Data center virtualization still holds significant value for most enterprises: IT organizations can optimize server hardware while reducing the total number of physical servers needed. The latter improves IT staff productivity and slashes power consumption.

But virtualization is currently a job half done according to most experts. While most organizations have embraced a move toward virtualization, the preponderance still has a substantial distance to go. They are able to virtualize Web, document management, file, and print services but often hit the wall when moving beyond this state.

This is understandable. Virtualization of business-critical servers and applications is complex. “Legacy applications that often have been running in the data center for a decade are sometimes difficult to virtualize,” says Torsten Volk, senior analyst, Enterprise Management Associates, Inc. (EMA). “They frequently aren’t supported in virtual environments.”

But it’s actually more complicated than that. “Some of those applications have high storage performance requirements, including certain databases, and...”
can be virtualized only if adequate shared storage is in place and staff is available with the right levels of IT staff expertise," Volk adds. “Disaster recovery and availability are other potential obstacles.”

But as virtualization technologies mature and most applications are certified on the primary virtualization technologies, the vast majority have gotten off the fence and achieved varying levels of success. Virtualization is no longer a question of “if” but “when” for the preponderance of IT shops; the Rubicon has been crossed.

For those that are still just getting started or those that have gotten mired in virtual sprawl and cannot get beyond the first phase on the virtualization journey, there are some proactive strategies that will move them toward a fully virtualized state. To map these out, CIO Digest spoke with several members of the Enterprise Management Associates team, an industry analyst and consulting firm specializing in the full spectrum of IT and data management technologies, along with IT thought leaders from Lotus F1 Team, Ruby Tuesday, Inc., SELEX Elsag, and Wayne State University.

**#1: Engage, then wed the business**

Opinions seem to vary as to when and to what level business owners should be engaged in regards to virtualization. “IT must make the business case,” asserts Scott Crawford, managing research director at EMA. “The business must understand what the IT organization is trying to accomplish.”

Achieving this linkage is critical for Wayne State University. The organization embarked on a virtualization strategy several years ago and shifted into high gear in early 2012. The primary problem to be solved: over the years, the university developed a decentralized IT model, where the different departments owned and operated their own systems. But the university determined that it could reduce costs and improve operational efficiencies by consolidating those systems into its central data center environment. “Now, researchers and faculty can focus on their research and teaching activities while IT provides the information technology piece of their efforts,” says Robert Hoogle, director, Computing Operations Support, Wayne State University.

The driving engine of the consolidation initiative at Wayne State University: virtualization. Using VMware vSphere, the

“As we moved more and more servers to the VMware environment, backup and recovery became more challenging.”

– Petrus Jakobs, Manager, Data Protection and Storage, SELEX Elsag

**VIDEO**

Symantec NetBackup appliances enabled SELEX Elsag to adopt virtualization rapidly across its data center environment. Watch the video at go.symantec.com/selex-video.
university virtualized nearly all of its 300 x86 servers in the data center. Approximately 25 percent run Red Hat Enterprise Linux, while the remainder run Microsoft Windows.

“It is really important for IT to communicate the value of virtualization clearly to your internal customers,” Hogle says. “My mandate is to double our x86 data center capacity without adding cost or IT staff. With our chargeback model, we must demonstrate that IT is working to further optimize the services we deliver, giving them economical and competitive alternatives.”

The IT leaders interviewed for the article concur that chargebacks are one approach that drives closer alignment with the business—both in terms of visibility and accountability. “Virtual sprawl isn’t an issue for us,” notes Petrus Jakobs, manager, Data Protection and Storage, SELEX Elsag. “If end users are being charged for their virtual machines and utilization levels, there will be no sprawl, or at least they understand there are higher costs associated with their request.”

The business case for virtualization at Ruby Tuesday was easy to demonstrate. “We had to replace servers every three years and were approaching 100 physical servers,” notes Michael Thomas, director, IT Infrastructure, Ruby Tuesday. “And when we looked at some of those servers, we uncovered vast underutilization. We constructed a proposal for virtualization, which included the business value analysis, and presented it to the business.” With a full return on investment anticipated in less than two years, it seemed to be a no-brainer. But the numbers don’t speak for themselves.

The anticipated business value is not the only area the business needs to understand. The potential ramifications of an implementation that goes awry must be clearly mapped out. In addition, appropriate resources and budget must be allocated to ensure success. “When you start touching systems that are critical to the business, you suddenly get very high visibility in the event that they go down,” observes EMA’s Volk. “Communicating risks and their impact is important.”

But virtualization is ultimately an IT responsibility, according to Ruby Tuesday’s Thomas. “The business is the beneficiary of virtualization,” he states. “Accountability for success or failure sits with IT.”

#2: Security: no longer physical
As IT organizations adopt virtualization, they typically try to adapt their existing security toolsets. “This is when they begin running into problems and look for alternatives,” says Scott Crawford, managing research director at EMA.

To avoid this scenario, Crawford offers two recommendations. The first is to take the existing toolsets and determine when they can be...
used in a virtualized environment, and when they cannot. "For example, will your monitoring systems be able to distinguish issues relevant in a virtual versus physical environment, such as virtual machine deployment in conflict with the logical segmentation of network security zones or policies that restrict the use of shared storage for sensitive information?" Crawford says. "Or will it be possible to know when a virtual machine is brought online if it conforms to security standards?"

The other suggestion from Crawford, which should be done in parallel with the first, is to learn what security solutions are available in the virtual environment. These can be overlaid against use-case scenarios where existing toolsets fail to cover security requirements or actually contribute to performance problems; this helps prevent situations where unidentified security holes and performance liabilities are suddenly exposed.

The enterprises interviewed for this article concur with Crawford’s assessment. Wayne State University’s Hogle explains that security in the virtual world is much different than security in the physical world. “You basically take a data center and all of its different components and move it into a box,” he explains. “However, the same security parameters in the physical data center don’t necessarily match up in the virtualized environment. My team works closely with the security team to ensure that our architecture aligns with our security requirements.”

For endpoint security, across several thousand desktops and laptops as well as 300-plus data center servers, Wayne State University relies on Symantec Endpoint Protection. “The fact that Symantec Endpoint Protection integrates with our VMware vSphere platform makes it much easier to plan for these contingencies," Hogle states. "SELEX Elsag, Ruby Tuesday, and Lotus F1 Team also rely on Symantec Endpoint Protection for endpoint security. "Whatever endpoint security tool is employed, it must tightly integrate with your virtualization platform," says Ruby Tuesday’s Thomas. “In our case, it is a requisite that our endpoint security solution evolve with our VMware investment.”

Performance degradation is a regularly cited problem when it comes to endpoint security and virtualized environments. One way to tackle this issue is to use a dedicated virtual machine or virtual appliance to handle security scans and updates to the guest virtual machines for that shared physical host. “There is no need to have all of that resource consumption across each individual guest when much of it can be
and allows maximum density in a virtual environment. “We cannot have any performance impact on our trackside virtual servers, and Symantec Endpoint Protection delivers precisely that,” notes Michael Taylor, deputy CIO, Lotus F1 Team.

Security for virtualized networks is a changing landscape. New compliance standards—and the requirement to track and report upon them across physical and virtualized environments—and the need to protect data at rest and in motion with encryption are emerging as the next set of requirements.

And simply emulating what is accomplished at the physical level is no longer a desirable state. Wayne State University’s Hogle elaborates: “The next bastion to be overtaken is to move security off the virtual machine up into the hypervisor or onto the network—a virtualized network in a box.” An example of this next transformation is the Shared Insight Cache feature in the latest version of Symantec Endpoint Protection that moves portions of security from each guest operating system into a dedicated security virtual appliance. It is onward and upward into today’s new virtualized world—or in this case the data center.

#3: Availability: much more than clustering

Storage is central when it comes to virtualization. In particular, shared storage is expensive and multiple operating systems on the same physical host can lead to significant performance challenges. “Ironically, many organizations still have sufficient SAN space available,” EMA's Volk observes. “But they still need to purchase storage hardware due to performance degradation.”

Automation is another area that will become increasingly important, replacing manual provisioning and management of virtual machines. “Lack of automation leads to virtualization stall,” Volk says. “Virtual machines become impossible to manage.”

In late 2010, before the start of the 2011 F1 season, Lotus F1 Team chose to move toward virtualization. Most organizations would start with their test or development servers supporting factory
systems. This, however, was not the approach of the Lotus F1 Team. “We elected to virtualize our most business-critical assets—our trackside servers,” Lotus F1 Team’s Taylor says. Under the previous scenario, Lotus F1 Team had to ship and manage 28 physical servers. “The hardware and shipping costs were substantial, not to mention their ongoing management,” Taylor says.

The Lotus F1 Team consolidated its trackside server environment to five physical servers using a combination of VMware vSphere and Symantec ApplicationHA. “Alone, VMware vSphere doesn’t give us the automation or control that we need,” Taylor says. “With ApplicationHA, we have granular control and the ability to start, restart, and monitor all of the applications that run throughout our VMware environment.”

Not a team to sit on their laurels, the Lotus F1 Team evolved the trackside environment further by migrating data protection tasks to a Symantec Backup Exec 3600 appliance. “As we moved more and more servers to the VMware environment, backup and recovery became more difficult,” Jakobs says. “Backups were resource intensive and created bottlenecks; this increased backup windows and impacted recovery performance.”

About two and a half years ago, SELEX Elsag upgraded to NetBackup 7. The before-and-after picture was vivid. Backup time was cut 60 percent with the addition of V-Ray technology. Recovery time decreased from as much as 9 hours to 20 minutes. And the amount of time spent managing backup and recovery was dramatically reduced.

Virtualization can create very complex backup and recovery architectures and processes. There are a number of issues, according to Steve Brasen, research director, EMA. “It includes everything from finding and recovering individual files to how backup agents are configured,” he states.

This was the initial experience of SELEX Elsag, which began implementing server virtualization using VMware vSphere in 2006. “We began by putting it on smaller machines in our test environment,” recalls SELEX Elsag’s Jakobs. “We then started to incrementally add services in our production environment. We’re now about 60 percent virtualized, with only our SAP and Oracle database environments running on Solaris left to go.”

This presented substantial benefits, though not without its challenges. “When we began implementing virtualization, we managed backup in the old-fashion way, by putting agents inside every virtual machine,” Jakobs recalls. “But this was highly inefficient and incurred a number of management challenges.”

Symantec NetBackup has been a long-standing fixture at SELEX Elsag since the late 1990s. “As we moved more and more servers to the VMware environment, backup and recovery became more difficult,” Jakobs says. “Backups were resource intensive and created bottlenecks; this increased backup windows and impacted recovery performance.”

Traditional organizational silos can also present new challenges as organizations adopt virtualization. Take SELEX Elsag as an example. The team that manages virtualization is different than the team that manages the backup and recovery environment. “Every time a backup job was conducted, each team had to talk to each other to identify virtual machines, storage targets, and physical hosts,” Jakobs remembers. “With V-Ray technology, we no longer need these two groups to communicate before a backup job is initiated. NetBackup gives us a transparent view across our data center environment, regardless of whether it is virtual or physical.”

Expansion of data is a big challenge for Wayne State University as it moves from a decentralized to centralized computing model. “A traditional approach to backup...
simply won’t work any longer,” Hogle asserts. “Take as an example a genomic DNA application that we’re integrating right now. It produces nearly a terabyte of data each day. And this is just one of many examples. You simply cannot conduct a weekly or monthly full backup with daily incremental.”

Hogle and his team are confronting this challenge in two ways. The first was to upgrade to NetBackup 7.5. “With NetBackup Accelerator, we are able to break our backup window into smaller pieces and load balance between the media servers,” he says. “We also get closer integration with VMware that allows us to back data up at the VMware ESX level rather than at the virtual machine level, in addition to recovery at the file level.”

The second was to deploy NetBackup’s Data Protection Optimization option as well as two NetBackup 5220 appliances. “We continue to rely on a software-based form factor for our traditional data center components but are leveraging the appliances for departmental file share,” Hogle says. “We anticipate deduplication rates between 8 and 12 times.” With nearly 120 terabytes allocated to file share data, Hogle expects to see this reduced to as little as 10 terabytes. This amounts to more than $1.5 million in storage savings. In addition, the NetBackup appliances will have a dramatic effect on recovery; large restores sometimes took days, a ratio that will be reduced to minutes with NetBackup Accelerator and Replication Director.

Deduplication also factored into the larger data protection strategy that SELEX Elsag implemented. Jakobs identifies three overarching issues that deduplication helped them resolve. First, restoring from tape was time intensive. It took a lot of time to search for the files and then recover the data. Second, as SELEX Elsag maintains storage at remote offices, managing the tape libraries at them had become quite complex. “Without dedicated IT staff, having a tape library at a remote office became a huge headache,” Jakobs says. Third, the ongoing explosion of data was expensive and time consuming to manage.

With the NetBackup Data Protection Optimization option, SELEX Elsag is achieving 90 percent to 95 percent deduplication rates. “This dramatically shrunk backup windows and slashed hardware and power costs,” Jakobs reports. “It also streamlined backup for our virtual environment.”

“We chose the appliance form factor because of ease of installation and management,” Jakobs continues. “Under the previous software-based model, we had to acquire dedicated servers, install an operating system, allocate storage, and then manage changes—including upgrades—manually. With the NetBackup 5220 appliances, this is virtually a matter of plug and play.”

Ruby Tuesday has similar challenges to Wayne State University and SELEX Elsag. “We have some backups that are pushing into business operations,” Ruby Tuesday’s Horn notes. “The traditional approach to backup simply cannot keep up with our data growth. A different solution is needed. NetBackup Accelerator, when combined with the Data Protection Optimization option, will completely change our backup mentality.”

Virtualization allowed us to be better prepared for disaster recovery.

– Jason Horn, Director, IT Network Services, Ruby Tuesday, Inc.

Virtualization presents its own unique disaster recovery challenges. For example, backing data up in a virtualized environment can create bottlenecks in disk I/O and network bandwidth. The same issues apply when recovering that same data. “Capacity planning is vital here,” EMA’s Brasen states. The more efficient the backup and recovery solution, the fewer constraints in performance and network bandwidth.

SELEX Elsag’s Jakobs concurs with Brasen: “IT should spend significant time on capacity planning and architecture design before moving to the implementation phase. If the wrong infrastructure is laid, the virtualization effort will be fraught with problems, even failure.”

Solutions that are agnostic in terms of hardware and software, physical or virtual, provide IT organizations a much greater degree of flexibility in architecture design and infrastructure selection of their primary and secondary sites. Specifically, the ability to migrate data between physical and virtual—or for that matter the cloud—is important. Once the
majority of systems have been virtualized, however, the need to conduct physical-to-virtual (P2V) and virtual-to-physical (V2P) recoveries diminishes. “Having a backup and recovery toolset that enables restores in both directions is important,” Wayne State University’s Hogle notes. “Even when fully virtualized, you never know when you might need to restore data to a physical box, say in a disaster recovery location.”

The situation at Ruby Tuesday is similar. “We have virtualized almost 90 percent of our data center environment,” Thomas says. “But on the journey, which took four or five years, we required a backup and recovery solution that permitted P2V and V2P data migration and restores.” Jason Horn, director of IT Network Services at Ruby Tuesday, continues: “Virtualization allowed us to be prepared better for disaster recovery. With NetBackup, we consolidated everything into our shared storage environment and replicate that to our disaster recovery facility.”

#6: Just a pit stop on the way to the cloud
Virtualization is simply a pit stop for most IT organizations. The ultimate destination is the cloud; virtualization is a requisite foundation. “Virtualization is a key enabler of cloud services,” EMA’s Crawford says. “Without the agility, cost and operational efficiencies, and flexibility that virtualization provides, the business case for shared services through the cloud would be greatly diminished.”

Consider the hiring of Hogle by Wayne State University. On the job for about 150 days, expediting the university’s journey to the cloud is the reason he was hired. “Virtualization lays the groundwork for our shared services model,” he says. “We offer a number of services today and are in the process of creating infrastructure as a service, platform as a service, and storage as a service private cloud offerings to our different departments.”

The ability to leverage a private cloud model enables greater flexibility while driving down costs for Wayne State University. “Not everyone needs a Cadillac,” Hogle continues. “The requirements of our customers are variable. We want to have the ability to spin up a computing environment and spin it back down as needed.”

Under the previous computing model, individual departments would acquire hardware and software infrastructures that might sit idle the majority of the time with low utilization rates, in many cases 15 to 20 percent. With virtualization, the university is seeing utilization levels in excess of 50 percent. “The savings we will see from our private cloud initiatives will be dramatic,” Hogle sums up.

SELEX Elsag is taking a similar approach. “Now that our virtualization infrastructure is in place, we are in the process of developing a series of private cloud offerings,” Jakobs notes. “Without virtualization, our move to the cloud would be impossible.”

The Rubicon has been crossed
In the ancient Republic of Rome, there was a codified rule stipulating that the Roman legions would not be used against the citizens of Rome. As a result, they were barred from crossing certain borders that separated Rome from surrounding allies; any Roman magistrates who violated this point of demarcation without designated authority were subject to death.

This long-standing precept was obviated when Julius Caesar and his legions crossed the Rubicon River in pursuit of Gnaeus Pompeius Magnus (Pompey the Great). And thus, just as Caesar’s legions filled the confines of ancient Rome when Pompey and the Senate fled to Greece, virtualization is filling the data center; it crossed the Rubicon and is overtaking nearly everything—starting with the servers and now the storage and network. The virtualization Rubicon has been crossed and there is no turning back.

Patrick E. Spencer (Ph.D.) is the editor in chief and publisher for CIO Digest.

**COMPANY PROFILES**

**LOTUS F1 TEAM**
- Location: Enstone, United Kingdom
- Founded: 1981
- Website: [www.lotusf1team.com](http://www.lotusf1team.com)

**SELEX ELSAG**
- Location: Genoa, Italy
- Founded: 2011 (Finmeccanica dates to 1948)
- Employees: 7,400
- Services: A Finmeccanica company, providing ICT services
- Website: [www.selexelsag.com](http://www.selexelsag.com)

**RUBY TUESDAY, INC.**
- Location: Maryville, Tennessee
- Founded: 1972
- Restaurants: 790 and expanding
- Employees: 37,000+
- Website: [www.rubytuesday.com](http://www.rubytuesday.com)

**WAYNE STATE UNIVERSITY**
- Location: Detroit, Michigan
- Founded: 1868
- Academic Programs: 400 through 13 schools and colleges
- Students: Nearly 32,000
- Website: [www.wayne.edu](http://www.wayne.edu)