligent algorithms ensure that performance exceptions are understood within a historical context and that only persistent degradation problems are reported.

TIME OVER THRESHOLD

This algorithm compares the value of a key performance indicator (KPI) at each poll to a predefined threshold and reports if the threshold value for a physical or virtual element has been violated for too long within a specified time window. Instead of generating a trap each time the threshold is crossed, the software aggregates the violations over time and determines if the violations represent a real problem. Significantly, the violations do not have to be continuously above the threshold, but can be a series of spikes within the measured time frame that add up to a persistent problem.

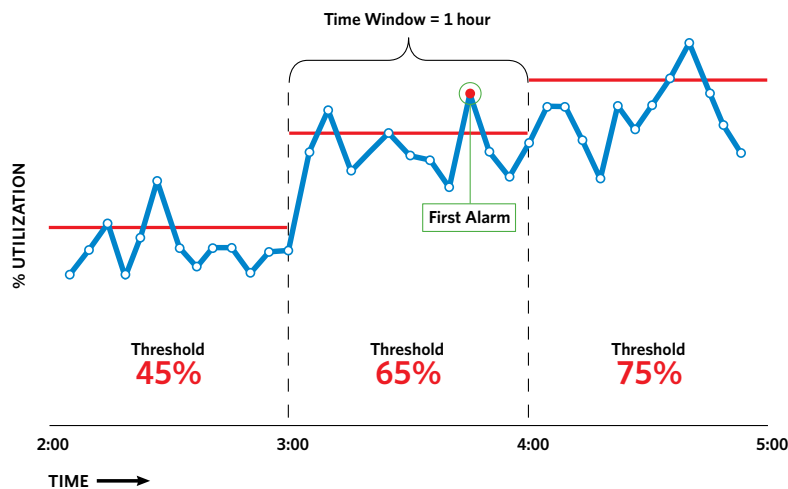


FIGURE C
Time Over Threshold Analytics
Filters Out Transient Spikes to
Avoid Nuisance Alarms

CA eHealth Time of Threshold only generates alarms for persistent issues; as in this example, random spikes do not trigger alarms.

CA eHealth provides predefined, out-of-the-box Live Exceptions and profiles for each KPI that are based on its certification of hundreds of third-party IT infrastructure devices, which helps ensure that all components are fully monitored and evaluated. These predefined KPIs can be modified and manually configured to reflect an organization's unique requirements and practices.

DEVIATION FROM NORMAL

This algorithm measures the end-to-end performance of an organization's infrastructure. Unlike set and forget systems that compare current performance to a fixed threshold, CA eHealth uses an organization's own historical data to establish a baseline for what is normal for a specific day and time and then determines whether the current behavior deviates from that norm, including both "above normal" and "below normal" settings.

The algorithm's adaptive thresholding allows the system to conform to the real life experiences of the IT department, where their network and systems exhibit different performance metrics throughout the day and week. The algorithm automatically adjusts normal thresholds based upon rolling averages calculated over a period of weeks, where a six-week window gives a good baseline. This algorithm lets CA eHealth successfully adjust to the dynamic nature of most infrastructures by correlating current behavior to expected behavior determined from actual past experience.

Business Service Modeling and Monitoring

The ability to manage and display the infrastructure elements required to deliver service to particular functional groups is an important capability of CA Spectrum. The CA solution allows an organization to specify all the resources, such as physical servers, virtual machines, routers, switches and other components, relied upon to deliver service to defined business units, such as departments, interrelated organizations or geographic regions.

For example, a large multinational corporation might model the network components that relate to each of its business units, such as finance, sales, marketing and engineering, as separate business services. It also might map individual locations, such as factories or remote offices, as distinct services. And it might roll up the elements required to support disparate physical locations as individual services, such as a service that connects all its regional sales offices or a service that connects all its international offices with its headquarters.

Once business services are identified, the CA solution can measure quality of service and perform fault analysis for both the overall infrastructure and for the individual business services. Best of all, its sophisticated modeling capability and automated topology mapping let the CA solution manage all the infrastructure elements of a defined service even when virtual machines migrate to new locations.

By defining and managing business services in this fashion, the CA solution gives the organization a complete understanding of the relationship between the health of each component and the service delivered to a particular group. The CA solution also allows an IT department to closely align the services with its business model. This capability allows IT to manage its infrastructure in ways that maximize business value. For example, IT might want to concentrate on restoring an organization's most critical services first, such as restoring its call center service before worrying about issues impacting a less critical department.

Informative Report Generation

Many products can create performance displays and reports, but simple reports without an intelligent perspective provide little value to an IT organization. CA eHealth and CA Spectrum provide clear, insightful displays of infrastructure information on-screen and in preformatted, printed reports for business presentations, resource planning, capacity utilization studies and all other management requirements. These reports make it easy for IT personnel to concentrate on the important facts while stripping away extraneous details, which leads to quicker action and more successful outcomes.

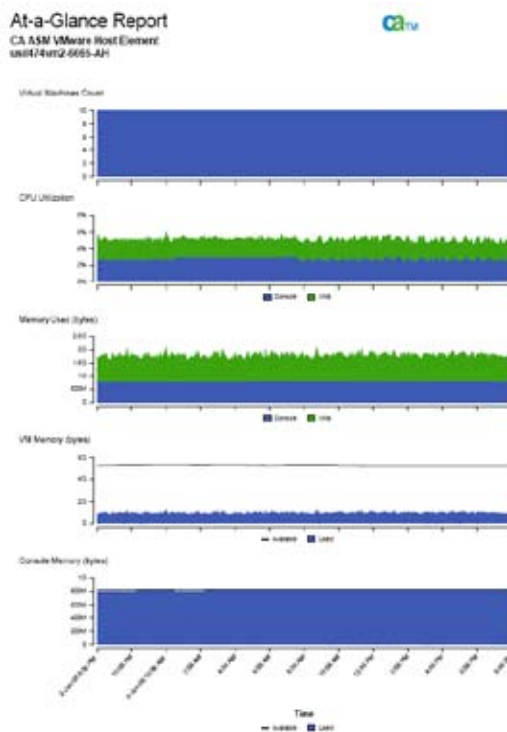


FIGURE D
At-a-Glance Report From CA eHealth

With this predefined, out-of-the-box CA eHealth At-a-Glance report, IT has a snapshot view of multiple aspects of a virtual server, such as Machine Counts, CPU Utilization, Memory Used, VM Memory and Console Memory.

CA eHealth provides on-screen graphics showing performance values for all the physical and virtual elements of the infrastructure. The comprehensive on-screen At-a-Glance and Trend reports show status, performance, threshold violations, trends and historical information for:

- Virtual centers
- Physical hosts, including machine counts, CPU utilization, memory used, VM memory and console memory
- Datastores
- Virtual machines, including heartbeats, CPU shares, memory allocation and percentage of memory actually used
- Virtual Disks, including bytes/sec (read/write)
- Virtual Networks, including bytes/sec (sent/received)

CA eHealth also creates sophisticated performance reports that combine historical and real-time metrics with intelligent analysis. The powerful performance reporting illustrates important trends and helps facilitate capacity planning.

Likewise, CA Spectrum creates a wide variety of preformatted SLA reports verifying the performance of service components over a variety of time periods. The comprehensive reports provide great management tools for documenting compliance with SLAs and showing the value of IT to the business.

Multivendor Support

CA Spectrum and CA eHealth are designed to support the management of network devices, systems, databases and applications in a multiplatform, multivendor, multiprotocol environment. CA supports an impressive list of leading and emerging vendors that span the IT industry. Partnerships with key virtual server technology suppliers, such as VMware, IBM, Microsoft, Sun and Citrix, are key relationships for CA as it enhances its management capabilities in this area.

Multivendor support is particularly important within virtualized environments, where a single physical device can run numerous operating systems and applications. Furthermore, a CA virtualization survey conducted in 2008 found that 56% of organizations are already employing more than one virtual server technology for their IT operations. This makes it extremely important to have management tools that cover a wide range of technologies in place.

Recognizing the industry's continued growth and the emergence of new vendors and protocols, CA continually enhances its products to remain abreast of vendor developments and technologies. This evolution helps ensure that CA solutions can remain the central focus of an IT organization's management capabilities and eliminates the tool sprawl that occurs when an organization feels the need to buy specialized tools to handle specific parts of the infrastructure.

Benefits

CA Spectrum and CA eHealth deliver significant benefits to IT organizations by reducing costs, improving IT efficiency and ensuring quality of business service delivery. The two CA solutions let organizations gain the financial and performance benefits of virtual servers while maintaining the ability to automatically monitor and respond to issues.

Reducing Costs

CA eHealth and CA Spectrum help IT departments reduce costs by leveraging their existing investments in infrastructure management tools to handle both the physical and virtual systems.

With their ability to manage physical and virtual environments, CA solutions ensure that IT departments don't have to acquire, learn and maintain a wide variety of vendor-specific tools. With the growing use of virtualization technologies, it is now extremely important that a management system, such as CA eHealth and CA Spectrum, offer the capability of handling both the physical and virtual elements within the infrastructure.

Of course, the costs of relying on multiple tools extend far beyond the initial purchase price. In addition to the upfront cost, IT departments must consider the training costs, the maintenance costs, and the ongoing cost of trying to correlate information provided by different tools when each tool can only view a portion of the infrastructure.

With their ability to highlight systemic problems and rapidly resolve issues, CA eHealth and CA Spectrum help organizations avoid the biggest cost of all, which is a disruption or degradation of service that leads to loss of productivity and risk to the business.

Improving IT Efficiency

CA eHealth and CA Spectrum let IT professionals manage their physical and virtual infrastructure under a single management framework. The ability to view their heterogeneous environment through a single pane of glass provides IT with an efficient, integrated understanding of their complex operations and streamlines management tasks.

The payoff from an effective RCA system is extraordinary. It has often been said that with incident resolution, 80% of the time is spent finding the problem and 20% goes into fixing it. Without effective RCA, IT departments will continue to spend inordinate amounts of time trying to determine if the incident was based upon a network, system, database or application issue.

By clearly indicating the primary fault, CA Spectrum saves diagnostic time and lets IT personnel restore the infrastructure to proper functionality more quickly. For some customers, CA Spectrum has improved the time it takes to find and fix a problem by 50% or more. Quick restoration is important because outages and impairments become extremely expensive when they start to interfere with an organization's everyday operations or violate a contracted service-level agreement.

With its automated discovery and visual displays, the CA management solution helps eliminate the inefficiencies of virtual sprawl, which is a growing problem for many organizations. With the proliferation of virtual machines, an IT department may have little idea how many virtual machines are running, where they are located, or how efficiently they are using the resources allocated to them. With the CA solution, IT can get a handle on all its physical and virtual assets and their utilization. The performance information helps IT departments reduce redundancy and use all their IT assets more efficiently.

Best of all, by automating many of the routine tasks, CA eHealth and CA Spectrum free IT professionals to concentrate on the more important issues facing their department.

Ensuring Quality of Service

The integrated CA infrastructure and performance management solution help network operators proactively address issues before users are impacted, which is the key to delivering the exceptional quality of service that organizations demand. In combination with CA VPM, CA eHealth and CA Spectrum can now ensure service quality for the virtualized network.

By comparing current infrastructure performance to historical benchmarks, CA eHealth helps IT professionals resolve performance abnormalities before they reach a critical state. In addition, the system's ability to collect and display performance metrics, including the resource allocation and utilization of physical and virtual servers, helps management perform capacity planning to ensure service isn't interrupted due to a lack of capacity.

CA Spectrum provides the sophisticated event correlation and RCA capabilities that IT professionals need to quickly isolate and resolve incidents. In combination with CA VPM, CA Spectrum monitors the logical relationships between physical servers and their VMs and detects the movement of VMs to new hosts, which helps in understanding the difference between the root cause and the events that result from it. The ability to suppress symptomatic alarms lets IT professionals concentrate on the critical fault and therefore quickly restore the business to full functionality.

Conclusions

In addition to its commitment to supporting multiplatform, multivendor, multiprotocol infrastructures, CA has implemented a long-term strategic focus on virtualization. This corporate priority has enabled CA to become the leader in management solutions for virtual environments. The company's virtualization focus and its tight relationship with virtual technology providers, such as Cisco, Citrix, IBM, Microsoft, Sun and VMware, help ensure that CA will continually enhance its IT management solutions to support the latest developments in virtualization.

The CA commitment to support evolving virtual technologies is important both as additional manufacturers release virtual systems and as new types of virtualization are developed. For example, major network equipment suppliers are currently developing new routers and switches that fully embrace virtualization. The CA commitment to virtual technologies will become increasingly important as this next wave of virtualization is adopted.

The CA commitment to supporting multivirtualization environments helps ensure the long-lasting relevance and efficiency of your CA management systems.

About CA

CA (NASDAQ: CA) is the world's leading independent IT management software company. With CA's Enterprise IT Management (EITM) vision and expertise, organizations can more effectively govern, manage and secure IT to optimize business performance and sustain competitive advantage. For more information, visit www.ca.com

To learn more about CA eHealth NPM, CA Spectrum and other CA products for virtualized environments, visit ca.com.