WHITE PAPER

A New Dimension in IT Infrastructure Management: Integrated KVM and Serial Console Control Systems

Sponsored by: Raritan

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DATA CENTER SPRAWL

Today, companies are shifting to Web-centric computing to support their extended enterprises. This shift has led to the phenomenon of data center sprawl — the proliferation of large, multiplatform, heterogeneous IT infrastructures with geographically distributed applications and human resources. IDC believes this sprawl will grow in a number of dimensions:

☐ In 2003, 5.2 million servers shipped worldwide; in 2008, server unit shipments are expected to increase to more than 9 million.

☐ Much of this growth is due to the introduction of blades into the marketplace. In 2003, 184,694 blades were shipped; in 2008, unit shipments of blades are expected to increase to more than 3 million.

☐ Along with the increase in the number of server shipments, there will be a corresponding increase in the shipment of peripheral devices such as networking switches and routers. In 2003, 103 million LAN switch ports were shipped; in 2008, shipments of LAN switch ports are expected to increase to more than 170 million.

Managing all of these servers and peripherals has become even more of a challenge as issues of security, reliability, and serviceability have grown in importance for IT managers and CIOs. These issues will only increase over time.

ENTERPRISE NETWORK COSTS AND COMPLEXITY

As an enterprise's IT infrastructure increases in size, so does its complexity, even to the point where there are negative impacts on economies of scale. Despite this situation, CIOs and IT managers are expected to improve efficiencies and productivity with a budget that is the same as, or less than, the previous year's. IT executives are faced with reducing staff; operation, administration, and maintenance (OA&M) costs; physical space allocations for servers and peripheral devices; electricity costs; HVAC costs; and cabling requirements. Achieving all of this with limited resources, while making sure the network is always up, robust, and secure, is a significant challenge.

The average cost associated with server hardware (average sales price) has decreased over the past decade, due to competition and increased use of industry-standard components, but overall IT costs have not declined. In fact, system administration costs as a percentage of total data center costs have continued to rise (see Figure 1).

FIGURE 1

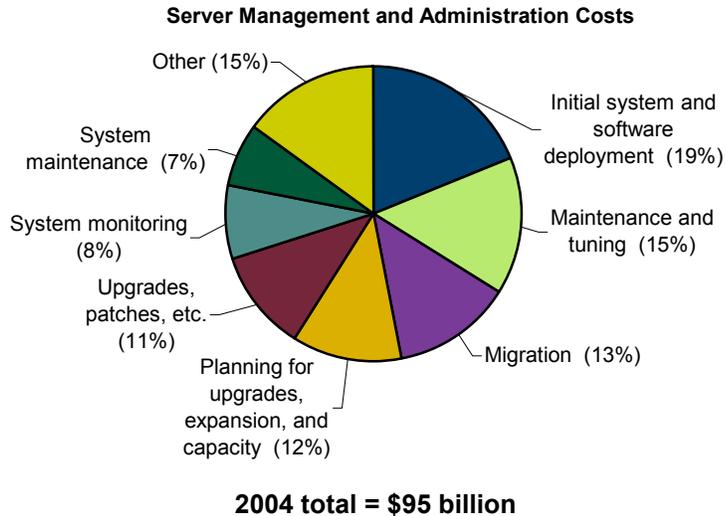Worldwide New Server Spending and IT Management Costs, 1996–2008
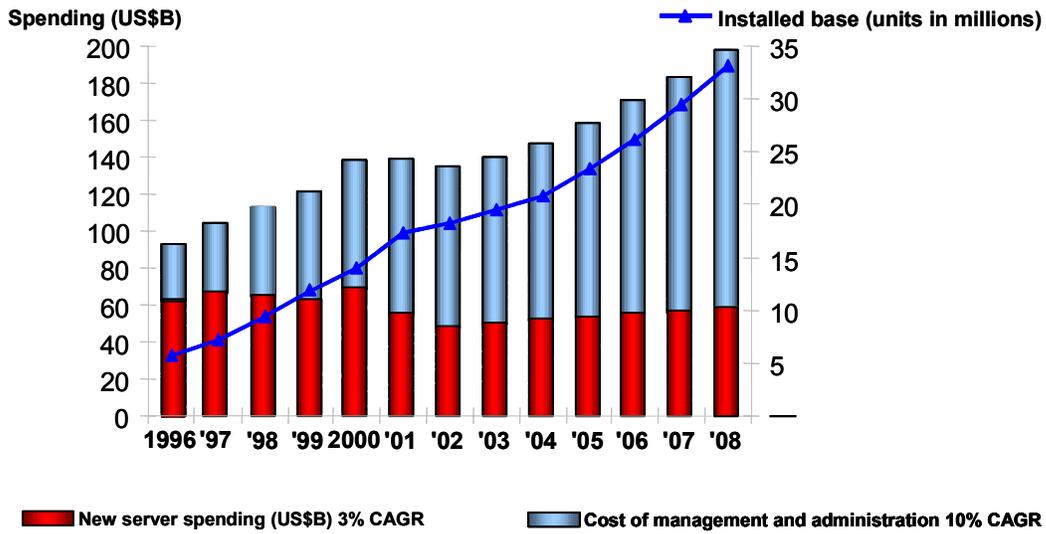
Source: IDC, 2004

IDC's research into total cost of ownership (TCO) shows that much of the after-purchase costs that are associated with server platforms are driven by inefficient use of management resources, downtime and its associated costs, and diminished productivity of management staff and end users (see Figure 2).

Where Are the Operational Costs Going?

Server Management and Administration Costs

Other (15%)

System maintenance (7%)

System monitoring (8%)

Upgrades, patches, etc. (11%)

Planning for upgrades, expansion, and capacity (12%)

Initial system and software deployment (19%)

Maintenance and tuning (15%)

Migration (13%)

2004 total = $95 billion

Source: IDC, 2004

Not only has data center and management complexity increased, but the cost of system downtime has also increased as companies depend more and more on their IT equipment to run their businesses. Airlines lose tens of thousands of dollars in new reservation revenue for every minute their reservation systems are down. Companies that host Internet auctions lose millions of dollars every day when transactions cannot occur due to a failed server farm or network. For these companies and others, revenue depends on servers being up and running at maximum efficiency. Many CIOs now consider email to be a mission-critical computing workload due to lost employee productivity during email outages.

Reductions in easily identified data center costs, as well as cost reductions associated with better management and reduced downtime that improve productivity and efficiency, fall directly to a firm's bottom line. Because of these factors, reducing mean time to repair (MTTR) is an important component in data center management. The ability to monitor alarms, troubleshoot, and repair in real time is of utmost importance.

IT MANAGEMENT ALTERNATIVES

Many companies have sophisticated software, such as the HP OpenView and IBM Tivoli enterprisewide management frameworks, for surveillance, alarming, and trouble ticketing of data center equipment. However, once a fault is identified, these systems have limited capabilities for actually accessing, controlling, and fixing devices without an IT administrator being present at the local device to make the repairs. In fact, these systems are limited to what can be controlled through

the network interface card (NIC) and, therefore, can be accessed only when the device operating system (OS) is up and running in a healthy state (see Figure 3).

F I G U R E   3

Manageability Domain
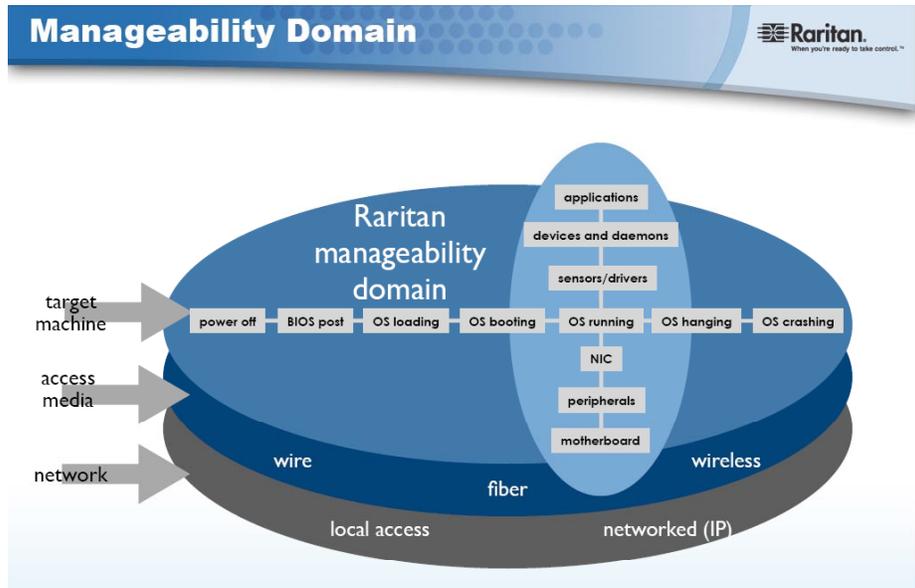
Source: Raritan, 2004

What happens if a trouble ticket is sent to an IT administrator in the middle of the night and the operating system on the server has crashed? Without remote BIOS-level access and the ability to reboot the machine, regardless of the state of the operating system, the IT administrator must travel to the site to diagnose and fix the system problem. Addressing this situation takes valuable time — time that the IT administrator could spend working on other types of problems, time while the system is down, and time while the company is losing revenue.

Some companies use different platform-dependent software packages, such as pcAnywhere™ for Microsoft Windows devices, Telnet for Unix servers, and CiscoWorks for Cisco's networking platforms. Such situations may require more than one software package because of the presence of multiple hardware platforms, operating systems, and applications, thus adding cost to the equation — and making trouble identification and isolation of offline devices more difficult. It is also important to note that the operating system on the target device still has to be in a healthy state for problem identification to take place, let alone for repairs to be implemented.

Today's IP-enabled KVM switches and serial console servers give data center managers and administrators the equivalent of "at the rack" BIOS-level access to thousands of servers and other devices anytime and anywhere.

But KVM switches and serial console servers solve only part of the problem-set that is created by size and complexity. In an enterprise-scale deployment with thousands of servers and hundreds of KVM switches and console servers, once a trouble ticket has been generated, finding the servers or network elements that have reported a fault can be time-consuming. And every minute of downtime results in decreased productivity and increased expense, resulting in lower profits for the company.

There is also the issue of security (see Figure 4). IDC research has shown that system security and system accessibility policy rights have grown exponentially in importance and complexity. IT administrators have to assign specific system access based on job function, and that access may have to extend to a combined total of hundreds of administrators and other technicians across a corporation. A firm with 10,000 servers and a 20:1 server/administrator ratio would have approximately 500 administrators and would likely have several hundred KVM switches and console servers. Administrating and monitoring security policies for hundreds of administrators across hundreds of switches, one switch at a time, is quite complex and time-consuming.

FIGURE 4

Worldwide Percentage of Server Spending for Security
Workloads, 2000−2008
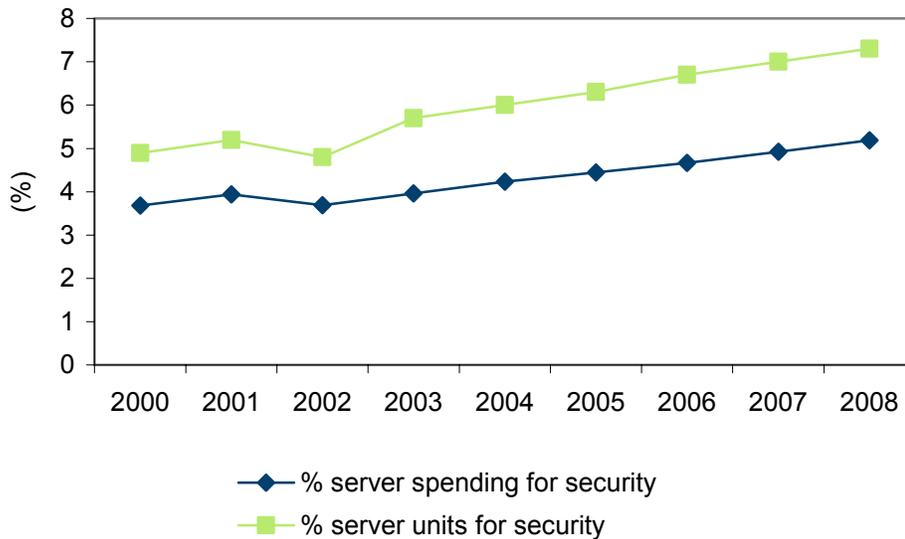
Source: IDC, 2004

KVM ARCHITECTURES

As infrastructure has grown and matured, so too have the management concerns that surround the ever-increasing number of servers and server blades. KVM and serial console equipment has evolved from a simple two-way switch to a sophisticated combination of hardware and software that enables IT administrators to control thousands of servers and other data center devices. There are two main architecture
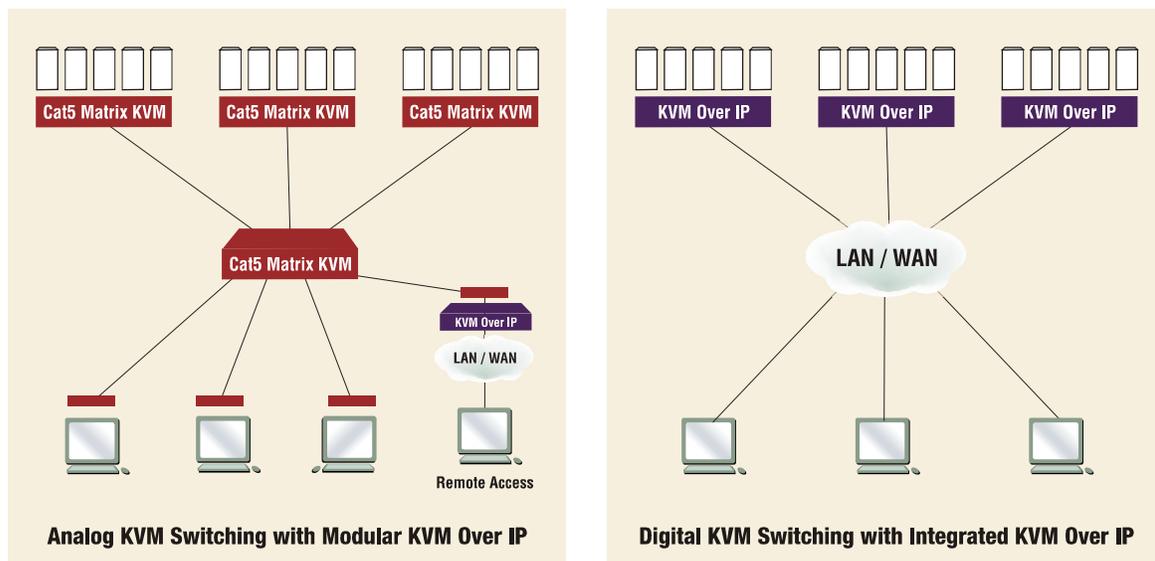
options for consolidated KVM switch solutions: analog KVM switching and digital KVM switching with integrated KVM over IP. Factors to be considered in selecting which type of solution to use include the following:

- ☑ **Deployment size.** How many servers and simultaneous users need to be connected in one location?

- ☑ **User proximity.** Will the administrators be in or near the data center, or will they be in one or more remote locations?

- ☑ **Cabling.** Are there existing cable runs that can be used, and is there space to pull more cable?

- ☑ **Number of simultaneous users.** How many administrators will need simultaneous access to the system, and how many will need simultaneous access to a specific rack?

- ☑ **Security.** What levels of security (including authentication, authorizations, and usage accounting) are required, and where?

Analog and digital KVM (both types are shown in Figure 5) have advantages and disadvantages:

F I G U R E 5

Types of KVM Equipment

Analog KVM Switching with Modular KVM Over IP | **Digital KVM Switching with Integrated KVM Over IP**

Source: Raritan Computer, 2004

- ☑ **Analog KVM** switching provides out-of-band access and is therefore network-independent. It is normally deployed in a centralized data center environment where UTP (Cat5/5e/6) or coaxial cabling is used to hardwire the servers directly to the KVM switch. Remote access can be achieved through a KVM-over-IP gateway at the front end of the KVM switch. (Analog KVM provides better video performance and requires less network bandwidth if a KVM-over-IP gateway is used for remote access.) Even if the network is down, the IT administrator has access to the servers to diagnose system problems and to start repairs. Analog KVM switches can provide nonblocked access to larger numbers of users than digital KVM switches. Users can be up to 1,000 feet away from the switch, a situation that is well-suited to a centralized data center environment. Analog provides the best video images and mouse synchronization because there is no LAN-related latency that can affect delivery of the data bits. Naturally, KVM implementations where all of the servers are hardwired to a centralized switch require more UTP (Cat5/5e/6) cables than digital KVM implementations, which have a switch at the bottom of each rack. Analog KVM switches are ideal for data centers where several IT administrators require unblocked access to a large number of devices.

- ☑ **Digital KVM** switching with integrated KVM over IP is an alternative to analog KVM. Because digital KVM is network-dependent, server management capability disappears in the event of network downtime. However, there are several advantages to this type of deployment. (IDC notes that an IT administrator can also use a modem device to have server access, if necessary.) Because management is performed over the network, less cabling is required than with analog KVM. Adding servers is easy because digital KVM leverages the existing LAN infrastructure. Because there is less cabling, this solution offers reduced costs and less disruption to the work environment. Some disadvantages of digital KVM include greater bandwidth consumption and increased latency because connectivity is performed over the LAN. KVM over IP is well-suited for an enterprise deployment where management of over 500 servers is required, especially when the servers are deployed in multiple locations.

A RECIPE FOR SUCCESSFUL MANAGEMENT

Managing IT infrastructures to optimize ROI requires not just a collection of KVM switches and serial console servers but rather an integrated suite of tools and a management architecture that provide the following:

- ☑ Reduced complexity through aggregated access as well as both physical and logical views of all IT assets

- ☑ Reduced MTTR and downtime with remote BIOS-level and console-level control to servers and other IT devices

- ☑ Reduced TCO by minimizing space, hardware, electricity, and cabling requirements, as well as streamlining OA&M

- ☑ Improved ROI by protecting existing investments, lowering costs, and increasing productivity and flexibility

The Business Value of Integrated KVM and Hardware-Based Infrastructure Management Tools

Many KVM and serial console servers improve administrator productivity; reduce downtime by shortening MTTR; and lower TCO by saving space, cabling, hardware, and electricity. However, enterprise-scale deployments have unique problems created by sheer size, and they require more functionality than the basic KVM and serial console control technology provides. Some KVM alternatives have evolved into very sophisticated management tools that work hand in hand with today's enterprise operational support systems (OSS). Companies should look for management solutions that do the following:

☑ **Reduce complexity** by providing a single sign-on to a single IP address, along with a consolidated view of all the devices in the entire corporate network. Users should be able to define customized physical and logical views of the infrastructure so that they can view just those segments of the network where they need to quickly accomplish their tasks.

☑ **Lower MTTR** by providing remote and local KVM and/or serial console control, as well as power control. Secure remote access, with a single sign-on to user-defined physical and logical views of the infrastructure, creates an environment in which administrators can quickly locate and access the devices that need to be fixed. Because administrators have BIOS-level and power control, they can troubleshoot and repair the fault, regardless of the machine's state. As a result of remote system access, the IT professional does not need to travel to the site to repair it, thereby reducing travel costs and network downtime. Should additional help be required, authorized personnel can combine resources and jointly troubleshoot a system problem, even if they are working from different locations around the office, or around the world.

☑ **Reduce TCO** by allowing an individual to simultaneously support system maintenance and administration on several systems, which will reduce system administration headcount requirements. By taking this approach, existing IT staff can be redeployed to improve reliability in other areas of the operation. Because remote access to the servers is provided, OA&M costs are reduced, and the overall result is better staff utilization and collaboration.

IT administrators may assign specific system accessibility rights based on job function and job title, and this access can be provided to hundreds of administrators and other technicians, if needed. With centralized role-based policy administration, a complete IT infrastructure can be managed by one person from one location, resulting in significant cost savings, fewer mistakes, and improved security. Users should be able to define multiple logical attributes for devices — the targets connected to the ports on the devices — and then use those attributes to group the devices and ports (targets). In this way, security policies can then be written based on the device and port groups, and they can be assigned to user groups. These policies should be distributed automatically with hardened security and encryption to all of the devices, using a single mouse click, thus saving time compared with administering each switch separately.

☑ **Improve flexibility** by employing a modular architecture to allow for easy modification and expansion. Some firms may deploy a scale-out IT infrastructure, using numerous x86 servers to replace a scalable server or mainframe, while others deploy a server consolidation strategy in order to reduce the number of servers installed. Ideally, in both cases, equipment can be added incrementally or redeployed, which has the potential to save many thousands of dollars annually.

Flexibility is key to supporting "utility computing," a service provisioning model in which a service provider makes computing resources, data services, and infrastructure management available to the customer, as needed. This approach, sometimes known as pay-per-use or metered services, is gaining adoption in the enterprise computing market space. However, adoption of this approach to computing is expected to become more widespread with the delivery of advanced virtualization, provisioning, and management software over the next few years.

As data centers move toward utility computing, provisioning by user-defined logical views (e.g., business processes and specific data services) becomes more and more important. IT staffers must view data center resources by hardware technology type or by operating system type, which slows down problem isolation in today's computing environment. For example, IT staffers may want to identify the source of downtime for a CRM system running on a Unix server. It would be more efficient for a manager who is responsible for a specific application or business process, such as CRM, to define a logical view that displays only the devices related to the CRM process itself rather than to search all the Unix servers on the network. In another example, a view could be defined for a manufacturer's onsite technical support representative that displays only the equipment from that manufacturer in a particular data center, or in a particular country. Such a system simplifies what may be a very complex infrastructure by making it quicker and easier for administrators and service personnel to locate and access the devices they need from the hundreds, or thousands, of devices that make up the enterprise network.

KVM: MEETING DATA CENTER CHALLENGES

KVM equipment has become more sophisticated over just the past five years. It should be considered an integral part of the IT network, and it should be included in any short-term or long-term infrastructure designs and upgrade plans. KVM, along with IT infrastructure management software, can improve system reliability, manageability, and security, resulting in lower TCO and less downtime.

In both large enterprise establishments and small companies, KVM and serial console solutions should be used in partnership with management software alternatives. When we take into account the TCO of a data center and the cost of downtime, we realize that KVM solutions are a small investment that allows access to the system when other options are not viable or fail.

RARITAN'S MANAGEMENT SOLUTIONS

Since its inception, Raritan has been a technology leader in its market space, providing solutions that improve IT efficiency and lower costs. Raritan was a pioneer in providing the following:

☑ KVM over coax

☑ Keep-alive emulation

☑ KVM over UTP (Cat5/5e/6), KVM over fiber, and KVM over Web browser

☑ Integration of KVM over IP and serial over IP in a 1U rack space device

☑ Enterprise device management

Raritan provides enterprise-class scalable solutions for improved server and device management, increased IT administration efficiency, lower TCO, and better ROI. From coax to UTP (Cat5/5e/6) cabling to wireless, as discussed in this paper, Raritan technology provides the flexibility to satisfy a variety of specific requirements in the heterogeneous server environment, including the following:

☑ Reduces complexity with aggregated access from anywhere via secure unified logical views through a browser interface. Allows remote cross-platform access and control to all servers on the network from one IP address at the BIOS level. Supports USB, Sun, IBM PS/2, and ASCII (serial device) platforms with modular architectures.

☑ Reduces MTTR with intelligent, centralized management that minimizes costly downtime by supporting BIOS-level fixes to OS problems and remote deployment of new applications.

☑ Reduces TCO by streamlining OA&M and by simplifying deployment and setup through plug-and-play operation and role-based policy administration.

☑ Improves ROI through seamless integration with multiple KVM switches and serial console management appliances connected to as many as thousands of IT devices. Enables access to any server on the network, even from remote locations, to address issues of concern before trouble occurs.
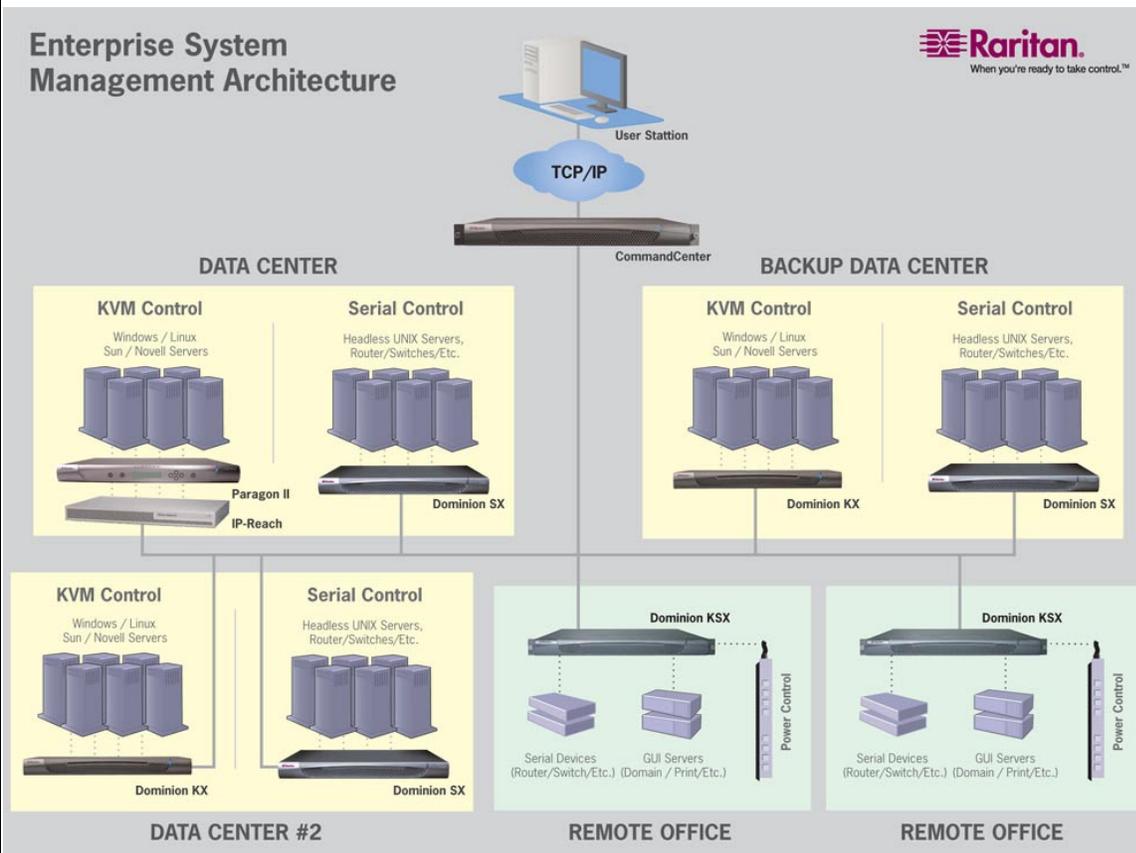
CommandCenter™

Raritan's new CommandCenter product ties together both digital and analog KVM solutions (see Figure 6). CommandCenter offers IT managers and service providers improved access to, and control of, hundreds of heterogeneous IT devices in data centers or remote offices.

FIGURE 6

Raritan CommandCenter[TM]

Source: Raritan, 2004

Dominion™ Series

The Dominion Series supports as many as 50 simultaneous users over the network. It uses digital KVM transmission with low bandwidth utilization and 128-bit encryption of video as well as keyboard and mouse information.

Three Dominion Series products address the demands of different IT infrastructures:

☐ **Dominion KX** is an enterprise-class digital KVM switch that allows BIOS-level control of servers from any location via a Web browser. This device can scale up to support hundreds of users and thousands of servers in a single KVM network.

☐ **Dominion SX** is a serial console server enabling serial-over-IP access via Secure Socket Shell (SSH) or a Web browser. Dominion SX provides secure remote access to serially managed servers and network devices, scaling to support hundreds of users and thousands of devices, including servers, routers, switches, virtual private networks (VPNs), and power strips.

◻ **Dominion KSX** is an integrated KVM-over-IP and serial-over-IP appliance designed to manage the variety of equipment that is typically found in the server closets of remote offices and branch offices. It provides all the features necessary for managing both Windows-based servers and serially controlled devices in a single, self-contained appliance via a Web browser.

Paragon® II

Paragon II, Raritan's analog KVM switch, is modular in design and can be expanded as the IT infrastructure grows. The Paragon product family has been in the field for over four years, controlling more than one million servers.

Raritan has a full complement of KVM equipment. With the introduction of CommandCenter, analog and digital KVM-over-IP solutions provide a high degree of management control both locally and remotely. Raritan's products can grow as the server infrastructure expands, and the equipment is both forward- and backward-compatible, a benefit not available from all KVM vendors.

CHALLENGES

When combined with management hardware and software, KVM and serial console technology can improve system reliability, manageability, and security, resulting in lower TCO and less downtime. It is critical that KVM and serial console equipment be part of any initial design and upgrade plans for networked devices, including client devices and servers. CIOs must be part of the system design process from the outset so that the resulting solution is successful. KVM and management hardware should be considered to be an integral part of the IT infrastructure rather than a nice-to-have add-on technology.

The challenge for KVM manufacturers and suppliers is to educate the marketplace, communicating with IT executives and CIOs about the long-term benefits of a complete KVM solution. IT administrators are often more concerned about short-term solutions, whereas CIOs tend to be concerned with long-term IT planning issues.

KVM equipment has become more sophisticated over the past five years and provides much more capability than it did in the early phases of its evolution. The challenge for KVM players is to raise product awareness and to show the benefits of a KVM solution to CIOs through a cost-benefit analysis.

KVM solution technology has changed over the past few years. Some vendors now offer KVM-like solutions that are embedded into the motherboard. Vendors with these offerings could be a threat to traditional KVM players. The challenge for Raritan is to stay ahead of the technology curve. The company needs to expand its product offerings through acquisitions. Raritan's acquisition of Peppercon AG portends an expansion of Raritan's OEM channel and new embedded remote management systems and subsystems. Competitors such as Avocent have taken the acquisition approach and been quite successful. The KVM landscape is evolving, and Raritan must evolve with it. Although Raritan is on the right path for continued success, it must look outside the KVM-only solution and evolve with the computer marketplace.

ABOUT RARITAN COMPUTER

Raritan Computer Inc. is a leading supplier of IT infrastructure management solutions for secure access, monitoring, and management of servers and other IT devices in data centers and remote offices. Raritan was founded in 1985, and since then the company has made products that are used to control millions of servers at more than 50,000 network data centers, computer test labs, and multiworkstation environments around the world. Raritan's complete line of compatible and scalable KVM and remote connectivity products for small/medium-sized businesses and enterprises offers IT professionals the most reliable, flexible, and secure in-band and out-of-band solutions for managing data center equipment while improving operational productivity. More information on the company is available at www.raritan.com.

MEETING THE CHALLENGES

Raritan has a full complement of KVM equipment and, with the introduction of its CommandCenter framework, is in a position to offer both analog and digital KVM-over-IP solutions with a high degree of management control both locally and remotely.

Continued user education will be required to raise the level of awareness of how KVM solutions have advanced into an enterprise play over the past several years. Raritan could leverage remote demonstrations of its solutions in order to show them to IT administrators, as well as CIOs, at a lower cost than onsite sales calls. The company should take advantage of this opportunity, as well as increase solution sales support materials for its resellers, as some of its competitors have recently done. The Raritan KVM solution suite provides high system availability, security, and manageability. With increased user education, Raritan is in a position to increase its market share in the KVM solution marketplace.

In the long run, Raritan must continue to evolve along with technology enhancements in management infrastructure tools. The company will be able to respond to some of these challenges internally, but it must continue to broaden its product offerings through acquisitions. Although Raritan has made some acquisitions, it has not done so at the same pace as some of its competitors.

CONCLUSION

When combined with management hardware and software, KVM technology can improve system reliability, manageability, and security, resulting in lower TCO and less downtime. It is critical that KVM equipment be part of any initial design and upgrade plans for networked devices, including client devices and servers. CIOs must be part of the system design process from the outset so that the resulting solutions are successful. KVM and management hardware should be considered an integral part of the IT infrastructure rather than a nice-to-have add-on technology.

CIOs must understand that the use of KVM equipment, when properly partnered with management packages that allow system monitoring and repair, results in reduced operational costs. This is especially important in a time of budgetary constraints and limited IT resources.

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