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X86 Server Virtualization For High Availability And Disaster Recovery

by Stephanie Balaouras and Christopher Voce
for IT Infrastructure & Operations Professionals

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How x86 Server Virtualization Affects Business Resiliency

by **Stephanie Balaouras and Christopher Voce**

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EXECUTIVE SUMMARY

To date, the primary driver behind the adoption of server virtualization has been consolidation. But as enterprises gain experience with the technology, additional uses and benefits are surfacing. According to a recent Forrester study, 49% of enterprises surveyed that are implementing or interested in x86 server virtualization indicate that improving disaster recovery/business continuity continues to be a very important motivation for adoption. Server virtualization facilitates a rapid — or even automatic — restart of applications after an IT failure, and when used in conjunction with data replication between data centers, it can restart applications at a recovery site following a primary site failure. In particular, x86 server virtualization can improve the availability of business-critical systems that are important to the business but not critical enough to warrant the investment in expensive and complex resiliency technologies like fault-tolerant hardware or clustering.

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Related Research Documents

["Six Years After 9/11, Most Firms Are Not Ready For Another Disaster"](#)
September 11, 2007

["What Does Windows Server 2008 Mean To My Organization?"](#)
August 1, 2007

["Despite Challengers, VMware Will Continue To Lead Server Virtualization"](#)
July 9, 2007

["Decoding Virtualization's Present And Future"](#)
January 9, 2007

APPLICATION RESILIENCY IS CRITICAL TO BUSINESS SUCCESS

Companies devote a significant amount of resources to keeping their core mission-critical applications up and running. According to Forrester's Enterprise And SMB Hardware Survey, North America And Europe, Q3 2007, 56% of surveyed enterprises identified the cost of downtime as a driver to improve disaster recovery (DR) capabilities, followed by the requirement to improve the availability of a mission-critical application (52%), and the requirement to stay online and competitive 24x7 (48%).¹ This indicates that there is less tolerance for application downtime specifically due to:

- **Cost of downtime.** Companies have come to the realization that the cost of downtime includes not only revenue losses, but also employee productivity losses; compliance penalties (e.g., fees because your finance system was unavailable at a critical fiscal close); and penalties and discount losses (e.g., penalties or late fees from an inability to process payments, or potential discount losses from an inability to process early payments and take advantage of discount terms).
- **Impact to reputation and customer retention.** Companies no longer work in a vacuum; they rely on and also are a part of a complex web of partners and suppliers. Downtime can have a very negative effect on your reputation with strategic partners and suppliers, as it can affect their ability to conduct business. In addition, downtime can affect your reputation with customers and your ability to maintain customers and market share. In this age of 24x7 operations, customers have a much lower tolerance for service downtime. They expect to buy the products and services they need when they need them, and they expect customer support 24x7. If they're disappointed, they'll move on to a competitor — either immediately or when their contract expires.
- **Impact to long-term business objectives.** Downtime also has an effect on long-term business objectives such as growth and globalization. Clearly, permanently lost revenue and lost customers affect growth objectives, but downtime can also affect the ability of a company to globalize successfully. In a 24x7 global operating environment, IT no longer has the luxury of maintenance windows during non-business hours or the luxury of a six-week time to recovery. In a global operating environment, companies have less downtime to perform scheduled maintenance and backups, and any extended outage will affect the ability of a foreign subsidiary, division, or partner to conduct business.

But Protecting Only Your Most Mission-Critical Apps Isn't Good Enough

There are two dimensions to application resiliency: high availability and disaster recovery. The goal of high availability is to prevent or mitigate application outages due to failures and errors within a specific system domain, while disaster recovery restores systems following a primary site disruption or failure. For your organization:

- **Providing resiliency for all applications in the data center is costly and complex . . .** Firms must balance the cost of downtime and the potential risk of loss against the cost of delivering resiliency, which can be high. As a result, firms often invest in resiliency technologies like clustering for

application high availability or SAN-based replication to support only the most mission-critical applications, while less critical applications are supported with options such as system backup and recovery. Addressing different resiliency requirements with the most cost-effective technology helps reduce the initial acquisition cost of the required technologies, but it can increase complexity. The more point products a company must manage, the more difficult it is to coordinate recovery. Companies must try to limit the number of point products they deploy.

- **... but different levels of application resiliency can cause problems.** Improving the resiliency of business-critical systems improves the overall resiliency of the business because there are a few business processes today that rely on a single mission-critical application. Applications are now so interdependent that one highly resilient application may utilize data or resources from multiple applications with lower levels of resiliency. In the event of a disruption, the highly resilient applications are at the mercy of their less resilient application partners, causing potential critical business processes to fail. For example, if a brokerage firm experienced a data center power outage, traders would not be able to successfully conduct business unless all of the applications involved in completing transactions were restored.
- **Server virtualization may offer a practical alternative.** Server virtualization can help extend resiliency to business-critical applications without breaking the bank.² Companies are beginning to recognize this, and it's becoming a driver of expanded use of server virtualization as well as new adoption (see Figure 1). For example, if a physical server that hosts an image of your CRM system fails, an administrator can restart the CRM image on another available physical server. Your downtime is limited to the time it takes to detect the outage and then to restart the virtual machine image.

Traditional Approaches To High Availability All Come Up Short

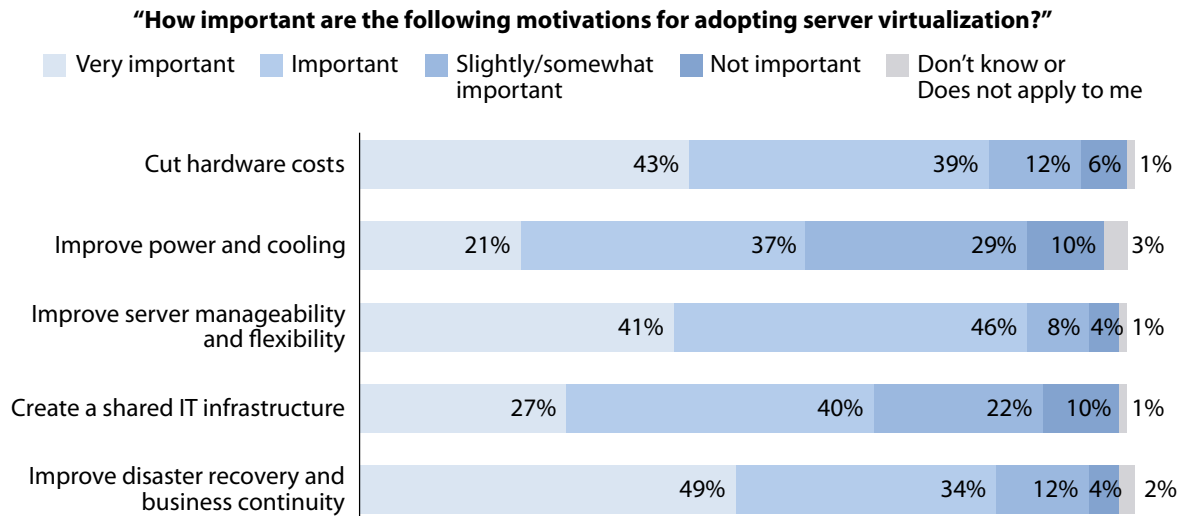
High availability focuses on the technology and processes to prevent application and service outages caused by human error, software crashes, and hardware failures at the primary site or in a specific system domain. The most common approaches for providing high availability include:

- **System backup and restore.** Simple system backup and restore solutions are generally dependable and the least expensive option, but they're also the most time-consuming. In the event of a system failure, you must restore the entire hardware/software system, including the server itself, the operating system, multiple applications, and potentially all the data from backup media. It's a time-tested approach, but it can take hours or days to restore the system. A backup and restore strategy is heavily reliant on process that might not provide timely restoration as servers are rebuilt and data is restored. If media is stored offsite, the process drags on even longer.
- **Fault-tolerant hardware.** Systems with fault-tolerant hardware, like HP's Integrity NonStop servers, guarantee uptime by providing fully redundant hardware within the same system. This ensures that their workloads are not interrupted by failure of individual components. Fault-

tolerant systems are used with the most mission-critical workloads like financial or telecom systems, where any kind of downtime is unacceptable. Fault-tolerant servers are typically far more expensive than generic systems due to their complex hardware and robust designs.

- Clustering.** A cluster is a group of two or more servers or nodes that work together to increase application availability. When one node fails, the other members of the cluster take steps to bring up the service or application elsewhere in the cluster to maintain availability. Many firms leverage failover clustering with their business-critical applications, although clustering is more complex than a backup and restore strategy and does not provide the same degree of availability as fault-tolerant hardware. This shortcoming is due to the time it takes a clustered network to notice a failure and remediate it. Transactions may be lost as the cluster responds to the failure by restarting applications and databases. Clustering is a cheaper approach than leveraging fault-tolerant hardware, but clusters are more complex to build and maintain, and they require greater application awareness.

Figure 1 Improving Disaster Recovery Fuels Server Virtualization Adoption



Base: 197 server decision-makers at North American and European enterprises that are interested in, are implementing in the next 12 months, or have already implemented server virtualization for x86 servers (percentages may not total 100 because of rounding)

Source: Enterprise And SMB Hardware Survey, North America And Europe, Q3 2007

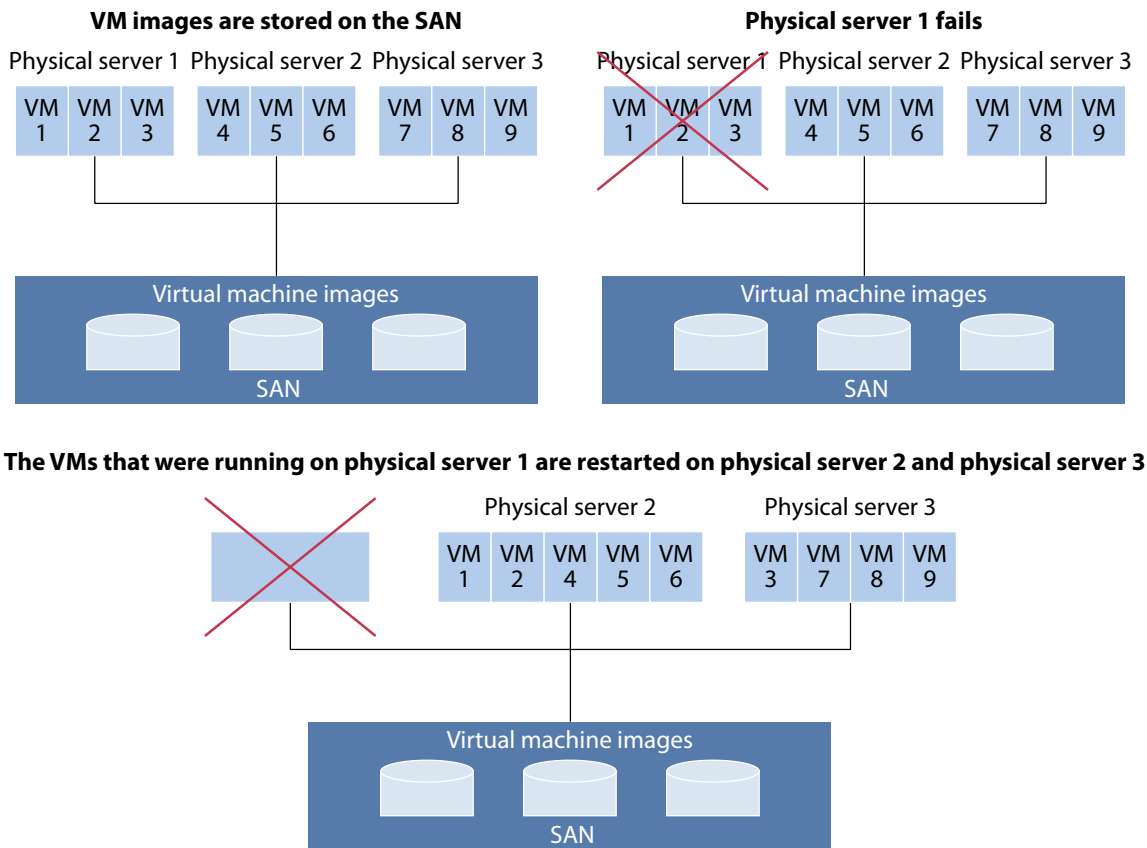
X86 VIRTUALIZATION IS A GOOD ALTERNATIVE FOR HIGH AVAILABILITY

Server virtualization fills in the gap between clustering and system backup and restore, but it's not a replacement for truly fault-tolerant hardware systems. In some cases, virtualization can enhance or replace existing approaches. Server virtualization can also assist with planned downtime scenarios such as required hardware maintenance, application patching, and migration. Some of the benefits and technologies enabled by server virtualization include:

- **Isolation or encapsulation.** In cases where a physical server hosts multiple applications, server virtualization enables administrators to move each application into its own operating system (OS) environment. Many applications depend on specific OS configurations, and, although workloads can seem to coexist peacefully on the surface, system updates or configuration changes designed for one application can have a negative effect on the other cohabitant applications. Running each application in its own virtual server allows you to tailor the OS to the specific needs of that application without affecting any other virtual servers on the physical system.
- **Virtual machine migration.** Technologies like VMware VMotion, XenSource XenMotion, and Microsoft Quick Migration allow your administrators to dynamically move live workloads from one physical server to another. VMotion and XenMotion can accomplish this without disruption to the workload. While this is helpful for planned downtime scenarios like patching, virtual machine migration techniques can't help with unplanned downtime scenarios — such as when a server motherboard suddenly fails. Other virtualization-enabled availability techniques leverage virtual machine migration to accomplish their tasks.
- **Smart resource allocation.** Performance degradation in an application can be just as problematic as an outright outage. Users are just as frustrated when a simple query into a database takes minutes than if it doesn't respond at all. When an application's compute demands exceed the physical server that it's running on, techniques like VMware Distributed Resource Scheduler (DRS) can identify another host server with enough capacity to handle the workload and leverage VMotion to move it over without taking the application offline.
- **Virtual server high availability.** Call it a poor man's clustering, but high availability solutions like VMware HA and the soon-to-be-released XenEnterprise HA might provide "good enough" protection for some workloads. This technique can help insulate applications from issues like server hardware failure or a problem with the hypervisor. A surviving node in the HA cluster can restart the affected virtual machines on another node within the cluster (see Figure 2). This is not an instantaneous cutover. The failed images must restart on the new host, which can take several minutes. Business-critical workloads might be able to tolerate this amount of downtime. Symantec's Veritas Cluster Server for VMware takes this a step further by providing protection from individual virtual machine and application failures as well even across the wide area network (WAN).

- **VM fault tolerance.** Rather than leveraging expensive fault-tolerant hardware, identical virtual machines running on different physical servers can be treated logically as a single server and run in lock-step with each other. If one server suffers a failure, the other can keep running without interruption to the application. Currently, only Marathon Technologies' everRun FT provides fault-tolerant protection without the use of specialized hardware, but Forrester believes that others will follow suit soon.

Figure 2 Restarting Failed Applications With Virtual Machines



DISASTER RECOVERY REMAINS A TOP PRIORITY

Disaster recovery preparedness continues to be a major IT theme, particularly for North American enterprises. According to Forrester's Business Technographics® November 2006 North American And European Enterprise IT Budgets And Spending Survey, 21% of North American enterprises and 14% of European enterprises identified "significantly upgrading disaster recovery capabilities" as a critical IT priority for 2007.³ Disaster recovery presumes that you have an alternate site to which you can recover your primary data center operations.⁴

Disaster recovery is primarily focused on recovery procedures and rapid replacement of critical assets following a significant disruptive event.⁵ There are two components to disaster recovery:

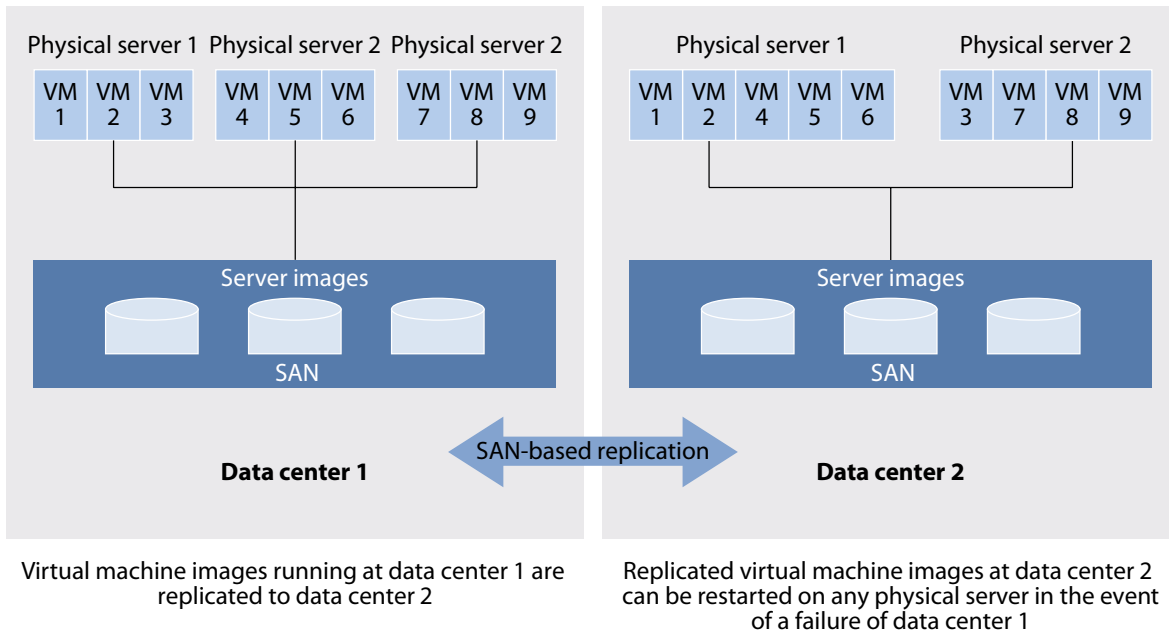
- **Limiting data loss through replication or copying data between two data centers.** To protect yourself from data loss in the event of disk failure, human error, or entire data center site failure, your data must be copied and stored at another location. Most companies employ electronic data replication to either continuously or periodically copy their data to their recovery site. There is a continuum of replication options from synchronous to asynchronous to periodic replication that satisfies a wide range of recovery point objectives and budgets, but the options for application failover or application restart are more limited.
- **Limiting downtime through application failover or rapid restart at the recovery data center.** You can either invest in expensive technologies such as geographically dispersed clustering, maintain identical hot standby servers, or invest in less expensive technologies such as full system restores from backup CDs and tapes.

Server Virtualization's Role In DR: Lower Costs, Reduced Complexity, Rapid Recovery

Once again, there is a gap in technology offerings that address business-critical applications that require a fast restart at the recovery data center but don't warrant the investment in automatic failover technologies such as geographically dispersed cluster. Server virtualization can fill this gap by providing the same rapid restart of virtual machines that are used for high availability as well as some additional benefits including:

- **Enables rapid restart of applications at the alternate site.** In the disaster recovery configuration, virtual machine images are either replicated or periodically copied to the recovery site in the event of a primary site failure. Virtual machines are rapidly brought online on the physical servers at the recovery site (see Figure 3). Third-party tools from vendors like Racemi, PlateSpin, and Vizioncore can help automate the recovery process as well as the VM snapshots and replication. In addition, VMware recently announced its own offering, Site Recovery Manager, to automate this process.

Figure 3 Restarting Applications At The Recovery Site With Virtual Machines



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Source: Forrester Research, Inc.

- **Eases complexity of configuration management.** In disaster recovery, one of the biggest challenges is the complexity and cost of maintaining identical server configurations across both data centers. But when virtual machine configuration files are replicated or periodically copied from the production data center to the recovery site, it reduces the need to rigorously monitor system configurations between data centers. The system configurations are always in sync because any changes are continuously replicated to the recovery site.
- **Reduces the capital cost of disaster recovery.** Server virtualization provides a layer of abstraction that gives you more flexibility in the hardware that you choose to deploy at each site. This means that you can use fewer physical servers or less expensive server hardware at the recovery site if you are willing to suffer some performance degradation during a disaster. Companies such as Cirba specialize in the development of tools that play matchmaker between applications and server infrastructure, identifying the best fits.
- **Facilitates more frequent disaster recovery testing.** According to Forrester's Enterprise And SMB Hardware Survey, North America And Europe, Q3 2007, approximately, 40% of enterprises never conduct a full test of their disaster recovery plans.⁶ This is due in part to the fact that DR testing is a very manual, complex, and potentially disruptive process. Companies do not want to leave physical servers at the recovery site idle, so they run secondary workloads

such as application development and test on these servers. While this increases the utilization of server assets, it also makes it more difficult to schedule and execute disaster recovery tests because the servers are in use for another purpose. With server virtualization, companies can more rapidly re-provision these servers for DR testing. The application development and testing images are suspended, and copies of production virtual machine images are started up. After DR testing is complete, these virtual machine images are taken offline and the application development and testing virtual machines are restarted.

WHAT IT MEANS

SERVER VIRTUALIZATION BRINGS BUSINESS RESILIENCY TO THE MASSES

Consolidation was the primary driver that fueled the first wave of server virtualization adoption, and affordable resiliency will fuel the next wave. Virtualization has lowered the cost of providing resiliency to a low enough point that firms are all but obliged to consider deploying virtualization to support a much broader set of applications than they might have in the past. As resiliency becomes ingrained in strategic IT decision-making — instead of being an afterthought or insurance policy as it is today — companies will expect their server virtualization technology to integrate more seamlessly with the entire resiliency ecosystem, from clustering vendors to storage vendors to traditional backup application vendors. VMware still has to prove that it can grow its own business without choking its partner ecosystem, as competitors like Microsoft and Citrix gather strength and coax VMware-exclusive partners to broaden their platform support to include their platforms. Forrester believes that many companies will soon have multiple vendors' virtualization solutions in their data centers, but the one that integrates well with the broadest set of technology partners and independent software vendors will win the minds and wallets of IT professionals.

ENDNOTES

- ¹ Enterprises cited a wide range of reasons driving the need to improve their disaster recovery capabilities. Topping the list, with more than half of the respondents, were cost of downtime and the desire to improve the availability of mission-critical applications. Not far behind was the requirement to stay online and competitive 24x7 (with 48% of respondents) and increased risk and fiduciary responsibility to stakeholders (both with 44% of respondents). Regulatory or legal requirements were lowest on the list. See the September 11, 2007, "[Six Years After 9/11, Most Firms Are Not Ready For Another Disaster](#)" report.
- ² Many firms attribute their adoption of virtualization to server consolidation, but an equivalent number are using the technology to make their server environments more flexible and agile in a manner once exclusive to more expensive Unix-based platforms. VMware, Microsoft, and XenSource have brought virtualization to the x86 world, finally bringing high-end capabilities to commodity computing hardware. See the January 9, 2007, "[Decoding Virtualization's Present And Future](#)" report.
- ³ For 2007, IT shops plan to spend the majority of their efforts preparing for disaster, securing the infrastructure, upgrading storage and servers, and replacing outdated systems. See the February 8, 2007, "[2007 Enterprise IT Budget Outlook: North America](#)" report and see the March 2, 2007, "[2007 Enterprise IT Budget Outlook: Europe](#)" report.
- ⁴ Disaster recovery, security, and compliance are still top of mind for firms. As in past years, disaster recovery, security, and support for regulatory compliance remained the top priorities. Fifty-six percent of firms point to purchasing or upgrading their disaster recovery capabilities and significantly upgrading their security environment as critical priorities or priorities. Fifty-four percent highlighted support for regulatory compliance like Sarbanes-Oxley and consolidating IT infrastructure as other high-priority IT themes. See the October 11, 2006, "[Enterprise IT Infrastructure 2006 Adoption](#)" report.
- ⁵ Data center continuity focuses on recovery procedures and rapid replacement of critical assets following a disruption that renders the primary site unavailable. Disruptions can range from major natural disasters to simple power outages to a burst pipe in the building. To address this, most firms arrange for a backup or alternative data center. Firms can provision their own alternative data center or work with a disaster recovery service provider that can provide data center space with its own dedicated IT infrastructure, or the firm can subscribe to a shared IT infrastructure to reduce costs. See the December 27, 2006, "[Workforce Continuity Is A Critical Strategy In Your Business Continuity Plan](#)" report.
- ⁶ Nearly a quarter of enterprises never test their plan, and 40% test their plans only once per year. Only 37% of enterprises reported testing their plans twice per year or more. See the September 11, 2007, "[Six Years After 9/11, Most Firms Are Not Ready For Another Disaster](#)" report.

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