



## Fujitsu Lays Foundation For Virtual Infrastructures

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### Executive Summary

Fujitsu brings a unique perspective to the growing market for virtualization solutions, derived from its long experience with mainframes, its leading-edge blade server technology, and its balanced portfolio of servers based on different processor architectures. Much of the recent interest in virtualization has been driven by VMware, which brought server virtualization capabilities to industry-standard x86 systems. Indeed, with its PRIMERGY line of x86 servers, Fujitsu is well positioned to support the use of the industry-standard virtualization platforms such as VMware, Microsoft Windows Server 2008,<sup>1</sup> and Red Hat Enterprise Linux 5 (RHEL 5). PRIMERGY servers are available in rack, blade, compact, and tower form factors, providing a range of platforms that customers in organization of all sizes can use to host x86 virtual machine platforms.

### IDEAS RECOMMENDATIONS

IDEAS offers the following recommendations for users considering Fujitsu's virtualization solutions:

- » Identify which virtualization platform is most appropriate based on the characteristics and importance of the workloads that are being virtualized. Deploy workloads appropriately based on the relative maturity, robustness, and scalability of virtualization functions available for Fujitsu's platforms, including PRIMERGY, PRIMEQUEST, and PRIMEPOWER. On PRIMERGY, understand the functional tradeoffs between VMware, Microsoft Windows Server 2008,<sup>†</sup> and Xen implementations such as Red Hat Enterprise Linux 5.
- » When considering the impact of virtualization on management tools and procedures, focus on managing the relationship and dependencies between virtual resources and their physical counterparts. On x86 systems, also focus on acquiring improved provisioning capabilities to automate as much as possible the process of populating virtual machines with the software and updates needed to host their workloads.
- » Measure the performance characteristics of application workloads being considered for virtualization. Study their dependencies on processing, storage, and networking resources. Evaluate tools such as Systemwalker Resource Coordinator Virtual Server Edition to bind applications with equivalent virtual resources.

<sup>†</sup> Planned.

<sup>1</sup> Planned.

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**Fujitsu's Systemwalker Resource Coordinator Virtual Server Edition (RC VE) provides a single management view that enables the control of both physical and virtualized blade servers. This capability directly addresses one of the most pressing needs identified by administrators engaged in large-scale virtualization deployments.**

Moreover, some workloads may require a stronger foundation than x86 platforms can provide. Fujitsu's choice of high-end PRIMEQUEST and PRIMEPOWER platforms, each with advanced virtualization functions, represents a key added value for organizations that want the confidence to virtualize their most critical applications. Fujitsu also has several offerings in its portfolio of storage products that complement its server virtualization capabilities with effective storage virtualization support. A true strength of Fujitsu's VS900 switch lies in the integration of its management capabilities. The ETERNUS SF AdvanceCopy Manager allows routine tasks such as backup, restore, and replication to be performed on a single virtual pool of storage without affecting server resources. Further, Fujitsu's ETERNUS storage virtualization software employs a unique two-pronged approach of dividing virtualization functionality and configuration management over separate servers, enabling streamlined management, higher performance, and simplified troubleshooting.

As users extend the scope of virtualization from single servers to multiple systems throughout a datacenter or an organization, the requirement for tools that help administrators manage virtual infrastructure becomes increasingly critical. Fujitsu not only offers a competitive and differentiated line of server and storage hardware that is suitable for virtualization, but also provides a robust management solution. Fujitsu's Systemwalker Resource Coordinator Virtual Server Edition (RC VE) provides a single management view that enables the control of both physical and virtualized blade servers. This capability directly addresses one of the most pressing needs identified by administrators engaged in large-scale virtualization deployments.

## Overview of Business Benefits of Virtualization

Virtualization is clearly having a major impact across the IT industry. It is generating genuine excitement in the IT community, and many vendors and solution providers are rushing to capitalize on the opportunities that this fascinating technology presents. While it may be tempting to dismiss virtualization as merely the latest fad, it has in fact already proven its ability to deliver several fundamental business benefits in a variety of real-world environments, including the following:

- » **Consolidation and improved resource utilization.** Consolidating servers with virtualization enables administrators to reduce the number of physical machines that they have to acquire and manage, resulting in lower maintenance costs, fewer cooling requirements, lower power consumption, and smaller hardware footprints in the datacenter. Virtualization also enables better utilization of computing resources. Because physical servers are often deployed to host single applications, only a fraction of the server's capabilities may be utilized. The remaining resources become "white space" – i.e., unused resources that are rarely, if ever, drawn upon. Virtualization allows multiple underutilized servers to share the resources of a physical system.

The use of virtualization on x86 has proven to be very effective at addressing the challenges of server sprawl, and it is now an essential tool for consolidating multiple underutilized servers onto fewer physical systems using virtual machines. Depending on the nature of the workloads being consolidated, many organizations routinely achieve consolidation ratios as high as 15-to-1 or more using virtualization.

- » **Simplified resource provisioning.** Virtualization can significantly reduce the time required to deploy new systems. Rather than set up new physical systems when users require new computing resources, administrators can maintain a pool of virtual resources that they draw on. When servers are implemented as virtual machines, they can be created almost instantly through either manual commands or scripts. With physical servers, the end-to-end process of installing a new system might take a month or longer, if one includes the time required to spec the needed system; push the request through an organization's requisition process; order the hardware and have it delivered from the vendor; configure the system; and set it up in a server room. With virtualization, that time can be reduced to hours or less. As a result, organizations can respond to business opportunities more rapidly than before.
- » **Simplified high availability and disaster recovery.** Virtualization can fundamentally improve the overall reliability of an infrastructure. Virtualization enables fewer physical servers to be deployed, which reduces the footprint for potential hardware failures that result in unplanned downtime. Moreover, the servers that are deployed can be configured with high availability (HA) features (such as redundancy) and hot-plug components to reduce downtime. Functions such as "live migration," in which virtual machines are moved from one host to another without interrupting their processing, provides yet another means to reduce planned downtime. Live migration allows workloads to be temporarily moved so that hardware maintenance can be performed on the hosts with minimal disruption. When coupled with HA clustering functions, virtualization can be used to restart workloads on a backup host in the wake of a primary host failure – dramatically simplifying the implementation of DR procedures. Traditional HA and DR implementation requires applications and their dependencies to be adapted so that they can be restarted on backup systems, which is a notoriously complex and error-prone process. With virtualization, the entire workload can easily be relaunched simply by restarting the virtual machine on which it is hosted.
- » **Improved test and development processes.** Virtualization simplifies and improves the quality of testing and development by enabling IT managers to rapidly allocate resources as needed to support test processes. Virtualization makes it easy to set up and manage farms of test systems. Virtualization also helps to isolate bugs during the testing process by neutralizing hardware variability, and it allows production systems to be copied easily for testing purposes. Finally, virtualization makes it easier for developers to test applications on different operating systems.
- » **Legacy application support.** Virtualization enables administrators to migrate legacy applications to new hardware without disturbing their environment. In some migration situations, it may be difficult or impossible to move certain applications to the new platform. In the case of third-party software, the application vendor may no longer be in business, and in the case of an internally developed application, the source code may have been lost or the original

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developers may have moved on. In these circumstances, virtualization can be used to extend the life of the application. The legacy application can be hosted in a virtual machine running on the new platform until that application can be replaced or rewritten.

## **Market Trends for Adoption of Virtualization**

Virtualization is clearly being adopted widely across the industry in organizations of all sizes. Virtualization itself is not new, and has been available on some platforms for decades. But much of the recent interest in the technology has been driven by the emergence of virtualization options for industry-standard x86 hardware. Of course, virtualization is still widely deployed on mature platforms such as mainframes, and various forms of virtualization technology are also available for UNIX platforms as well. Indeed, users are adopting virtualization on many classes of platforms, and the patterns for deploying virtualization are quite different on x86 systems and non-x86 systems such as UNIX platforms.

Ideas International (IDEAS) has found that virtualization on x86 systems is primarily used for purposes of large-scale consolidation. Typically, such consolidation is part of an effort to contain the sprawl of servers running workloads with a relatively fixed footprint that tap only a fraction of their host's resources. The use of virtualization on x86 has proven to be very effective at addressing the challenges of server sprawl, and it is now an essential tool for consolidating multiple underutilized servers onto fewer physical systems using virtual machines. Depending on the nature of the workloads being consolidated, many organizations routinely achieve consolidation ratios as high as 15-to-1 or more using virtualization.

On UNIX systems, IDEAS believes that administrators are usually more interested in employing virtualization to dynamically vary the resources assigned to individual workloads in response to changing demand. On these systems, the virtualized workloads are usually more business-critical and designed to scale up on larger systems. Virtualization allows administrators to provision high-end UNIX servers for the average capacity of multiple workloads, rather than over-provisioning for the peak capacity of each.

IDEAS has found that on both x86 and UNIX platforms, users typically start with tactical virtualization applications such as test and development, consolidation, or hosting legacy applications. But as users become more comfortable with using virtualization in production environments, and start to drive virtualization technology more directly into IT infrastructures, its impact goes far beyond solving these tactical problems. At that point, virtualization can result in a fundamental transformation of IT operations.

**Storage virtualization may become particularly significant, because some of the more sophisticated server virtualization techniques – such as live migration of virtual machines – often depend on tight integration with virtual storage functions such as Storage Area Networks (SANs) or Network Attached Storage (NAS).**

## Virtualization Technology Trends

At a fundamental level, virtualization involves decoupling a workload and its data from the functional details of the physical platform on which it is hosted. This decoupling increases the flexibility with which the workloads can be matched with physical resources, enabling administrators to develop business-driven policies for delivering resources that are appropriate to specific time, cost, and service-level requirements. Therefore, virtualization potentially enables IT operations to be performed with far better economies of scale, maximizing the utilization of existing resources by allowing infrastructures to be managed efficiently even as they undergo high rates of growth.

### Server Virtualization Alternatives

Much of the recent interest in virtualization on x86 hardware has been driven by VMware, which brought server virtualization capabilities to industry-standard x86 systems, where before virtualization was largely limited to high-end systems such as mainframes. VMware introduced the ability to run multiple operating systems simultaneously on a single x86 server, which is the fundamental building block of virtual infrastructure. Following VMware's early success, several alternative virtualization solutions for x86 systems have appeared, including: Microsoft Virtual Server™, which is available for free and has particularly strong support for the Windows operating system; and Xen, an open-source virtual machine platform that is available in a variety of implementations, including major commercial Linux distributions such as Red Hat Enterprise Linux 5. Platforms running the UNIX operating system also continue to evolve and benefit from continued innovation, with very strong virtualization functions compared to standard x86 systems. Some of these high-end platforms benefit from advanced virtualization capabilities that may be more appropriate for virtualizing the most critical workloads.

### Storage Virtualization

While much of the focus in the industry has been on virtualizing servers, it is also possible to implement virtualization at other levels of IT infrastructure, including networks, storage, and possibly even desktops. Storage virtualization may become particularly significant, because some of the more sophisticated server virtualization techniques – such as live migration of virtual machines – often depend on tight integration with virtual storage functions such as Storage Area Networks (SANs) or Network Attached Storage (NAS). With the addition of an abstraction layer that decouples applications from storage systems, storage managers and applications are no longer limited by the need to know where data is physically stored. In other words, managers and applications are not required to know which array, disk, or disk partition holds the required data. For applications, the decoupling of applications and data greatly reduces development time and maintenance, and provides a foundation for developing Service Oriented Architecture (SOA) and Software as a Service (SaaS) based applications. For storage managers, tasks such as backup, restore, provisioning, and capacity

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allocation can be greatly simplified – and thus, easier to automate – through virtualization. A simplified, automated storage management process will free up storage managers from mundane tasks as well as significantly reduce the number of errors.

### **Data Migration**

Data migration is the process of moving data from a particular disk, disk array, or other storage device to another device located either locally or in a remote location. There are several business and legal reasons for migrating data:

- » **System upgrades.** When computing and storage systems are updated, data must be moved from the old systems to the new systems. In some cases, the data must also be “translated” to a new format to accommodate updated software on the new systems.
- » **Tiered storage.** In a tiered storage environment, data that was once business critical is moved to a second tier of less expensive storage infrastructure in order to save on costs over the long run. Business critical data is typically stored on highly reliable Fibre Channel or Serial Attached SCSI (SAS) drives. Second-tier storage usually consists of higher capacity, less expensive Serial ATA (SATA) drives.
- » **Disaster recovery.** Data is migrated to devices in remote locations so that it will be available in the event of a primary site loss (caused by a man-made or natural disaster such as a fire, flood, or sabotage).
- » **Regulatory requirements.** To meet certain regulations, data must be stored for a specified period of time and retrieved easily if required for any type of litigation. For example, Sarbanes-Oxley requires certain records to be maintained for a specific period of time, with evidence that the data has not been altered in any way during that time. In this case, data could be moved to a content addressable storage (CAS) array, which ensures data integrity.

Data migration in a non-virtualized environment requires that data be moved from a specific disk, disk partition, array, or other storage device to another device. The storage manager must know exactly where the device is located and where on that device the data resides. In terms of the target device, the storage manager must also know exactly where that device is located and where on the device to store the data. Additionally, the destination (or target) devices must be identical to the source device.

Storage virtualization greatly reduces the complexity of the data migration process by allowing storage managers to focus on logical chunks of data as they relate to applications, departments, or people. In this sense, data can be migrated in these logical chunks with no concern for where they are physically located or the location of the target device. The treatment of data in logical chunks also facilitates

**The typical capacity utilization rate in a non-virtualized environment is approximately 50% or less. In a consolidated, virtualized environment utilization rates can be as high as 80%. Storage administrators can realize significant cost savings by deploying “recovered” capacity rather than purchasing additional storage.**

automation and enables data migration between “non-like” devices (i.e., the source and target devices do not need to be similar).

### **Dynamic Capacity Allocation**

Today’s global 24x7 business environment has little or no tolerance for system downtime. Applications may need to quickly increase storage capacity in order to continue functioning with no interruptions in service. In order to ensure that applications will have the necessary capacity to function continuously, storage administrators tend to allocate more capacity than initially required. This is a manual and often wasteful process where capacity is dedicated to specific applications, but goes unused for the most part. Storage managers over-allocate or over-provision capacity because it is difficult and time consuming to move capacity where necessary. The risk of application failure due to inadequate storage resources outweighs the cost of underutilized storage.

Storage virtualization plays a key role in utilization efficiency. Managing pools of capacity rather than devices helps to automate capacity allocation according to business and application requirements. Rather than go through the tedious and stressful process of manually allocating capacity by device, in a dynamic environment, administrators can implement processes that automatically assign more capacity to applications as needed. Capacity can be added on the fly without disruption because it is allocated from the overall pool. The ability to dynamically increase capacity greatly increases efficiency and utilization, and it also reduces system downtime. The typical capacity utilization rate in a non-virtualized environment is approximately 50% or less. In a consolidated, virtualized environment utilization rates can be as high as 80%. Storage administrators can realize significant cost savings by deploying “recovered” capacity rather than purchasing additional storage.

### **Green Storage**

With today’s emphasis on the green datacenter, it is easy to see how virtualization can contribute to the overall green strategy. Shared resources with higher utilization rates result in fewer devices overall. Fewer devices translate into less power, cooling, space, and waste requirements – and thus, greater energy savings. A comprehensive green strategy involves more than virtualization alone, but a virtualized environment lays the foundation for an overall green datacenter plan.

### **Virtualization Management**

Finally, virtualizing servers and storage is in fact only the first step toward putting a full virtual infrastructure into place. While improved server and storage utilization may help to lower acquisition costs, those savings may be relatively insignificant compared to the ongoing costs of managing the infrastructure needed to host virtualized workloads. As administrators start to virtualize more of their

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infrastructure, they become increasingly concerned with the impact of virtualization on their management tools and procedures.

Some of the key management issues that arise in virtual infrastructures include:

- » bridging the differences between managing virtual machines and physical servers;
- » gaining the ability to rapidly provision virtual servers;
- » instrumenting and monitoring virtual and physical resources simultaneously;
- » integrating virtual management tools with physical hardware management frameworks;
- » implementing distributed resource management, which involves matching workloads with resources regardless of where they are located on the network (and may represent a prelude to deploying full-fledged Grid computing infrastructures); and
- » correlating virtualization with ancillary initiatives such as blade servers.

### **Fujitsu's Virtualization Strategy and Solution**

Like most major systems vendors, Fujitsu is responding aggressively to the growing demand for virtualization capabilities by its customers. Fujitsu offers a broad range of server products crossing multiple processor architectures, and it has a long heritage of developing and supporting mainframe-class systems, so it has somewhat of a unique perspective on how to best deliver virtualization solutions based on the current market requirements.

Fujitsu's key virtualization offerings can roughly be grouped into the following categories, which correspond to the major areas of demand in the market described above:

- » **Industry-standard virtualization solutions**, combining Fujitsu's PRIMERGY line of x86 servers with the key virtual machine platforms for the x86 architecture, including VMware, the Xen implementation in Red Hat Enterprise Linux 5, and Microsoft Virtual Server™.
- » **High-end virtualization functions**, providing more robust virtualization support for the most critical workloads running on Fujitsu's PRIMEQUEST and PRIMEPOWER servers.
- » **Storage virtualization functions** provided by Fujitsu's ETERNUS VS900 switch and ETERNUS storage virtualization software.
- » **A portfolio of virtualization management tools** based on Fujitsu's Systemwalker Resource Coordinator architecture. These tools have been designed not just to manage resources in the context of virtualization, but to integrate the management of virtual machine platforms, blade servers, and storage into a single framework.

**With its PRIMERGY line of x86 servers, Fujitsu is well positioned to support the use of industry-standard virtualization platforms such as VMware, Microsoft Windows Server 2008,<sup>1</sup> or RHEL 5.**

It is worth examining each of these offerings in a little more detail in order to understand their relationship, and which customer needs they meet.

### **Industry-Standard Virtualization with PRIMERGY**

With its PRIMERGY line of x86 servers, Fujitsu is well positioned to support the use of industry-standard virtualization platforms such as VMware, Microsoft Windows Server 2008,<sup>2</sup> or RHEL 5. PRIMERGY servers are available in rack, blade, compact, and tower form factors, providing a range of platforms that customers in organizations of all sizes can use to host an x86 virtual machine platform. For example, PRIMERGY tower and compact servers are suitable for small and medium-sized enterprises (SMEs) to begin virtualization. The PRIMERGY BX620 blade server can be configured with dual- or quad-core blades, making it ideally suited for hosting larger x86 virtual machine deployments, in which large numbers of virtual machines are consolidated into a single system.

Fujitsu provides PRIMERGY users with a choice of virtual machine platforms. Fujitsu has a strong relationship with VMware, which is currently the market leader for x86 virtual machine software and offers the most advanced set of functions. PRIMERGY servers and storage are qualified by VMware, and supported by both VMware and Fujitsu for use with VMware ESX Server. Moreover, Fujitsu's Systemwalker Resource Coordinator software is designed to complement VMware's ESX Server virtual machine platform and VirtualCenter management software (see below).

Customer interest is also growing in certain alternatives to VMware. Some users are interested in Microsoft Virtual Server™ and find it suitable for consolidating small numbers of servers. These users are typically most comfortable with running Windows on their servers, and want to get virtualization running quickly and easily, particularly if they are not yet ready to adopt the advanced virtualization functions provided by functional leaders such as VMware.

Red Hat Enterprise Linux 5 builds in support for the Xen hypervisor, an alternative virtual machine platform based on open source software. As open source software, Xen is available from a variety of vendors, and it is thus appealing to users for whom a choice of suppliers is important, and who are most comfortable running Linux on their servers. Xen also has an extraordinarily efficient implementation, and it is quickly increasing its functional capabilities thanks to the rapid development pace of the open source community.

VMware, Microsoft Windows Server 2008,<sup>3</sup> and Xen on Red Hat Enterprise Linux 5 can all be used to achieve the essential value of virtualization on Fujitsu's PRIMERGY servers. All three enable underutilized servers to be consolidated on

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<sup>2</sup> Planned.

<sup>3</sup> Planned.

**PRIMEQUEST servers support several forms of virtualization that allow multiple instances of operating systems to run simultaneously.**

the appropriate physical hardware, depending on the scale of consolidation, and they can be used to simplify the provisioning of resources. They can also be used to simplify test and development processes, and will support certain legacy environments. For users who require the most sophisticated tools for high availability and resource positioning, PRIMERGY offers strong support for VMware ESX Server, backed by the solid relationship between Fujitsu and VMware

### **Virtualizing Critical Workloads with High-End Platforms**

IDEAS research has found that some customers are not yet willing to trust their most critical workloads to volume x86 hardware. Such customers prefer to rely on higher-end platforms that have been designed specifically for more rigorous scalability and reliability requirements, and possibly more proven operating systems such as UNIX. These customers also want to benefit from the superior flexibility and greater uptime granted by modern virtualization technology. Fujitsu offers powerful virtualization functions in its high-end PRIMEQUEST and PRIMEPOWER servers that meet these needs.

Scaling up to 32 Itanium 2 processors with 64 cores, PRIMEQUEST can handle the largest application workloads. PRIMEQUEST servers support several forms of virtualization that allow multiple instances of operating systems to run simultaneously. The first is flexible hardware partitioning, which takes advantage of the underlying modular building block approach consisting of system boards with processors and memory, and I/O units providing PCI slots and Gigabit Ethernet access. Up to 16 isolated partitions can be configured, which can be either physical partitions (PPARs), using a full system board, or extended partitions (XPARs), using half of a system board. Each partition runs its own operating system instance: Windows or various releases of Linux, each with a custom software stack. Each independent partition is electrically isolated from hardware or software failures in other partitions, guaranteeing that a catastrophic failure in one partition will not affect the others.

Since PRIMEQUEST partitions can be used to run RHEL 5, customers also have the option of deploying the Xen hypervisor either on the entire server, or within a partition. Xen enables virtualized resources to be distributed to applications at finer granularity than hardware partitions, which must have a minimum of either two chips (i.e., four cores) in XPARs, or four chips (i.e., eight cores) in PPARs. Thus, PRIMEQUEST users can make the choice between strong isolation with XPARs or PPARs, and finer resource granularity with Xen.

Similarly, Fujitsu's PRIMEPOWER servers also provide a range of virtualization choices. For workloads that require the highest degree of isolation, PRIMEPOWER provides XPAR partitions, which maintain hardware-enforced isolation between different instances of virtualized operating systems. PRIMEPOWER runs Sun's Solaris operating system, which provides Container functionality that virtualizes operating system functions. Like partitions, workloads running in Containers are

**For workloads that require the highest degree of isolation, PRIMEPOWER provides XPAR partitions, which maintain hardware-enforced isolation between different instances of virtualized operating systems.**

protected from each other, and each operates under the illusion that it is deployed on its own system, with a private file name space, IP address, and security profile. But unlike partitions, which require a separate instance of the operating system to be managed for each workload, Containers all share a single instance of Solaris, which dramatically increases the granularity at which resources can be assigned to workloads. Again, PRIMEPOWER users can make the choice between the strong isolation of XPARs, and the finer resource granularity of Solaris Containers.

Both PRIMEQUEST and PRIMEPOWER allow the power of virtualization to be applied to workloads that require a higher degree scalability and reliability than x86 servers can provide. PRIMEQUEST provides a superior hardware foundation for industry-standard operating systems such as Linux and Windows, while PRIMEPOWER provides an advanced platform for administrators who prefer UNIX.

### **Fujitsu Storage Virtualization**

Fujitsu has several offerings in its portfolio of storage products that complement its server virtualization capabilities with effective storage virtualization support. Storage virtualization can generally be implemented at three levels: software, switches, and arrays. With its solution, Fujitsu targets the first two approaches. The ETERNUS VS900 is a highly reliable, 16-port virtualization switch that can be implemented in pairs to further increase operational continuity. The VS900 provides the customary features expected in such a product, such as virtual volume creation, data migration, and capacity expansion. However, the true strength of the VS900 lies in the integration of its management capabilities. The ETERNUS SF AdvanceCopy Manager allows routine tasks such as backup, restore, and replication to be performed on a single virtual pool of storage without affecting server resources. Overall management is accomplished centrally in conjunction with servers, applications, and networks. Management integration such as this is essential to providing a seamless, virtualized environment.

Fujitsu's ETERNUS storage virtualization software employs a fairly unique method to implement multipathing and replication. Although the virtualization software itself resides on the VS900 CPU, it is managed by a separate layer of software that resides on the management server. The virtualization and management software communicate and share information, such as configuration, copy, and migration data. This two-pronged approach of dividing virtualization functionality and configuration management over separate servers enables streamlined management, higher performance, and simplified troubleshooting. In addition, future enhancements can be implemented with no impact to performance. The dual-server approach to management also increases reliability – once virtual disks are configured, the VS900 is not required to communicate with the management server and can therefore continue functioning, even if the management server fails. Fujitsu's implementation of virtualization software is thus optimized for both performance and reliability.

**Fujitsu has several offerings in its portfolio of storage products that complement its server virtualization capabilities with effective storage virtualization support.**

### **Systemwalker Resource Coordinator Virtual Server Edition**

While Fujitsu clearly offers a full line of server and storage hardware that is suitable for virtualization, virtualizing resources themselves is in fact only the first step to deploying virtual infrastructure.

As users look beyond the application of virtualization on single servers, and extend the scope of its functionality from single servers to multiple systems throughout a datacenter or an organization, management tools for the virtual infrastructure become a critical requirement.

IDEAS recently performed a user study on the impact of virtualization on systems management, and noticed several trends. The first was that administrators require greater visibility of the state of their entire infrastructure (i.e., the virtual layer, the physical layer, and ideally, storage). There are plenty of tools for managing these layers individually, but to properly maintain performance of a virtualized environment and its applications, it is necessary to be able to pinpoint bottlenecks at any level of the stack. As a result, a need exists for new kinds of systems management tools that are as capable of providing insight on the state of the virtual layer as they are on the state of the physical layer.

The second trend that IDEAS observed was that a major impact of virtualization on x86 systems is an increase in the number of virtual servers that need to be managed, even as the number of physical servers decreases. Because it is so much easier to configure new virtual machines than physical machines, end users respond by increasing their demand for new systems. As a result, administrators are under greater pressure to provision the growing number of virtual servers with the necessary software to support workloads (i.e., operating systems, patches, middleware, application software etc.).

Fujitsu provides a management tool called Systemwalker Resource Coordinator Virtual Server Edition (RC VE) that responds to both of these needs. RC VE enables the unified administration of physical and virtual servers hosted on Fujitsu's blade servers, providing a single management view that controls both physical and virtualized blade servers. RC VE also folds in management of storage that has been virtualized in SANs, and handles some provisioning requirements.

RC VE is based on Fujitsu's Systemwalker Resource Coordinator (RC), a software system designed to manage the resources of servers, storage, and networks in a single framework. RC provides the orchestration functions that enable administrators to reassign system resources in a coordinated fashion. RC can dynamically adjust not only processing resources (i.e., CPUs and memory), but also storage. To implement storage reconfiguration, Fujitsu collaborated with Emulex, a manufacturer of Fibre Channel devices, to develop a function called SAN Connection Virtualization. This function eliminates the need to reconfigure a SAN when adding or replacing servers, allowing an operating environment to migrate

**RC VE provides a single, integrated interface that can be used to manage physical PRIMERGY blade servers and virtual machines hosted on the blades, including virtual machine functions based on VMware, Linux, and Windows.**

from one blade server to another without disrupting its access to data, so that workloads can continue running. SAN Connection Virtualization can be used not only with Fujitsu ETERNUS disk array connections, but also with third-party storage environments.

RC VE extends the functionality of Systemwalker Resource Coordinator to virtual servers. RC VE provides a single, integrated interface that can be used to manage physical PRIMERGY blade servers and virtual machines hosted on the blades, including virtual machine functions based on VMware, Linux, and Windows. Information about virtual machines is displayed on the same single Graphical User Interface (GUI) management screen alongside similar information for physical servers. The interface visualizes the operation of the virtual machines and guest operating systems, which helps administrators identify the causes of failures, their location, and the extent of their effect. The RC VE interface is designed to complement existing virtualization management interfaces such as VMware's VirtualCenter, so that they can be used easily side-by-side.

RC VE also provides tools specifically for managing virtualized storage and networks. It includes tools for configuring the connection path between virtual servers and SAN storage, and tools for managing the connection path between virtual servers and the network, including automatic collection network configurations. RC VE includes some provisioning functions for implementing, changing, and backing up configurations using a master image (boot disk), without requiring administrators to concern themselves with the differences between physical and virtual servers. Finally, RC VE provides some system orchestration functions (i.e., tools for automating consecutive management processes that are needed to ensure operational consistency for an entire environment consisting of virtual servers, physical servers, and storage).

Separately, Fujitsu offers additional tools in the Systemwalker family that can be useful for managing virtual infrastructure. Systemwalker Centric Manager helps to manage the lifecycle of systems, offering an inventory management framework for managing network and system configurations. Systemwalker Centric Manager manages the entire lifecycle of hardware, operating systems, networks, and applications, covering steps of installation/setup, monitoring, recovery, and assessment. Systemwalker Service Quality Coordinator helps administrators monitor the performance of virtual machines, guest operating systems, and middleware. This new administration tool, also based on Systemwalker Resource Coordinator, is specifically for implementing and managing the virtualization of blade servers.

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**The IDEAS Bottom Line**

The adoption of virtualization continues to gain momentum. As users move beyond the stage of simple experimentation, they are becoming aware of more specific decisions that they have to confront as they start to deploy virtualization for production workloads. Some of the factors that users have to consider include:

- » choosing which virtualization platform technology is most appropriate for a particular workload;
- » learning how to deal with the impact of virtualization on parts of the infrastructure beyond servers (i.e., storage and networks); and
- » understanding how to adapt management tools and procedures as virtualization is extended from individual servers to entire infrastructures.

Many vendors are currently attempting to capitalize on the industry's current wave of investment in virtualization technology, and users need to consider a variety of factors – including cost, performance, and reliability requirements – before choosing a server platform for virtualization. The decisions that organizations make now will have a long-term impact as virtual infrastructures become woven ever more tightly into business processes.

Fujitsu's perspective on the virtualization landscape stems from its long experience with mainframes, its more recent but focused investments in differentiated blade server technology, and its balanced portfolio of servers based on different processor architectures. Fujitsu's mainframe heritage provides it with an unusually deep base of expertise on managing the flow of resources in large systems, which it has extended to modern server architectures based on blade servers, virtual networks and storage, and now virtual machines. Although much of the attention in the industry is currently on x86 virtualization, some workloads may require a stronger foundation than x86 platforms can provide. Fujitsu's choice of high-end platforms, each with advanced virtualization functions, represents a key added value for organizations that want the confidence to virtualize their most critical applications.

Virtualization management is another area being pursued by seemingly more and more vendors. Fujitsu's approach with Systemwalker Resource Coordinator Virtual Server Edition targets a specific tactical requirement typically faced by organizations engaged in large-scale virtualization: the need to understand and manage the relationship between physical and virtual resources from a single interface. Systemwalker Resource Coordinator Virtual Server Edition builds on the strength of Fujitsu's existing blade server technology, as well as key innovations that it developed with partners (e.g., the ability to dynamically reconfigure storage through SAN Connection Virtualization). The industry is still in the early stages of the virtualization wave, with most users just beginning to evolve from simple server consolidation to fully virtual infrastructures. Fujitsu's offerings provide a solid foundation for organizations that plan to take virtualization seriously in the future.