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WHITE PAPER

Virtualizing Tier 1 Applications: A Critical Step on the Journey Toward the Private Cloud

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EXECUTIVE SUMMARY

Virtualization has evolved rapidly since it first began to be used on x86 servers in 2003, mainly for test and development. By 2007, the second generation, Virtualization 2.0, was under way, and the focus was consolidating production applications. Today, we are transitioning to the third era of virtualization deployment (3.0), which is taking on cloud-like attributes for highly virtualized and automatically managed internal deployments.

The transition to adopting cloud-like deployments shifts the focus from early capex savings drivers to transforming IT into a service and delivering operational efficiencies. Crucial to the success of this transition to the cloud computing deployment model is the inclusion of tier 1 applications, the most complex and often business critical in nature to an enterprise.

In the past, although many production applications were virtualized, tier 1 applications were lagging. Some of the concerns and obstacles included:

- Performance
- ISV support and licensing
- Application owner resistance

Today, most of these roadblocks have been removed. The latest x86 server hardware and virtualization software offers unprecedented virtual server performance and greatly improved I/O performance. ISVs are now supporting virtualized environments in greater numbers than ever before as customers have adopted virtualization en masse.

Infrastructure teams have become better at conveying the benefits of virtualization to application owners and proving those benefits through coordinated trials with application teams. The initial wave of virtualization was about consolidation, which primarily benefited the infrastructure team. But as virtualization has advanced and is building toward the private cloud, additional application benefits have emerged as well:

- Faster provisioning of applications and better configuration management through virtual machine (VM) templates
- Universal high-availability services that can be applied to any VM and application
- Automated resource optimization that takes advantage of VM mobility to dynamically ensure service levels
- Dynamic scaling of applications to meet changing business needs

These features of a private cloud can offer an improved platform upon which to run applications. In the long term, using a cloud-like infrastructure seeks to transform static applications into dynamic IT services and prepares customers to eventually move some applications to external cloud environments.

This IDC white paper also includes two case studies and a sidebar highlighting the experiences of three enterprises with virtualizing their tier 1 applications, which include Oracle and Microsoft SQL databases and a Microsoft Exchange email system.

SITUATION OVERVIEW

Since its emergence in the early 2000s, VM and hypervisor software technology aboard x86 servers has quickly become one of the most disruptive technologies in IT infrastructure. The ability to virtualize servers and reclaim excess capacity caught the interest of datacenter managers who sought to reduce capital spending and faced difficult power, cooling, and space problems.

The first phase of customer adoption of virtualization on servers, the 1.0 era, began in 2003. About 70% of all virtualization software deployments in 2003 were related to software development and testing — using hypervisors inside a sandbox of large organizations' test and development labs for consolidation purposes. Hypervisors were primarily leveraged for their encapsulation (the ability to wrap an operating system [OS] and application into a single VM file) and static consolidation properties. The ability to quickly replicate, snapshot, and roll back virtual machines was also a perfect fit for test environments.

But by the end of 2005, IDC saw the spending shift from consolidating software development and testing environments toward organizations trying to consolidate applications within the production part of the IT infrastructure as IT managers became more familiar with and confident of the hypervisor's ability to handle enterprise workloads (the 2.0 era). Consolidation was still the primary use case, and enterprises realized huge capex savings from it. The infrastructure was still fairly static, with some enterprises beginning to leverage on-the-fly migration for tasks such as planned downtime.

Since then, the industry has continued to focus more heavily on production-level consolidation, which today continues to be a primary motivator for customers to bring virtualization within their organizations. With production-level virtualization well proven in the industry, we now begin the march to the 3.0 era of virtualization, which is synonymous with cloud-like virtualized infrastructure. IDC believes that as we exit 2.0, there will be a multitude of intermediate steps (2.x steps, if you will) that will culminate in Virtualization 3.0. These steps will go well beyond just consolidation to deliver new benefits from virtualization.

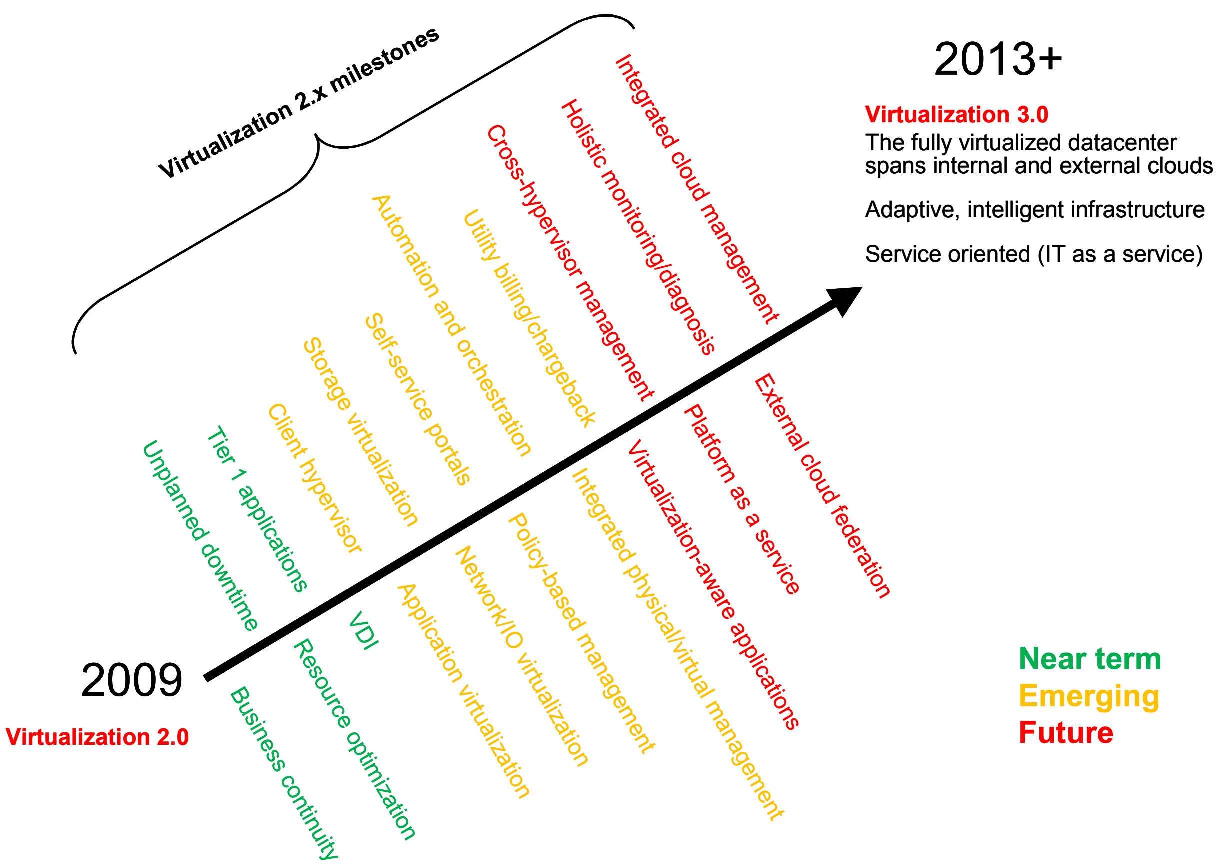
Virtualization 3.0 is really about highly virtualized, autonomously managed, and scalable infrastructure, the same attributes that cloud infrastructures can provide. Virtualization 3.0 and/or cloud infrastructures apply to both internal and external deployments and private or public clouds.

The future enterprise cloud is a fully virtualized datacenter. It is driven by server virtualization, but in tight concert with storage, network, and I/O virtualization. Virtualization will abstract the infrastructure and present it as a service to application owners (infrastructure as a service). The cloud can offer applications uniform and universal infrastructure services, such as on-demand provisioning, automated release cycles, dynamic scaling, and high availability/disaster recovery (HA/DR). Enterprises may also tightly couple an application runtime environment with this virtualized infrastructure to create a platform-as-a-service offering. As virtual servers will explode in number and far outstrip physical servers, a Virtualization 3.0 datacenter will have a very intelligent management layer that will automate most tasks through a policy-driven, service-oriented approach.

To get to Virtualization 3.0, however, enterprises must go through a series of intermediate 2.x milestones. IDC has divided the milestones into three categories: near term, emerging, and future. Enterprises may adopt the items in different orders and at different times, but the conglomeration of these milestones will make up Virtualization 3.0 (see Figure 1).

FIGURE 1

The Long Road to Virtualization 3.0



Source: IDC, 2010

TIER 1 APPLICATIONS CRUCIAL FOR THE CLOUD

Virtualizing tier 1 applications is critical to the success of a private cloud. To deliver the most value, the private cloud must encompass the majority of workloads already in use and reduce the number of fragmented resource silos that lie outside the cloud. This allows organizations to take advantage of the economies of scale for optimal infrastructure efficiency. In addition, many of the advanced features of the cloud that transform applications from static entities into dynamic IT services will be of the most value to mission-critical, complex applications. For example, a simple print server will probably not benefit greatly from dynamic scaling features, but a crucial customer-facing Web application would benefit greatly.

While virtualization of production applications has certainly become mainstream, the most mission-critical tier 1 applications have not been virtualized at the same rate. Customers point to the following common concerns as reasons for this slower uptake:

- **Performance.** Hypervisors incur overhead and customers fear that VM performance won't be enough for their application. In addition, consolidation implies that computing resources must be shared among VMs, which could further affect performance.
- **Application owner resistance.** Virtualizing an application requires agreement and coordination between the infrastructure and application teams. In general, the more critical the application, the more influence the application owner has on the underlying platform. Application owners often are possessive of physical hardware and perceive a loss of control with virtual hardware. They are obviously concerned about performance for their application, but they are also historically reluctant to change and may be uninformed about the benefits of virtualization.
- **ISV support and licensing.** Enterprises are concerned that ISVs won't support virtual environments and are unsure of the impacts on licensing.

ACCELERATING THE VIRTUALIZATION OF TIER 1 APPLICATIONS

Today, many virtualization customers have misperceptions about the current state of virtualization technology and support. In the past, virtualization incurred fairly significant overhead, especially in the area of I/O. ISV support was nearly nonexistent. However, perception has not kept up with reality, and the reality is that virtualization continues to change and improve at a phenomenal pace.

Performance

Virtualization performance is not the situation that it was even as little as a year ago. Several factors have gathered over the years to address performance concerns:

- **Increased native system performance.** Microprocessors continue to follow Moore's law and increase performance. Higher raw CPU power means that any virtualization overhead becomes an increasingly smaller burden for the server.

In addition, the explosion of multicore technology has led to CPUs with four or more cores becoming mainstream. Additional processor cores have given servers heavy multiprocessing capabilities to address applications that need that computing capability as well as to allow even resource-heavy applications to be consolidated with other applications.

- **Hardware acceleration of virtualization.** Virtualization has become the new design point for server hardware. The newest servers are designed from the chip level to specifically increase virtualization performance. CPUs have special instruction sets to decrease hypervisor overhead, and system chipsets are designed to accelerate tasks such as VM memory performance and system I/O. Network cards have been designed at the hardware level to be sliced into virtual functions, which accelerate network I/O to multiple VMs on a server. In short, the latest hardware is purpose built for virtualization and erases many of the performance shortcomings of earlier virtualization technology that did everything in software.

- **Software optimizations.** While massive performance gains are certainly seen from hardware improvements, much of the magic of virtualization is still software based. Optimizations in the most recent versions of hypervisors further improve the performance gains from hardware. And as with any technology, reliability and stability increase with time, and virtualization has certainly matured in that respect. Software optimizations are also seen at the OS and driver level, where techniques such as paravirtualization and pass-through take advantage of special drivers that increase device performance.

Customers should look for concrete proof points as they consider virtualizing their tier 1 applications. There are widespread customer examples (see the two case studies included in this white paper) of enterprises running performance-sensitive applications in virtual environments as well as time-proven accounts of hypervisor reliability and stability running enterprise workloads. In addition, many benchmarks are available in the industry, which can quantify just how far virtualization performance has come.

ISV Support and Licensing

As virtualization has become mainstream, ISVs have not been able to resist the onslaught from customers who are demanding support for this environment. While there are certainly laggards in the industry, ISV support has dramatically improved from even as little as a year ago and continues to improve. The most mixed bag in terms of support has generally been in the area of specialized vertical applications, where ISVs have been slower to adopt. IDC's research with customers has found that most customers are well supported in regard to virtualization from their ISVs. Most still do have some applications for which the support is either unofficial or a best effort case, but these instances are generally isolated to just a few applications. Further, a great deal of those applications are in the process of being certified and supported on virtual infrastructure over the next year.

Licensing also has become much clearer in regard to virtualization and in some cases can even benefit. Several common licensing scenarios exist today:

- **Licensing that is not based on server capacity, such as a per-user scenario.** In this case, licensing costs are the same whether or not the application is virtualized.
- **Per virtual CPU.** Customers simply license via the virtual CPUs inside the VM. The most virtualization friendly and traditional CPU licensing paradigms can be applied, simply substituting virtual CPUs for physical CPUs.
- **Per physical CPU.** This is currently the most challenging licensing scheme because it was devised for bare metal deployments where a 1:1 ratio of applications to CPU was assumed. However, in certain instances, this could be a benefit. For instance, by licensing all of the CPUs in a database server or a cluster, one could then run as many virtual database instances as desired on the server or cluster. Some applications can actually be more efficient by being divided into separate smaller instances, and then it is simply a matter of how many VMs one can pack onto the server or cluster to increase license utilization. This scenario offers possible license consolidation savings.

University of Texas at Brownsville

Brian Matthews, Software Systems Specialist at the University of Texas at Brownsville (UTB), is responsible for hosting email for the university's 16,000 students; 2,100 faculty and staff; and alumni using Microsoft Exchange. The original deployment of Exchange 2003 was on physical hardware and spanned 10 servers, 4 being front-end servers and 6 mailbox servers, consuming about 2TB of storage to host 40,000 mailboxes in total. UTB was already using virtualization at its DR site to reduce the space and hardware required to host it. During the upgrade from Exchange 2003 to Exchange 2007, the decision was made to also virtualize the primary site. The successful experience of running Exchange in a virtualized environment at the DR site gave UTB the confidence that there would be no issues with virtualizing the primary site. Another key difference in the Exchange 2007 deployment was to move to 64-bit infrastructure to allow the servers to address more than 4GB of memory to increase the number of mailboxes per server. The Exchange 2007 application was put on a 4-node ESX cluster, with each node having 64GB of RAM and 16 CPUs. This cluster also hosts other applications besides Exchange, primarily file and print servers, licensing servers, and Microsoft SQL. Matthews did not want to create a separate, dedicated cluster for Exchange because that would have increased complexity and management, and the cluster had enough horsepower to run the application without any performance issues.

Matthews had already been using CA's XOsoft application-based replication to the DR site, but with virtualization, the primary site is now able to take advantage of VMware HA and VMotion to provide a higher level of availability. Matthews also found that upgrading virtual infrastructure was much easier and faster than upgrading physical infrastructure. "There are a lot of things that I can do on the fly that I cannot do on a physical environment. For example, if I needed to increase the size of a drive, it's a lot easier in a virtual environment. With physical, if I need more storage on the C drive, I actually need to shut it down. In a virtual environment, I can add more storage on a C drive on the fly, and with Windows 2008, you can extend that C drive without even shutting down the server. There's just a lot more flexibility. I can easily VMotion a VM to a different physical ESX host to load balance between hosts or when I need to shut down a host for maintenance. I need to add a new NIC or network card, a virtual switch, or anything like that, it's much easier and faster than to do it in the actual physical environment."

Exchange was the first application to be virtualized, but since then, UTB has also virtualized its Microsoft SharePoint installation. Of the remaining applications, which include a lot of Web servers, Matthews says there isn't any reason why they couldn't all be virtualized. "It's just a matter of actually going through the process of virtualizing them. I will say hopefully within the next six to eight months, we will be at least 80% virtualized," says Matthews.

The Private Cloud as a Better Platform for Applications

The focus of most virtualization deployments in the past was consolidation. Today, consolidation continues to be a major driver, but as we transition out of the Virtualization 2.0 era and into 3.0, the focus shifts from capex savings to operational gains. With performance and ISV barriers falling rapidly, more and more tier 1 applications can be successfully virtualized and consolidated. However, one of the often overlooked benefits of virtualizing these applications is leveraging advanced virtualization features to create an experience that is actually better than bare metal. Today's latest virtualization platforms, combined with advanced management tools, are fostering the creation of private clouds that offer a more agile platform for applications. The private cloud can transform applications into dynamic IT services that can react quickly to changing business requirements. Some advanced and unique benefits that a private cloud can bring to applications include:

- **Faster application development and lifecycle.** Virtual lab managers turn internal development resources into a cloud service, similar to many external cloud services that have become popular with developers due to the speed and convenience of provisioning. Self-service portals enable developers and application owners to self-provision infrastructure for their applications in minutes, as well as leverage templates or "golden images" for faster, more consistent provisioning. Unique virtualization features such as snapshots and cloning accelerate testing and troubleshooting of applications. With bare metal provisioning, application lifecycles were often tied to hardware lifecycles, being deployed, decommissioned, or upgraded with the underlying hardware. Virtualization decouples application lifecycles from hardware lifecycles for a more flexible application lifecycle.
- **Resource optimization and dynamic scalability.** With bare metal provisioning, infrastructure for applications is overprovisioned as insurance against workload peaks. Even with overprovisioning, workloads can be unpredictable and applications sometimes still run out of capacity. Reprovisioning these applications on another physical system is a major task that requires not only effort but also precious time during which the application is underperforming. Virtualization creates a much more dynamic and adaptive infrastructure that can adjust quickly to changing application needs without overprovisioning. Advanced management software can monitor application performance across multiple tiers and VMs and adjust the infrastructure dynamically to support variable loads. This can be done by "hot adding" CPU and memory to a VM, migrating a VM on the fly to a larger host, adding another application instance, or using a resource scheduler for load balancing across servers.
- **Application availability.** Virtualization platforms can provide availability services as part of the infrastructure layer, without requiring OS- or application-level availability solutions. In the event of a failure, virtual machines can be automatically restarted on any available physical host in a cluster. Virtualization-based HA solutions can provide a universal, base level of protection for all applications, without requiring application-specific clustering solutions. In most cases, virtualization-based HA can be complemented by application-specific solutions to ensure even higher levels of availability.

Global Biopharmaceutical Company

This case study involves a global biopharmaceutical company with annual revenue of over $5 billion and approximately 4,000 employees. The company has currently virtualized about 95% of its servers, the core of which lies in its primary datacenter in the Bay Area of California. That datacenter contains about 40 physical ESX servers, which, combined, host over 1,000 VMs.

The company's journey through virtualization began about three years ago when the physical growth of its datacenter was out of control. The infrastructure team made a conscious decision to curb the physical sprawl using VMware virtualization. At the time, the company had only dabbled with virtualization in the lab, but Virtual Infrastructure 3 was close to general release and the IT team felt that it would be good enough for production deployment. The Director of Architecture and Infrastructure Operations, whom we call 'John Smith,' explains, "We didn't make a conscious decision to only put certain types of loads on there; we just took them as they came. The first production deployment, and the first Oracle deployment that we virtualized, was to support our HCM, our HRIS platform for PeopleSoft. Our PeopleSoft deployment here is now entirely virtualized. And then it's just been more of the same — more Oracle, more SQL. We have Oracle 9i, 10g, and 11, and all of those are virtualized."

One of the most mission-critical and largest databases is an Oracle database cluster to support the company's Siebel eCRM system. The database spans 3 physical servers and about 45 VMs and is approximately 1TB in size. The deployment of the system was straight to virtual, which sped up the process. With physical deployments, it normally took about four to six weeks to plan, budget, order, and install physical infrastructure. With virtual servers, that time was reduced to one or two days. In addition, the flexibility of virtual allows quicker recovery from the inevitable errors during the deployment process. Smith says, "It's not uncommon for ISVs to come in and struggle with the first deployment and have to do it again. So, we're able to clone servers and move them around or rebuild them easily when that happens."

Working with the application owners to virtualize a critical Oracle database was also key to a successful deployment. The first thing Smith and his team did was to run the virtual infrastructure plans through the quality, security, and compliance group and qualify the infrastructure to make sure there were no regulatory objections. After that, it was a matter of allaying the concerns of the application owners, many of whom had performance concerns about virtualization. Smith agrees that most of these concerns may have been relevant during the early years of virtualization, but they have been addressed today. Smith says, "The reality is that a lot of these are simply myths today, rules of thumb such as 'don't virtualize a database' and 'poor I/O performance.' We've found really nothing we can't virtualize today from a technical perspective."

Smith used several different strategies to allay application owner concerns. One was simply educating owners about the latest in virtualization technology to shed old myths. Another was demonstrating the willingness of the infrastructure team to set up the technology and prove its performance in trials. Yet another approach that helped to address the performance concerns was to invest the time to develop a scale-out strategy for applications. Smith says, "Even without virtualization, eventually you'll hit the limits of a physical box. So what then? Developing a good scale-out strategy ahead of time helped to convince application owners that the application would be able to perform well as it grew."

Support is always a concern, especially with critical applications. Most of the firm's ISVs do an acceptable job of supporting virtualization, but as an industry in general, it could be better. Smith explains his organization's philosophy as follows: "Our general stance is that software shouldn't support virtualization any more than software should support Dell or HP or IBM hardware. Software doesn't run on hardware. Software runs on OSs, and OSs run on hardware. So as long as the OS is supported, we should be able to move forward. But that said, many support organizations do have a policy that says if you're on VMware, you're not officially supported. But most of the time, our stance has been just give us best effort and we'll work from there, as has been the case with Oracle."

Beyond consolidation, virtualization has brought new features to the company's applications that were not available with bare metal. VMware High Availability (HA) and VMware Distributed Resource Scheduler (DRS) are enabled for their workloads to ensure availability and better service levels. The infrastructure team regularly uses VMotion and Storage VMotion as part of ongoing maintenance. It has also begun piloting vCenter Site Recovery Manager (SRM) for offsite DR.

But virtualization has also changed some of the company's IT processes. Because of virtualization's ability to quickly provision, the company had to make its provisioning process more efficient because it became so quick. The other issue it faced was one of scale as it began to experience some VM sprawl. Smith says, "A lot of that we intentionally inflicted. Part came from the fact that we got really good at provisioning. Part of it was we also started enforcing standards on our applications group that said 'We want your development environment to resemble its production counterpart in terms of the layers or number of tiers.' So we began to cause machines to be built that maybe wouldn't have because someone would try to save a few grand in the physical world." Once machines began to be created so quickly, the challenge was applying the proper policies to each virtual server (such as backups, availability, configuration management) and not being sloppy.

A larger future issue that has been identified is the need for better insight as virtualization has introduced a layer of abstraction. Smith says, "Our virtualization world is servers, storage, and networking. There have to be more tools that take a look at that environment collectively as a set of components that provide services and be able to provide insight in the event of a problem."

The key to the success in virtualizing tier 1 applications and the majority of its datacenter was simply an unrelenting commitment that virtualization was something that was essential to the future of its infrastructure. Smith states in advice to other enterprises, "My answer is, not to be overly contrite, but it's just that we started. We started, we had some principles, and we didn't change back. We were running out of room in the datacenter, and we had to do something. We just wanted to start and move forward each and every day."

Rochester General Health System

Rochester General Health System is an organization of several affiliates that provide healthcare services to the Rochester, New York, area. It consists of about 7,000 employees and 3,000–4,000 practicing physicians. Thomas Gibaud, Manager of Information Services, leads a team of 13 IT professionals who run the company's server and storage infrastructure. Currently, the team manages 107 physical servers, 57 of which run as virtualization hosts using the VMware ESX hypervisor.

Like many enterprises, Rochester General began virtualizing in 2006 due to a growing lack of power, cooling, and floor space in its datacenter. Virtualization allowed Rochester General to consolidate the infrastructure and buy additional time to figure out the power, cooling, and space problems, which have since been solved. Gibaud initially built a test environment of 20 servers and then used the lessons learned to rebuild it into a production environment. First candidates for virtualization were the low-end file, print, and directory services applications. Soon after, the team virtualized its 50–60 Microsoft SQL servers, as Gibaud explains: "We have everything from a very high transactional mission-critical application like our EMR down to the very low-tiered SQL servers, and everything in between." Rochester General still has one SQL server that isn't virtualized due to lack of support from the ISV, which is only beginning to explore virtualization support. It supports the patient registration system, and Rochester General relies heavily on the vendor for support. Currently, Rochester General has the application running in a Lab Manager environment for cooperative testing with the ISV, and Gibaud expects that the application will be virtualized soon.

Gibaud was able to build support for virtualization by successfully virtualizing an internally developed electronic records system, which he was able to use as leverage. As Gibaud explains, "I used that to convince our vendors [that] we know how to virtualize servers and that we are not looking at virtualization as just a cost savings consolidation tool but more as a management and DR solution. This is just sitting down with their engineers and convincing them that this is what we want to do, this is why, and that in doing so we are going to be in much better shape to keep their system up and running." Gibaud would bring in hardware for certain large applications and virtualize the application. He would then let the ISVs test and prod the system to verify that it was performing the way it should be. Once the ISVs became comfortable with the environment, Gibaud would join the systems to the VMware cluster.

Internally, Rochester General's IT structure allowed Gibaud to make key technology decisions and convince application owners to virtualize. Infrastructurewise, Gibaud was able to make technology decisions without having to consult the CTO, CIO, or CFO, and the infrastructure team was aligned on its virtualization goals. Internally with application owners, Gibaud also met with little resistance. Some departments at Rochester General have their own IT person and often purchase and manage hardware along with their applications. Gibaud often played the role of a salesperson, going into these departments and giving a pitch on virtualization and how it would benefit their application. Some application managers were simply notified that the application would be moved onto a new server, and no one noticed any difference between virtual and physical. "It all comes down to who the customer is and what's our relationship with them and how we handle it," says Gibaud.

Performance is always a concern when virtualizing highly transactional databases, and Gibaud tested thoroughly beforehand and discovered that the disk configuration was crucial for I/O performance. Gibaud found that most of the bottlenecks with VMware and SQL were disk related rather than system or virtualization related. Rochester General changed its best practices in terms of how disk was laid out to better handle I/O. Gibaud recommends, "Make sure you don't throw away what you know about disk just because it's virtualized. If you need a RAID 1 set for logs, you have to make sure your disk performance is there because that's where most of your bottleneck is. I've heard stories upon stories of people virtualizing systems and thinking it runs terribly. They undo it, and it's really most of the time because of disk."

For mission-critical applications, Gibaud generally has the ESX host run by itself for a week or two, and then he makes it part of the VMware cluster. The organization has had no issues with consolidating SQL with other applications, though Gibaud notes that it doesn't try to overpack the servers, keeping a VM density of about 10:1. In terms of ongoing performance management, Gibaud found that most performance problems are with the application and not related to virtualization. Rochester General had one SQL 2000 server that was constantly overloaded. The problem was that the organization had just reached the limitations of the OS and that version of SQL. Gibaud upgraded the OS to 64-bit and the SQL server to the 2005 edition, which fixed the problem. "We were very careful not to immediately blame it on VMware; it was more of our bottleneck with SQL and the OS it was sitting on. We didn't change anything with the physical hardware. That could have been a case where a lot of people would actually blame that on a virtual environment," says Gibaud.

Rochester General also reaped benefits beyond consolidation for its applications. Gibaud runs VMware HA on clusters, which he says has improved availability. "My experience with high availability and these type of products, outside of VMware, is that they've caused more problems than they have actually prevented. VMware HA has its limitations; it doesn't have everything a true cluster would have, but for my environment, it's definitely good enough," says Gibaud. Rochester General's infrastructure team also invests heavily in resilient hardware, leveraging technologies such as memory RAID and drive RAID to complement software availability solutions.

Virtualization has also greatly decreased Rochester General's provisioning time, which has led to a more agile infrastructure. Before virtualization, testing was difficult and time consuming for the IT team due to the scarcity of physical test machines. Now Gibaud can spin up entire application environments on the fly and shut them down days later. It has also enabled the infrastructure team to deal with emergency requests, such as the case of a business unit needing a new server at the last minute.

Overall, Gibaud sums up the benefits of virtualization by looking at how his staff has changed over the years: "I had 12 people four years ago with 200 servers. Now I'm managing 588 [physical and virtual] with the same amount of people. That says a lot I think. It allowed us to be much more efficient with rolling out systems, and we have better standards."

VMWARE PROFILE

VMware is a leader in server virtualization software with its vSphere virtualization platform and vCenter advanced management product family. Together, these products enable the creation of private infrastructure clouds that can be linked with external cloud services.

vSphere 4 is VMware's core virtualization platform that enables the development of a virtualized infrastructure with the attributes of a private cloud. It features a set of application services that allows IT to control application service levels. Key components of the application services include:

- **Availability.** For planned downtime, VMotion allows the migration of live running VMs to another server and Storage VMotion migrates virtual machine disks across arrays. For unplanned downtime, vSphere has VMware HA for automated restart of VMs and VMware Fault Tolerance for continuous application availability. Additional modules such as VMware Data Recovery provide disk-based backups for VMs with deduplication, and vCenter Site Recovery Manager assists with migrating entire virtual infrastructures to a remote DR site.
- **Security.** VMware VMsafe provides an API that allows security products to be virtualization aware and work in conjunction with the hypervisor to provide security services to VMs. vShield Zones, built on VMsafe, allows users to create a virtual firewall with logical security zones within and across ESX hosts so that security policies can follow VMs regardless of their physical layout.
- **Scalability.** VMware Distributed Resource Scheduler (DRS) allows VMs to be prioritized and the workload to be dynamically rebalanced across servers to ensure that applications get the resources they need and service levels are met. In addition, individual VMs can be extended on the fly by leveraging "hot add" of CPU, memory, storage, and network capacity.

vCenter is VMware's line of management products, which is based around the core vCenter Server with a growing line of à la carte add-ons for advanced functionality, such as:

- **vCenter AppSpeed.** AppSpeed is an application performance monitoring product designed specifically for virtual environments. It can discover and map the various tiers of an application to physical and virtual infrastructure. It monitors the service levels from an application end-user point of view and correlates that performance to the physical and virtual back ends to help quickly identify the root cause and resolve service-level problems.
- **vCenter Chargeback.** Chargeback allows IT to map the cost of virtual infrastructure to business units. It can assign costs to server, storage, and networking resources and generate reports to provide more insight into usage and cost.
- **vCenter CapacityIQ.** CapacityIQ optimizes capacity for individual virtual machines and the underlying infrastructure. By identifying unused or overallocated capacity with ongoing monitoring, it enables IT to rightsize each application and the infrastructure. CapacityIQ also can trend and forecast capacity usage based on analysis of collected data. In addition, it allows IT to model various scenarios to understand the impact on capacity.

- **vCenter Site Recovery Manager (SRM).** SRM automates the disaster recovery process for all applications running on VMware vSphere. SRM accelerates recovery and ensures successful recovery by automating the recovery process and eliminating the complexity of managing and testing recovery plans.

vCenter also has products to assist in application development, testing, and lifecycle management:

- **vCenter Lab Manager** accelerates application development and testing by creating a private cloud for testing and development. Users can self-provision their own infrastructure with quotas and access rights automatically managed. Lab Manager can deploy, capture, and share configurations easily to speed development as well as integrate via APIs to other tools. The latest version of Lab Manager also includes Stage Manager (previously a separate product), which assists in moving applications out of the lab to production.

- **vCenter Lifecycle Manager** automates and standardizes the lifecycle of a VM from request to deployment to decommissioning. It creates a portal to service VM requests and then tracks approval/denial, ownership, and decommissioning date during a VM's life. The product also can integrate with existing enterprise systems management solutions.

CHALLENGES/OPPORTUNITIES

Challenges

- **Obtain ISV support.** While awareness and support for virtualized environments have improved greatly in recent years, many ISVs aren't all the way there yet. Virtualization support may not extend to all products, especially legacy products. In addition, more vertically targeted, niche applications have been slower to qualify, especially if the ISV is smaller and has more limited resources. With non-mission-critical applications, many IT departments were willing to go it alone and virtualize anyway, usually with few ill effects. However, with tier 1 applications, IT is unable to take that risk and often relies heavily on the ISV for support.

- **Overcome performance/reliability perceptions.** Many in IT still believe that virtualization incurs high overhead and has poor I/O performance. In reality, the virtualization performance penalty is a nonissue for the majority of workloads and increasingly more tier 1 workloads with modern hardware and software. However, the performance limitations of the early generations of virtualization still stick in the minds of many, causing virtualization implementers to constantly have to battle application owners who are concerned about whether a VM will be as good as a physical server.

Opportunities

- **Expand virtualization footprint and standardize the infrastructure.** Virtualization is quickly becoming a standardization layer for the underlying physical hardware. Bringing more applications into the fold, especially mission-critical applications, allows IT to service more of its assets in a standardized way.

- **Build the private cloud for a more agile application platform.** Virtualization offers many unique benefits in the areas of availability, management, and resource optimization. Applications can pick up these advanced features, which are presented through the private cloud as a service. By leveraging these services, applications can actually run with better availability and service levels compared with bare metal.

CONCLUSION

Virtualization has matured rapidly in just a few years. What started out as a testing and development consolidation tool quickly evolved to being applied to production applications. The latest generation of server hardware and virtualization software offers the reliability, stability, and performance that can address the majority of even tier 1 applications. Virtualization support from ISVs is becoming mainstream, making more and more applications addressable with virtualization. A key strategy to success is working closely with application owners, who are often not up to date on the latest virtualization technology, to dispel old myths. As virtualization begins to transform datacenters into private clouds, the benefits of virtualization begin to extend beyond infrastructure consolidation to offer application owners a better underlying platform that can dynamically adapt to meet service levels and provide better availability. The ultimate goal of the private cloud is to transform IT into a dynamic service and extract better operational efficiencies. The more workloads that are placed in the cloud, the more economies of scale can be leveraged. Tier 1 applications arguably stand to reap the benefits of the cloud the most as they are the most complex and the most critical. The advanced service-level management, availability, and dynamic scaling features of the private cloud become more desirable as the complexity and criticality of the application increase.