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Technical Guide:
Using a comprehensive virtualization solution to maintain business continuity

Virtualization solutions from Citrix are ideal for meeting disaster recovery and business continuity objectives.

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Introduction

Establishing, implementing and maintaining an effective disaster recovery and business continuity plan is a high priority agenda item for organizations worldwide. To understand why, one need only consider the frequency and type of events that have occurred in recent years—from natural disasters and pandemics to man-made calamities and a wide range of less severe, yet still significant disturbances—and the potential they have to substantially impact a company's bottom line due to diminished productivity, lost revenue, missed opportunities, failure to meet service level agreements and customer defections.

This paper explores the challenges of maintaining *business as usual* during disasters and disruptions to distill the requirements of an ideal solution for disaster recovery and business and workforce continuity. It shows how virtualization capabilities provided by several components of Citrix Delivery Center—in particular Citrix® XenApp™, Citrix® XenDesktop™, Citrix® XenServer™ and Citrix® NetScaler®—can be used to fulfill the crucial objectives of ensuring the availability and secure accessibility of essential information resources. Applicable during normal operations as well, these solutions substantially enhance the availability of an organization's information infrastructure while also enabling users to securely access desktops, applications and data from anywhere using any device. Additional strengths and benefits include the ability to improve infrastructure scalability and performance, reduce complexity and costs, increase adaptability and business agility, and help maintain compliance with applicable privacy and security regulations.

A disaster by any other name

Although they are far and few between, major disasters that disable or destroy an entire data center—such as an earthquake, hurricane or tsunami—must be accounted for due to the magnitude of damage they can cause. One alarming statistic to consider is that historically 93 percent of businesses that suffer more than 10 days of system downtime will file for bankruptcy within a year (National Archives and Records Administration, Washington, D.C). For those management teams that believe *it will never happen to us*, just consider that, according to the Forrester/*Disaster Recovery Journal* October 2007 Global Disaster Recovery Preparedness Online Survey, 76 percent of companies have declared a disaster or experienced a major business disruption.

However, organizations should not focus on major disasters alone. Events that are far less violent (e.g., an influenza outbreak or cable cut), smaller in scope (e.g., a transit strike or political rally) or even somewhat mundane (e.g., a power outage or water main break) are far more common and can have a significant impact on business operations as well. What would the cost to your business be if 40 to 50 percent of the workforce was unable to perform its duties for one day? Two? More? Besides the obvious hit to worker productivity, businesses must consider the potential for lost revenue, lost market share, having a negative impact on cash flow, having a negative impact on one's customers and partners, and not being able to maintain contracted or regulated levels of operation.

76 percent of companies have declared a disaster or experiences a major business disruption.

Forrester
Disaster Recovery Journal
October 2007

The plethora of possible lesser events also reminds us that it's not sufficient to plan only for network, device, datacenter and site-level outages. People are a major part of the equation as well. Everyone knows that employee safety and well-being comes first. But what if the event in question disrupts their usual mode of operation? What if the organization's information systems are all up and running but the users can't access them because they're unable to get into the office? What then?

A comprehensive disaster recovery and business continuity strategy should also include plans for maintaining workforce continuity. As a result, sustaining business operations and keeping them as close as possible to normal should be treated as a two part problem:

- Ensuring that essential information resources—data, applications and desktops—are available
- Ensuring that users can access them in a secure manner

Availability requirements

Having separate instances of critical resources at multiple datacenters and being able to seamlessly and intelligently failover between them is a common starting point. Ideally, there should be no noticeable interruption or difference to the users and no need for intervention by operators. Although someone will need to configure everything to begin with, from that point forward all transitions should take place automatically. In addition, failing over intelligently means that it should happen not just if the target resource itself is down, but also when any other component along the end-to-end path is not functioning properly—for instance, if an intermediate router, local authentication server or network link were to fail.

Beyond having intelligent, automatic failover capabilities, savvy IT departments will also want to focus on maintaining adequate levels of performance and persistence.

First, CIOs need to acknowledge that not all failures are complete outages; poor performance should also be regarded as a failure. An ideal solution should account for scenarios where the user experiences slow response times—for example, due to network congestion or flash periods of activity. If a better user experience can be achieved by using a different instance or site, then that is what should happen, automatically.

Because users can dynamically be vectored to alternate sites, there is also a need for persistence. The goal is to ensure that disrupted sessions or users involved with multi-step transactions are consistently returned to the instance or site where they originally connected. This way users can avoid the frustration of having to *start over* or deal with incomplete data.

Finally, one further scenario that requires consideration is the use of a cold, or non-active, site for backup and recovery purposes. This is another relatively common starting point, especially for organizations where size, financial means or criticality of IT operations do not warrant having multiple, overlapping datacenters operating at once. Seamlessness is once again an important characteristic, but not quite to the same extent. With a standby site, it's understood that some amount of manual effort will be needed to re-establish operations. However, minimizing this effort and the duration that critical systems remain offline is still a priority. An ideal

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solution, therefore, should include the ability to rapidly spin-up fully configured and networked instances of critical resources with minimal operator involvement.

Accessibility requirements

A truly effective solution for disaster recovery and business continuity must account not just for disruptions to your application infrastructure but also for disruptions to the people who use the infrastructure. In other words, workforce continuity matters too. This means that a complete solution must support secure remote access. Moreover, it needs to do so:

- For a population of users that normally operates locally—you can't count on them having corporate-issued laptops, complete with a pre-configured remote access capability and appropriate security software

- Regardless of where the users are located and what sort of network connectivity they have

- For all types of applications—web-based, Windows® and client-server

Another underlying characteristic important to a successful solution is the speed and flexibility with which these capabilities can be provisioned. Ideally, IT should have the ability to rapidly set up new users, to selectively expand the access rights of others, to accurately track who has access to what during an event and to easily restore all configuration parameters to their pre-event settings once the disaster or disruption has concluded.

This paper identifies how several virtualization technologies and solutions available from Citrix can be used to thoroughly address the requirements outlined above while also delivering a wide range of additional capabilities and benefits. In particular, the focus is on XenApp, XenDesktop, XenServer and NetScaler. Citrix Online services also have a role to play by allowing businesses to support users and collaborate effectively during a disruption, GoToMeeting® connects employees with simple web conferencing and GoToAssist® allows IT staff to remotely support any user.

The role of XenDesktop— Desktop virtualization

XenDesktop is a groundbreaking product that provides organizations with a powerful and broadly applicable method for ensuring that all of a user's essential information resources remain highly accessible at all times. Because XenDesktop virtualizes a user's entire desktop—not just individual applications—users can securely access *all* of the data, services and applications that are typically at their disposal when operating from a local office. Other important features, characteristics and advantages of the solution include:

- IT has the flexibility of streaming desktops directly to user PCs wherever they happen to be located or, alternately, they can be hosted centrally on datacenter servers. In addition,

Citrix® FlexCast™ delivery technology ensures applicability for all types of users by supporting every major desktop virtualization model, including shared servers, dedicated virtual machines and PC blades.

- Users have the flexibility of gaining access to their personalized desktops from almost anywhere, over almost any network and almost virtually any device.

- Security is enhanced and ensured based on having the option for sensitive data and applications to never leave the datacenter. Tight control over user sessions is also enabled via support for a wide array of authentication mechanisms, the ability to granularly specify and enforce access policies, and comprehensive monitoring, logging and reporting for both user and administrator activities.

- A high definition user experience and better than PC performance is guaranteed with embedded Citrix® HDXTM performance and optimization technologies, and by having desktops and applications that are always up-to-date and always available.

- Operating costs are substantially reduced, typically by more than 25 percent, because all desktop provisioning, management and maintenance tasks, including patching, are accomplished centrally. In addition, capital expenditures associated with purchasing desktop systems can be trimmed or deferred by enabling use of thin-clients, re-purposed thick-client PCs and user-owned devices.

- Business agility—not to mention responsiveness to disruptive events—is increased because provisioning new users is as fast and simple as associating an Active Directory user account with a predefined desktop image.

Yet another strength of XenDesktop is that it extends the value of desktop virtualization even further by including all of the functionality of XenApp as a core integrated feature. In this way, IT departments can easily deliver on-demand applications as a seamless part of their overall desktop management strategy. Operational efficiency can also be improved. The ability for users to leverage a self-service app store to add, remove and update applications on-demand significantly reduces the number of unique desktop images that IT needs create, manage and maintain.

The net result is that XenDesktop provides organizations with a highly flexible, secure and efficient solution for addressing the challenges of maintaining workforce continuity during disasters and other types of disruptive events.

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XenDesktop High-Availability
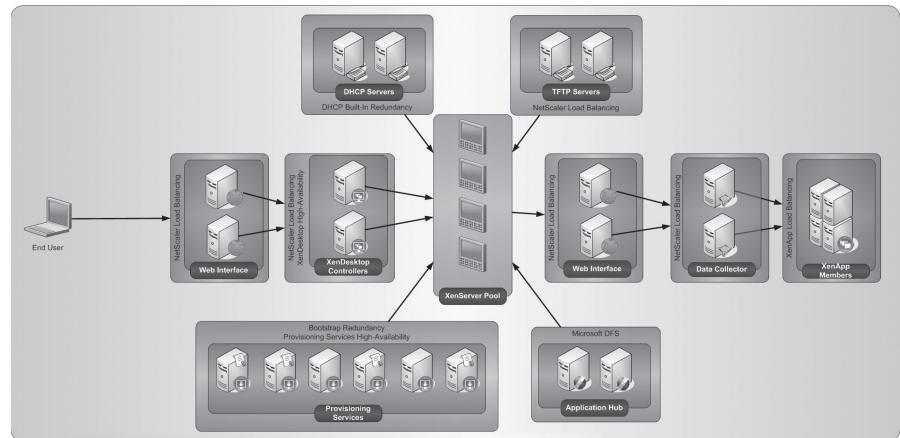
The role of XenApp— Application virtualization

Application virtualization is an alternative to conventional deployment techniques that separates applications from the underlying computing hardware in a way that allows them to be delivered to user machines as a service rather than being distributed and installed on them. With XenApp, the process begins with profiling, a step that yields a single package that accounts for all target platforms on which each application may need to run. Application packages are then stored and maintained on a centralized App Hub or file system, and delivered to users for either offline or online application access.

- With offline application virtualization, applications are dynamically streamed into an isolated environment on the user's PC. Local computing resources are then used to run the application and users have access to essential programs and data even when they are disconnected from the corporate network.

- Alternately, with online application virtualization, applications are dynamically streamed to centralized hosting servers. Datacenter resources are used to run the applications which users are able to access from anywhere. A highly optimized protocol conveys only keystrokes, mouse movements and screen updates, thereby helping to achieve a high definition user experience.

The net result is that with XenApp administrators can quickly and easily provision, adjust and de-provision users with the ability to access almost any application from almost anywhere using almost any device—a highly valuable capability when it comes to ensuring workforce continuity. Furthermore, using the associated Provisioning Services, IT departments can dynamically add capacity to their XenApp farm as needed. Another significant advantage is that with XenApp, an organization's sensitive data need never leave the datacenter. At the same time, associated applications can be managed in an efficient, centralized manner that substantially improves business agility and reduces complexity, risk and cost of ownership compared to traditional application deployment techniques.

Customer Case Study

Lovells, one of the world's largest business law firms with more than 3,500 employees, enabled flexible access to promote mobility and business continuity using Citrix solutions.

Learn more at www.citrix. com/English/aboutCitrix/ caseStudies/caseStudy. asp?storyID=164399.

The role of XenServer—Server virtualization

XenServer is an open, powerful server virtualization solution that increases datacenter agility and efficiency by enabling faster application delivery, higher levels of availability and improved utilization of IT resources.

By running important applications, services and business solutions—including XenApp and XenDesktop—on XenServer, IT managers gain several powerful capabilities that help ensure continuity of operations and satisfactory performance.

- **Citrix® XenMotion™ live migration** – Administrators can move workloads from one physical server to another without service interruption. As a result, scheduled server maintenance can be conducted without incurring any application downtime and workloads can be shuffled around as needed to make the best use of available resources

- **Dynamic workload allocation and provisioning** – When a virtual machine hosting a given workload is reaching the limits of its underlying server hardware (e.g., due to sustained or flash periods of high utilization), XenServer automatically relocates the workload to another operating server with sufficient resources, or provisions an additional instance of the workload on an available bare-metal server (e.g., from a shared pool of inactive, backup resources). In this way, performance and capacity issues are avoided.

- **Automated high availability** – Virtual machines from a failed server are automatically redistributed and restarted on other physical servers within a designated resource pool according to priority and resource availability. Critical workloads are thus protected against localized faults and events, without having to implement a separate, standalone high availability product.

- **Disaster recovery** – XenServer supports using a non-active, standby facility for disaster recovery purposes. Metadata describing virtual machine configurations can be scheduled for periodic backup to storage devices located at an organization's standby facility. If the primary site goes down, administrators can then have standby XenServer systems attach to the replicated storage and automatically restore the associated virtual infrastructure, including all relevant network connections and settings.

Beyond its business continuity capabilities, XenServer has several other strengths and benefits. To begin with, server virtualization technology allows multiple workloads to run on a single, physical server. This is a well-proven approach that significantly reduces server requirements and yields dramatic savings in IT administration, equipment, space, power and cooling—not just at a primary datacenter, but at any backup facilities as well.

Organizations that run their XenApp instances on XenServer also benefit from the fact that XenServer has been tuned for XenApp. Memory management routines optimized specifically for XenApp help achieve virtualization of associated workloads with market-leading performance and scalability.

Customer Case Study

March of Dimes, a non-profit organization with chapters in all 50 US states and Puerto Rico, leveraged their Citrix solution to provide business continuity to their many workers who were affected as a result of Hurricane Katrina.

Learn more at www.citrix.com/English/aboutCitrix/caseStudies/caseStudy.asp?storyID=37334.

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The role of NetScaler—Network virtualization… and more

NetScaler is a full-featured application delivery controller that enables organizations to optimize and ensure the performance, availability and security of their application infrastructure. A market-proven solution, NetScaler is used by 75 percent of Internet users daily.

NetScaler supports network virtualization by incorporating Citrix® Access Gateway™, a robust SSL VPN solution. With Access Gateway, users can gain secure remote access to centralized IT resources—including those run on XenApp and XenDesktop—over any type of communications network. High availability is also provided at the device, network connectivity and site levels based on NetScaler including a comprehensive set of local and global server load balancing capabilities.

Secure remote access

During a disaster or disruption, some users who do not typically operate remotely will inevitably find themselves displaced from their normal work environment. Consequently, they'll have to make due with whatever computing devices and network connections they can cobble together, or already have at home. One obvious concern in such a situation is ensuring the confidentiality and integrity of application sessions and any sensitive information that is accessed. Even though XenApp and XenDesktop can easily deliver the applications these users need to do their work, there is still a need to provide robust security—ideally without having to pre-install any client software, which would be impractical or impossible in a disaster situation.

This is where Access Gateway fits in. This fully integrated component of NetScaler enables remote users to connect to centralized resources, including XenApp and XenDesktop, via an easy-to-use web client. It provides a rich, desk-like experience wrapped in a standards-based, SSL/TLS encrypted session. Integrated endpoint scanning helps ensure that user devices are safe for connection to the corporate network and Citrix SmoothRoaming™ seamlessly reconnects users in the event of intermittent connectivity. In addition, fine-grained access control is rendered by the included SmartAccess capabilities that:

- Determine the level of user access based on administrator-defined rules and endpoint analysis

- Control not just what data can be accessed, but what actions the user can perform—such as print, save, launch and view

- Adapt access policies accordingly as users move between locations or devices

The net result is that NetScaler not only provides a robust mechanism for dynamically extending remote access capabilities to displaced users that typically operate locally, but also delivers a much-needed layer of protection and control for each, individual access session and all associated data.

It's also important to acknowledge the value of Citrix Online services, which are highly complementary to the secure remote access capabilities of NetScaler. With GoToAssist, IT staff can remotely control user machines and

fix problems instantly, regardless of where they might be. When employees need to meet online to share ideas and present, they can use GoToMeeting to collaborate easily.

Local and global server load balancing

If an event disrupts one datacenter, enterprises need the ability to automatically redirect users to information resources at an alternate site. A solution should also be intelligent enough to discern the impact of issues—including both failures and performance degradations—to entire sites and any of the individual components and services upon which a user session depends. All of these requirements can be fully met by the robust set of server load balancing (SLB) capabilities provided by NetScaler.

First, NetScaler includes local SLB. A substantial layer of resiliency and responsiveness can readily be achieved by taking advantage of the extensive server health checks and load balancing algorithms that identify and route application sessions around any datacenter components that are not operating properly.

More relevant in the event of a site-level outage, however, is the global server load balancing (GSLB) capability of NetScaler. Because it acts as an authoritative DNS server, NetScaler can provide users with the IP address corresponding to whichever site it calculates is best.

When all sites are operating normally, users will be directed to their default site. If that site becomes unavailable or overloaded—based on the status of a wide range of configurable parameters—users are automatically directed to an alternate site without having to alter their behavior in any way. For example, in a Citrix-based environment, the GSLB service accomplishes this by first checking the availability and health of any existing Access Gateway instance, as well as the Web Interface and XML Broker components of XenApp and XenDesktop. If any of these elements is unresponsive, NetScaler classifies the site as *down* and redirects user sessions accordingly.

The NetScaler GSLB service also uses advanced health checks and policies to assess numerous factors—including application response time, application load, packet rates, available SNMP metrics and the user's geographic location—and subsequently to route users to the datacenter that will provide them with the best service. In this way, enterprises can maximize the return on their datacenter investments even under routine operating conditions.

The net result with NetScaler SLB and GSLB is greater assurance of both the availability of your entire information infrastructure and the quality of experience your users will receive.

Support for cloud computing and the potential for datacenter virtualization

The use of Internet-based services to deliver business processes is commonly referred to as cloud computing and is attractive for the same reasons as other virtualization solutions: it offers agile delivery of IT services and lower total cost of ownership. IT-as-a-service—an option that entails obtaining access to a flexible grid of servers, storage and

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network components—is particularly interesting because it introduces the potential to take advantage of yet another level of virtualization as part of an organization's disaster recovery and business continuity strategy.

The idea with *datacenter virtualization* is that separation is achieved between many or possibly even all of the services that a datacenter provides and the physical infrastructure on which those services run. IT-as-a-service offerings provide the alternate physical infrastructure in this scenario, including the ability to scale up or down on-demand.

However, the complete solution also requires the ability to dynamically relocate both critical workloads *and* the network services crucial to their secure, optimized delivery.

Citrix clearly supports the first part of this requirement. XenApp, XenDesktop and XenServer make it exceedingly easy to dynamically migrate applications, desktops and servers, respectively. With NetScaler VPX, a virtual appliance version of NetScaler, Citrix addresses the second part as well. The net result is the ability to migrate almost all IT services needed to maintain business and workforce continuity to the cloud, thereby enabling a backup datacenter to be established whenever the need arises.

Benefits of the Citrix approach

Enterprises that employ virtualization technologies from Citrix to help address their disaster recovery and business and workforce continuity requirements stand to realize a wide range of both technical and business-oriented benefits.

From a technological perspective, these include:

- **Local resiliency and responsiveness** – Failed or poorly performing components of the information infrastructure can automatically be circumvented.

- **Global high availability** – Key applications will remain in service even during events which take an entire datacenter off line.

- **Secure remote access** – High accessibility to computing resources is essentially guaranteed, both in times of trouble and during routine operations. Secure access capabilities can rapidly be provisioned for new users, and rights and permissions can easily be expanded or contracted to account for changing conditions.

- **Reduced complexity and increased flexibility** – NetScaler integrates SLB, GSLB, secure remote access and many other capabilities in a single, easy-to-manage device. At the same time, XenServer significantly reduces server count and the effort required to manage server images, while also providing the means to rapidly accommodate new or expanding application workloads.

- **Scalability and performance** – The combination of load balancing, content switching, application acceleration and server virtualization effectively optimizes the performance and scalability of the existing application infrastructure. In conjunction with XenApp, these features ensure high performance for the user.

From a business perspective, these include:

- **Resiliency –** Having robust information infrastructure and a highly flexible solution for secure remote access reduces operational risk by helping ensure that critical business functions can be accomplished on a non-stop basis and that user productivity is not impeded.

- **Broad applicability –** While the solution excels during disruptions and disasters, it also delivers an optimized user experience and support for both virtual and office-based workers under normal operating conditions.

- **Consistency –** By enabling XenApp and XenDesktop to be used in all scenarios, not just during normal operations, users are provided with one familiar way of operating as opposed to having to learn multiple methods for connecting to and interfacing with key applications.

- **Agility and adaptability –** A rich and flexible feature set provides the ability to easily and rapidly accommodate changes in business plans, objectives and strategies, and to withstand the test of time.

- **Compliance –** Granular access control and robust logging capabilities provide an audit trail and also help ensure enterprises stay compliant with regulatory requirements and internal policies, even when they have to operate in an atypical manner due to a disaster.

- **Efficiency and cost savings –** Because XenApp, XenDesktop, XenServer and NetScaler are part of a broader, comprehensive portfolio of virtualization solutions, enterprises can continue to add enhancements without having to establish and manage relationships with additional vendors. Furthermore, when used in conjunction with emerging cloud computing offerings, the portfolio of Citrix virtualization solutions can help reduce the need for costly, dedicated backup facilities.

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Conclusion

Reducing operational risk by maintaining business as usual is not simply a matter of ensuring the availability of information infrastructure during major disasters and less severe but far more common events. The impact to users must also be addressed. After all, what good is it if a computing resource is available but users can't access it because they're unable to get into the office? Productivity will still be impaired, as will the ability of the business to generate revenue, satisfy its customers, and meet contracted or regulated levels of operation.

In this regard, virtualization solutions from Citrix are ideal for meeting disaster recovery and business continuity objectives. The combination of XenApp, XenDesktop, XenServer and NetScaler not only ensures the availability of an organization's entire information infrastructure, but also guarantees that the essential data, application and desktop resources are securely accessible by users operating at any location with any device. Workforce continuity is seamlessly addressed as an integral part of a broader, more complete solution for business continuity.

Organizations further stand to benefit from the fact that Citrix virtualization solutions enable the delivery of IT as an on-demand service. As a result, the one-time investment made to address crucial business continuity objectives will pay dividends in many other ways as well, such as through increased business agility, reduced complexity and lower cost of infrastructure and operations, better employee attraction and retention, easier fulfillment of compliance requirements, and improvements in scalability, performance, and utilization of associated networks and systems.

Business continuity and disaster recovery preparedness checklist

Ensure that essential information resources —data, applications and desktops—are available.

	Plan in place	Testing successful	Next review scheduled
Establish separate instances for critical resources.	☐	☐	☐
Provide seamless and intelligent automatic failover for critical resources.	☐	☐	☐
Ensure performance to achieve consistent user experience.	☐	☐	☐
Deliver persistence to achieve non-disruption to user activity.	☐	☐	☐
Offer rapid spin-up for fully configured and networked instances of critical resources from any non-active backup and recovery sites with minimal operator involvement	☐	☐	☐

Ensure that users can access information resources —data applications and desktops—in a secure manner.

	Plan in place	Testing successful	Next review scheduled
Support secure remote access for a population of users that normally operates locally—they may not have corporate-issued laptops, complete with a pre-configured remote access capability and appropriate security software.	☐	☐	☐
Support secure remote access for users in any location with any network connectivity.	☐	☐	☐
Support secure remote access to all types of applications including web-based, Windows and client server.	☐	☐	☐
Deliver provisioning speed and flexibility for IT to rapidly set-up new users, selectively expand the access rights of others, accurately track who has access to what during an event and to easily restore all configuration parameters to their pre-event settings.	☐	☐	☐

Additional resources

For more information about business continuity and disaster recovery solutions from Citrix visit **www.citrix.com/businesscontinuity**.

Share our business continuity and disaster recovery solution brief with business decisions makers in your organization. The solution brief guides savvy business leaders as they select and invest in the right business and workforce continuity solution.

www.citrix.com/bcsolutionbrief

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