

Nationwide



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Section 1: Introduction / Customer Summary

Ranked number 104 in the Fortune 500, Nationwide Mutual Insurance Company ("Nationwide") is one of the largest insurance and financial services companies in the world. With more than 16 million policies in place, its areas of expertise include domestic property and casualty insurance, life insurance, retirement savings, asset management and strategic investments. Nationwide is headquartered in Columbus, Ohio, and has 36,000 employees.

After a major data center upgrade that cost in the millions of dollars, in 2004 Nationwide was still facing continued server sprawl — particularly with its Windows servers. The company realized that if it continued with its existing one-server-per-application IT model, it would need to expand its data center further in order to keep growing business at the rate it wanted. But with a new data center costing millions of dollars, and with the likelihood of outgrowing the data center in the near future, Nationwide began researching alternatives to its existing IT model.

By "going virtual" — that is, running operating systems and applications into virtual machines that share physical resources — the company found that it would be able to grow its infrastructure as it wished, while conserving equipment, data center space and IT management costs. Another reason the company wanted to go virtual was to realize better server-utilization levels. Typical utilization rates for Windows servers were between one and five percent, with almost all being less than 20 percent.

In evaluating virtualization solutions, Nationwide's criteria included product stability, minimal performance overhead, solid customer base, performance and breadth and depth of features.

After evaluating competing virtualization products, Nationwide chose VMware® Infrastructure to form the foundation of its virtual infrastructure. Virtual Infrastructure 3 includes VMware Virtual Center to manage and monitor the environment and quickly provision servers. Virtual infrastructure services like VMware Distributed Resource Scheduler (DRS), VMware VMotion™ and VMware High Availability (HA) help Nationwide to balance workloads automatically and keep the infrastructure optimized.

Since moving the solution into production in 2005, the company has seen manifold benefits. It has

- Reduced its physical server count by nearly 700
- Achieved a consolidation ratio of at least 13:1
- Improved server utilization rates by 30 to 70 percent
- Saved more than \$2,200,000 in hardware costs
- Decreased server provisioning time from 45 days down to 48 hours
- Reduced the time it takes to bring up systems in the event of a disaster

Having experienced these compelling benefits, Nationwide has standardized on VMware Virtual Infrastructure and implemented a "virtual-first" policy for its Windows-based systems. "All servers are eligible for virtualization," says Tom Gruzs, systems engineer at Nationwide. "This is our default server configuration. There needs to be a business case why a server can't be deployed on the virtual platform."

In November 2007, Nationwide was awarded the prestigious InfoWorld 100 Award for its smart, innovative and creative use of virtualization to control server sprawl. The insurance company looks forward to continued innovations in VMware Infrastructure and sees the platform as a vital tool in helping to manage its Windows infrastructure while reducing overall infrastructure costs.

Section 2: Challenge / Business Requirements

In 2004, Nationwide faced typical server sprawl and underutilization issues: Business was growing rapidly and the company needed to control its growing number of servers, which totaled nearly 3,000. In particular, the company needed to stem the growth of its Windows servers. As many organizations do today, Nationwide was buying one Windows server for each software application. With complex applications, says Gruzs, "A new application may mean one server, or it may mean five or six more servers."

The company had recently completed a data center upgrade — adding power and cooling capacity — that cost several million dollars. After that upgrade, says Gruzs, "We still had room to grow, but we saw that as our business continued to expand, we would quickly outgrow the floor space and the power and cooling."

Using the traditional one-server-per-application IT model, the company would need to acquire more physical boxes and expand the data center in order to continue growing. But with the towering costs of an expanded data center, Gruzs says, "Nationwide decided to see what other options were available to us. We wanted to see if there was a way for us to continue growing without necessarily having to keep increasing floor space."

As Nationwide was considering its options, server virtualization was just beginning to gain momentum in IT organizations. By turning to virtualization, Nationwide could not only consolidate applications onto fewer servers, but because virtual machines share the resources of multiple hardware components, server utilization would improve as well. "We found that the majority of our Windows servers ran below 15 percent of CPU capacity, on average," says Gruzs. Nationwide wanted to use those untapped resources.

Section 3: Solution Evaluations

As the company began to evaluate its virtualization options, small pockets within Nationwide had already seen good results using VMware virtualization products. Disparate business units were successfully using VMware Workstation and VMware GSX Server for test and development.

Nationwide was open to all options when researching choices for its companywide virtual infrastructure solution. For Nationwide, critical evaluation criteria included

- Product stability
- Performance
- Reputation with customers
- Ease of management
- Technology leadership and vision
- Breadth and depth of solutions

After extensive market analysis and comparative evaluations, in mid-2004 Nationwide chose VMware Infrastructure as the foundation for its companywide virtual infrastructure solution for Windows-based systems. VMware ESX Server, the foundation of VMware Infrastructure, installs directly on physical hardware (on "bare metal") and allows multiple operating systems to run in virtual machines that share physical resources. Virtual machines share CPUs, memory, disk space and network interface cards as a single resource pool. IT administrators provision virtual machines and monitor the performance of physical and virtual machines with VMware Virtual Center.

Section 4: Deployment

In 2004, Nationwide deployed Virtual Infrastructure 2 for software development and testing purposes. At that time, many employees in the company were still unfamiliar with virtual infrastructure, and there were challenges in getting the solution widely accepted. "Early on, there was a lot of resistance to virtualization," says Gruzs. "Many of our business partners did not know what virtualization was. Some may have seen it at the workstation level, but on an enterprise level they really had nothing to compare it to."

To introduce people to the technology, Nationwide first marketed virtual servers internally as being "as good as" physical servers. Says Gruzs, "Our strategy was to promise comparable performance, availability and recoverability we were able to provide with physical servers."

Internal Education

Nationwide used this introductory deployment phase to actively and gradually educate employees about virtualization. "We deployed a complete VMware virtual server environment and invited people to work with it," says Gruzs. "We found that once people had an opportunity to use the servers in a virtual environment, they liked it. Virtual servers were not as different from physical servers as they were expecting."

Nationwide connects today's widespread acceptance of the solution with the step-by-step, hands-on approach the company took in educating its employees about the solution. "We introduced virtualization very slowly. We gave presentations, walked through things with everybody piece by piece," says Gruzs. The skeptics have come a long way. Gruzs says, "In fact, as people become more and more familiar with the technology, many are starting to view virtual machines as better than physical servers."

Demonstrating the cost benefits of virtualization was key in breaking through the initial "server hugger" mentality at Nationwide. "We had to make it cost-effective," Gruzs says. Today the startup costs of a virtual machine are nearly \$5,000 less than the price of a 2-CPU physical server. This is not including monthly savings on power, cooling, floor space, and so on. Nationwide already had an existing chargeback model for its physical servers, and it was easy to maintain this with its virtual servers. "We have a set monthly rate for physical servers and another for virtual machines," says Gruzs.

ISV Support

Though today's independent software vendors are increasingly supportive of their products in a virtual environment, when Nationwide was implementing VMware, many companies did not yet have official policies around virtualization. Nationwide needed to contact some of these vendors directly. Says Gruzs, "Our VMware Technical Account Manager (TAM) was especially helpful in this effort. Through him we were able to use VMware's internal resources and vendor relationships. We were usually able to get at least a 'one-off' support statement, even if the vendor did not yet have an official support policy."

Virtual Infrastructure Timeline

After using VMware Infrastructure 2 for testing throughout 2004, Nationwide moved it into production in 2005. In late 2005 the company switched from using local attached storage to using an EMC Clariion SAN. With a SAN, Nationwide could now use VMware VMotion to perform live migrations of virtual machines with no downtime.

The Nationwide data center consisted of over 3,000 x86-based servers before virtualization — 2,000-plus were production servers and 1,000-plus were lab and disaster recovery servers. Today Nationwide has reduced its server count by nearly 700. The VMware Capacity Planner helped Nationwide to identify how many servers in the environment were candidates for virtualization. By 2006, “We had reduced physical server counts by a net of 500,” says Gruzs. In 2007 Nationwide made 137 additional server reductions.

Recently, Nationwide upgraded its core data center to VMware Infrastructure 3, the third-generation VMware infrastructure solution. It simultaneously upgraded its hardware from single-core processors to dual-core processors — an upgrade that lets Nationwide take full advantage of VMware SMP™. Four-way symmetric multiprocessing lets a single virtual machine use up to four processors (single-core or dual-core). VMware Virtual SMP with dual-core processors greatly enhances the performance of virtual machines — especially those running resource-intensive workloads. Nationwide is currently running over 250 virtual machines with Virtual SMP.

Today Nationwide has virtualized over 40 percent of its Windows servers, with the number steadily growing. “In total,” says Gruzs, “we have close to 900 virtual machines — 650-plus in production and 200-plus in lab — spanning over 100 ESX servers.”

Applications Running in Virtual Machines

More than 60 percent of virtual machines at Nationwide are in production. The remaining are test/lab machines. Guest operating systems include Microsoft Windows 2000, Windows 2003 and Windows XP. There are also a small number of Red Hat Linux and SuSE Linux operating systems in virtual machines. Nationwide applications in production in virtual machines include

- Enterprise applications: PeopleSoft, Citrix, Bloomberg
- Enterprise collaboration applications: Lotus Notes Domino Databases
- Databases: Microsoft SQL Server, IBM DB2 Connect
- Business intelligence: Hyperion Performance Suite
- Infrastructure workloads: Domain Controllers, WINS, FTP and Print servers

Section 5: Virtual Infrastructure Operations

In 2007, the company decided to standardize on a “virtual-first” policy. Nationwide has developed best practices that have made IT infrastructure management more efficient while increasing the reliability of the virtual environment.

ESX Host Provisioning

In 2006, Nationwide began using Hewlett Packard’s Rapid Deployment Pack (RDP) scripts to build out its ESX Server hosts. Says Gruzs, “Not only have the RDP scripts saved us time, the scripts helped us minimize the configuration variances between ESX Server hosts.”

Virtual Machine Configuration and Provisioning

Nationwide uses a standard configuration for new virtual machines:

- 1 CPU
- 1GB RAM
- 2 Virtual Machine Disk Files (VMDKs). The first VMDK contains the operating system and the second contains any utilities such as antivirus and VMware Tools. Every machine receives 10GB for the first VMDK and 4GB for the second. Additional VMDKs are added to the configuration as needed for application data. These default to a standard 10GB unless the customer specifies otherwise.

Nationwide uses VMware templates and the Hewlett Packard RDP utility for help in building out the virtual machines as well. “We have a two-stage process for deployment now,” says Gruzs.

The company initially deployed virtual machines using preconfigured templates for those virtual machines running Windows Server Standard Edition and Windows Server Enterprise Edition. However, Nationwide later encountered problems with Microsoft SYSPREP changing the security settings. Today, Gruzs says, “We start with a virtual machine that has a base OS, so that it’s as if you installed Windows with all of the defaults. Once SYSPREP finishes, we run RDP scripts to build out the server. The RDP scripts complete the process with antivirus and backup agents, monitoring agents, security settings and so on.”

Of all factors affecting virtual machine performance, using multicore processors has had the strongest impact. Says Gruzs, “We’ve done tests over the years, and we’ve found that the single resource that has the most impact on performance is the number of CPU cores on the physical box.” VMware Infrastructure RAM capacity and virtual symmetric multiprocessing also significantly affect performance. “With dual cores, increased RAM, and virtual SMP, we can now take a lot of the machines we previously excluded and make them virtual,” says Gruzs.

Automatic Workload Balancing with DRS

Nationwide relies on VMware DRS for automatic workload balancing among virtual machines. DRS continuously monitors utilization levels across resource pools, and when virtual machine resources are constrained, DRS automatically migrates live virtual machines to a different physical server using VMware VMotion.

While it is possible to customize rules for DRS behavior, Nationwide has implemented DRS in automated mode, where the recommendations for re-allocating virtual machines get automatically executed. Within DRS, there is a threshold system that signifies how urgent it is to take action. Says Gruz, "We take the DRS default setting, which is a three-star setting, so when things reach that point, DRS determines how much of an improvement it can make and it takes action on a particular virtual machine."

Nondisruptive Maintenance with VMotion

Nationwide relies on VMotion to perform maintenance tasks without downtime. "VMotion allows us to do maintenance and administrative work without disrupting service to the business," Gruz says.

When migrating from Virtual Infrastructure 2 to Virtual Infrastructure 3, says Gruz, "One-time VMotion contributed to the success of the migration. We were upgrading both to V13 and a new storage frame simultaneously, and one-time VMotion helped to make this a huge success."

Management and Alerts

Nationwide uses Mercury SiteScope for host-up and host-down monitoring on hosts and virtual machines. Hewlett Packard's System Insight Manager (SIM) also helps Nationwide to monitor the physical hardware for ESX Server hosts. For Virtual Center, says Gruz, "We use the default settings that are automatically installed by Virtual Center. We are exploring using Virtual Center alarms to help monitor ESX Server SAN storage capacity and other aspects of our virtual environment."

Disaster Recovery and Availability

At Nationwide, a physical server has a physical DR counterpart in another data center, and a virtual machine has its own virtual DR counterpart in a separate data center as well. The company backs up each server or virtual machine to tape every night. Says Gruz, "Just as when we were using only physical servers, we still maintain a 1:1 ratio of restoration to production servers, but now there is also a virtual-to-virtual configuration in the mix."

Financial Model

Monthly costs for maintaining virtual machines are much lower than for maintaining physical ones. In 2006 Nationwide instituted a purchasing system where Nationwide Services Company, the company IT department, would charge a fixed monthly fee for server usage. "With a virtual environment," says Gruz, "those costs are drastically reduced, because the costs to run a virtual server — including personnel, heating, cooling and power — are much less."

VMware High Availability and VMware Converter

Nationwide has implemented VMware High Availability, which monitors physical servers and restarts virtual machines affected by server failure. Gruz says, "It's an important failsafe in case a host server goes down unexpectedly."

When the company needs to convert an existing physical system to a virtual machine (rather than create a new one), Gruz says, "We take advantage of VMware Converter, which helps to automate the conversion process."

Training, People and Processes

Nationwide credits VMware support and training with helping the company get its employees proficient in all aspects of the infrastructure. Nearly 50 people at Nationwide have attended installation and configuration classes led by VMware at Nationwide. Other employees attend trainings when they occur locally.

VMware offers a Certified Professional Program that demonstrates expertise in VMware virtual infrastructure. "Seven of our employees have completed the VMware Certified Professional Program," Gruz says.

"There is currently not a specific internal VMware team. We made the decision early on that we were not going to create a team like that, because eventually the majority of servers would be virtual," Gruz says. "So we spread responsibility evenly over the team that manages Windows servers."

Virtual-First Policy

Nationwide has steadily expanded the scope for which applications are considered appropriate for virtualization. Initially, in 2005, a machine could only go virtual if required

- Less than 40 percent CPU
- Less than 2GB RAM
- Less than 100GB of disk storage

In 2006 Nationwide removed the disk storage limitation. In 2007, Nationwide removed the remaining criteria so that, says Gruz, "We now consider all servers eligible for virtualization. There needs to be a business case why they can't go virtual."

Section 6: Impact of Virtualization

The expanded, strategic role of virtual infrastructure at Nationwide reflects its power to dramatically improve IT management processes, while providing mainframe-class availability for industry-standard hardware. When Nationwide originally embarked on the virtualization journey in 2004, the goal was to consolidate servers in order to improve server utilization — and ultimately defer building a new multimillion dollar data center. Since then, virtual infrastructure has become a strategic technology that is changing the way Nationwide manages its IT infrastructure. A primary benefit of the solution, says Gruzs, “is the increased stability of workloads.” Because virtualization takes the hardware component out of the picture, “We don’t have to deal with hardware-specific issues like different driver levels and different hardware agent versions.” There is now a directive from senior management to decrease the number of physical servers as Nationwide grows. “VMware software plays a key role in enabling that strategy.”

Improved Utilization

Before switching to VMware Infrastructure software, most Nationwide servers had a utilization rate between one and five percent — almost all fell below 20 percent. With VMware Virtual Infrastructure, server utilization improvement levels range between 30 and 70 percent, with most VMware ESX Servers averaging between 30 to 70 percent utilization. Some reach as high as 90 percent utilization, depending on the applications or system the server is running.

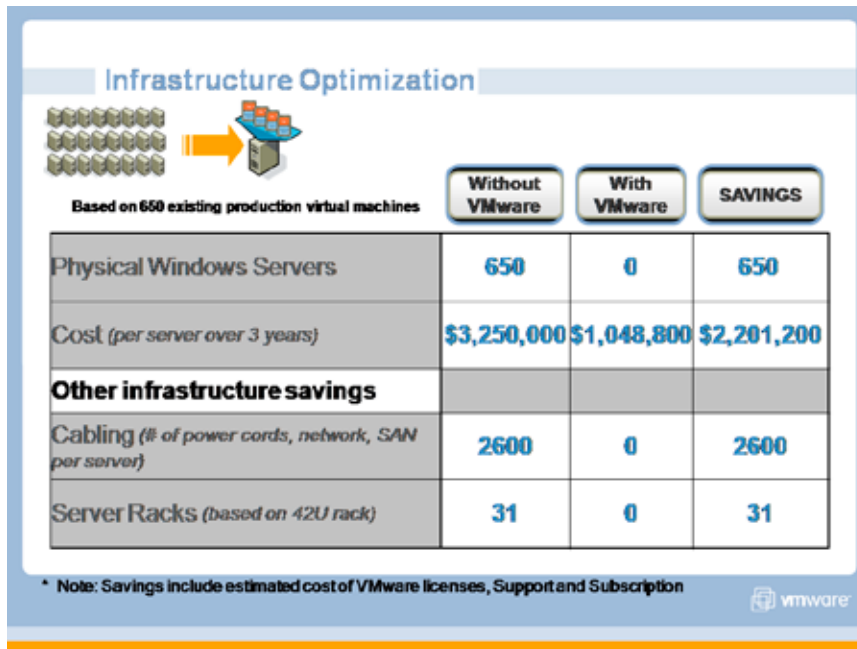
Cost Savings

To date, Nationwide estimates a savings of more than \$2,200,000 in hardware costs. In fact, virtual infrastructure-based cost savings at Nationwide increased between 2005 and 2007. In 2005, the average virtual machine — including hardware, VMware ESX Server license and SAN costs — cost Nationwide about \$3,800. A comparable 2-CPU physical server costs \$5,000, putting the per-virtual-machine savings at \$1,200, not including monthly power and cooling savings. After Nationwide implemented a virtual-first policy and standardized on VMware Infrastructure in 2007, savings more than doubled. With a virtual machine costing \$1,200 compared to a physical machine’s \$5,000 the savings per virtual machine is nearly \$3,800. When factoring in savings in server rack usage and network cabling costs, Nationwide is saving significantly more per month (see Figure 1).

Faster Provisioning

Server provisioning time has been cut from 45 days down to 48 hours. Without virtualization, Gruzs says, “We would have had to increase our provisioning time and spend extra resources designing and engineering servers. Deployment is also faster with the help of the virtual machine template feature in VMware Virtual Center and RDP scripts.”

Figure 1: Virtual Infrastructure Cost Savings



Easier Capacity Management

The company can also handle change requests more easily. "If there is a request for more capacity for a given virtual machine," says Gruz, "we can usually adjust their current resources or give them another CPU, extra RAM or additional storage."

Easier Server Lifecycle Management

Virtual machines can now be deployed and decommissioned more easily than physical servers, improving the entire server lifecycle process. "One of the attractive things about virtualization," Gruz notes, "is that it's much easier to dispose of unneeded virtual machines. If you want the virtual machine, that's great. If you don't want it you can delete it and there's no equipment to remove and no facilities to disrupt. Actually the whole server lifecycle process has been greatly enhanced, from speed to deployment, and speed to decommission."

Reduced IT Management Time

Gruz estimates Nationwide has seen a 20-25 percent reduction in server administration time. "Server administration is much easier with VMware Virtual Center and DRS. We can easily view reports. Administrators use Virtual Center to view resource usage for each virtual machine. And DRS moves virtual machines to different servers automatically, if needed," says Gruz. "Even if there's a network problem, Virtual Center always guarantees access to virtual machines."

With DRS, Nationwide does not need to pay close attention to the kinds of workloads it runs, on which hosts and other statistics. "Now," says Gruz, "we set the DRS threshold to what we want, and we know DRS is monitoring and balancing things out on a regular basis."

Mainframe-Class Reliability and Uptime on Industry-Standard Hardware

"With the exception of patching and upgrades, it's common for us to see an ESX Server host remain up for 200 days or more," says Gruz. "Windows guests can have 150 days or more of uptime."

Increased Workload Stability

With VMware Virtual Infrastructure, Nationwide finds that workloads in general are more stable. In fact, Gruz considers this one of the biggest benefits of the VMware solution. He says, "We've taken the hardware component out of the picture such that we're not having to deal with hardware-specific issues — different driver levels, hardware agent versions — variables that for one reason or another could compromise stability."

Better Disaster Recovery

Using virtual machines for disaster recovery, the IT team does not have to replicate hardware. Also, the time to reboot a virtual machine is much faster than for a physical machine — approximately 30 seconds for a virtual machine as compared to 3–5 minutes for a physical server.

Section 7: Looking to the Future

The goal for Nationwide in 2008 continues to be reducing physical server counts. In 2007, the company reduced servers by 137, while in 2006 it reduced the count by 500. The company sees its VMware virtual infrastructure growing. Gruzs concludes, "Not only in capacity, but also in performance and features. Virtual infrastructure is transforming the way Nationwide views and manages the data center."

VMware Virtual Infrastructure at Work

- Number of physical servers: 2,000
- Reduction of physical servers: 700
- Number of virtual machines: 874 (654 in production, 202 in test & dev)
- Number of VSMP machines: 250
- Percent of x86 infrastructure virtualized: 25%
- Server consolidation ration of 13:1
- More than 100 instances of VMware Infrastructure 3 on 2- and 4-CPU HP Proliant servers:
 - ESX Server 3
 - VSMP
 - VMotion
 - DRS
 - HA
- Virtual Center 2 on 2-CPU HP Proliant servers
- EMC Clarion & Symmetrix SAN
- Guest operating systems running in virtual machines: Microsoft Windows 2000, Windows 2003, Windows XP, RedHat Linux and SuSE linux
- Production applications running in virtual machines:
 - PeopleSoft, Citrix, Bloomberg
 - Microsoft SQL Server and IIS Web Services
 - IBM DB2 Connect, Hyperion Performance Suite
 - Lotus Notes Management and DB services
 - Domain Controllers
 - Print Servers



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