When Failure Isn't an Option

ESRI/Citrix partnership delivers geospatial business continuity from the data center to the end-user.






In today's government, citizen safety and emergency response efforts often depend on geospatial information. Indeed, because GIS data is critical to disaster mitigation, response and recovery, it's likely the biggest demand for these applications will occur under the most demanding circumstances.

After Hurricane Katrina in 2005, officials and relief workers used GIS to assess damage and plan recovery efforts. When a tsunami devastated the coastal regions surrounding the Indian Ocean in 2004, relief workers relied heavily on GIS to identify impacted areas and coordinate efforts. And GIS helped guide firefighting and evacuation efforts during Southern California's wildfires in 2003.

Simply put: Growing reliance on geospatial information makes GIS a critical piece of governments' information infrastructure. More and more, these systems simply can't go down.

And natural disasters aren't the only business continuity threat. Cyber-attacks, viruses and terrorism can all stall vital government operations if public agencies do not have effective business continuity plans in place. Not only must government IT shops safeguard GIS data from natural and man-made danger, they must ensure reliable and secure delivery of that information to first responders and other mobile workers wherever and whenever they need it.

ESRI and Citrix Systems work together to provide business continuity solutions that protect GIS data from nature and man, and enable end-users to log on under nearly any circumstances without missing a beat. Both companies are committed to the principles of service-oriented architecture (SOA), so ESRI and Citrix solutions integrate smoothly with one another and with existing enterprise applications. Furthermore, the partnership delivers additional tools and efficiencies that strengthen business continuity and disaster tolerance at all levels of the architecture.

Tech Terms

SOA:
service-oriented architecture — a modularized computing architecture that allows functions, or services, to work across platforms.

Use Case: Disease Outbreak

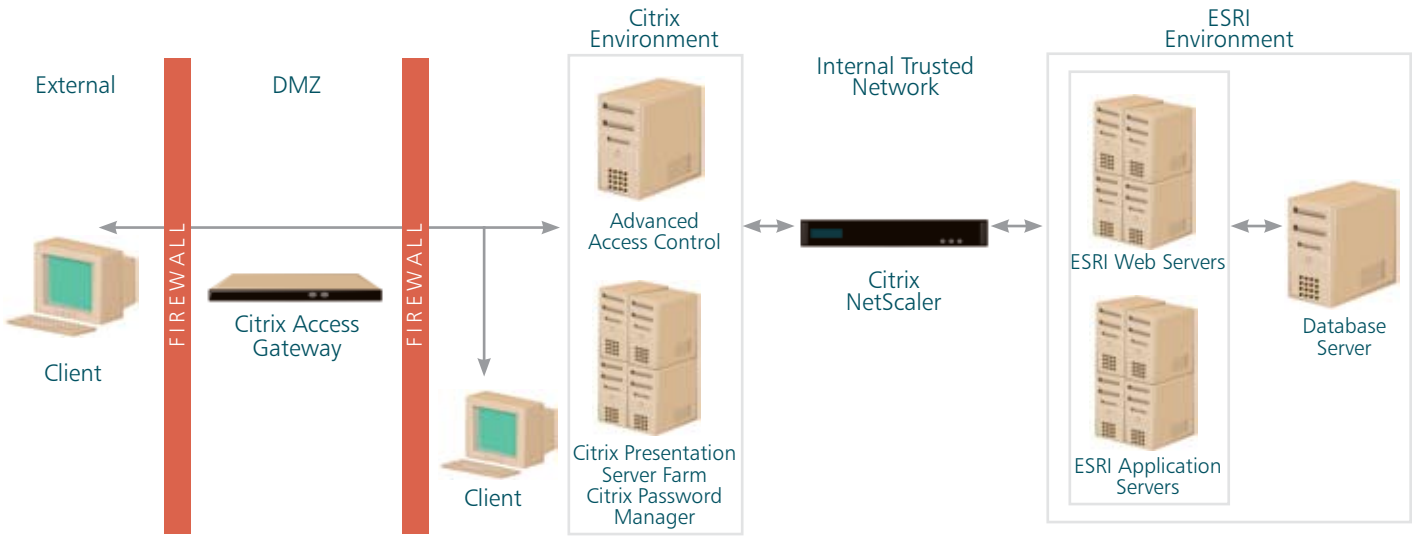
In the event of a highly contagious and lethal disease outbreak, such as the type feared by scientists watching the bird flu, daily life would change drastically. Quarantines would disrupt transportation routes; work schedules for public employees and the general public would be thrown into turmoil, affecting day-to-day business; and hospitals and emergency services would be strained to their limits.

Much of the U.S. economy would come to a standstill, but to contain the situation and provide needed public services, governments would need to find ways to continue vital operations.

Epidemiologists would use GIS data to track the illness geographically and make treatment decisions accordingly. Governments would rely heavily on GIS to make decisions on where to set up quarantines, how to facilitate the delivery of needed supplies despite travel restrictions, where to direct patients when hospitals have become overcrowded and where to set up services for impacted families.

However, government officials and others involved in responding to the outbreak are not immune to the same impact as the public at large, and officials may have to access geospatial information from their homes or other locations as travel routes may be impacted and government buildings may be closed. Business continuity capabilities provided by ESRI/Citrix solutions ensure that remote users can rapidly access the geospatial data they need from any location, without any impediments or learning curve to slow their work in protecting and serving the public.

Integrated ESRI/Citrix Application Delivery Platform



From the data center, across the network and out to the end-user, Citrix and ESRI build solutions that are as secure, reliable and as easy to use in an emergency as they are on an average day at the office.

Well Protected, Yet Flexible

Step one to ensuring business continuity is safeguarding the data and applications end-users rely on. The combination of ESRI server GIS technology and Citrix application virtualization enables IT managers to centralize GIS applications and information in a secure data center, behind the government firewall. Only screen images are sent from the server to the end-user's computer, and when the end-user device is shut down, no data remains on it.

By storing GIS data in a central location, IT managers can integrate the GIS with enterprise security and virus protection tools. And because both ESRI and Citrix use an SOA approach, GIS data can be integrated with other enterprise systems and security can be applied throughout the architecture. ESRI/Citrix solutions let agencies take advantage of security measures that can be implemented within the application, application delivery mechanisms, client and server operating systems, network and relational database management system.

Furthermore, a centralized GIS allows IT managers to back up all GIS infrastructure to a remote location. Citrix NetScaler intelligently shifts and balances computing loads across servers, and it can just as intelligently shift computing functions to remote locations. That means users can count on uninterrupted access, regardless of whether a server goes offline for routine maintenance or an entire data center goes down due to flooding. During normal operations, data center managers can choose to keep both sites live so users can connect to whichever center offers the least latency, or they can keep one center in passive mode and avoid the additional costs of running two active data centers, depending on the needs of the institution.

Load-balancing mechanisms provided by NetScaler also protect data center computers from being overwhelmed by spiking demand from users. Because GIS is so heavily used in disaster situations, the ability to withstand sudden increases in user demand is essential. NetScaler also takes over the information processing tasks that servers traditionally must perform just to handle network requests, so the servers can focus on

Tech Terms

Firewall: hardware or software that inspects data entering a network and rejects or admits the data based on predetermined criteria.

Tech Terms

Load balancing: distributing computing workload among servers to optimize performance.

responding to user requests and serving applications. The increased server capacity this affords in combination with NetScaler's ability to efficiently balance workloads allows the data center to accommodate peaking demands.

Citrix Edgesight, which comes integrated with NetScaler, allows IT managers to monitor application performance, which helps administrators identify trouble, such as an erratic or failed server, to ensure optimum performance.

A Burden-Free Network

Network flexibility proves critical during a crisis, when displaced office workers must function from makeshift locations and the demand for mobile connectivity is at its greatest.

When government workers need to work from home or from temporary facilities, Citrix application-delivery mechanisms provide the same work environment that workers experience in the office. And for workers at a disaster site, ESRI/Citrix solutions deliver access to critical systems despite high demand and limited bandwidth.

NetScaler's load-balancing capability eases the network burden by more efficiently distributing client requests traversing it. The solution automatically routes client requests to the least busy functional servers available.

Citrix Presentation Server reduces network bandwidth requirements and mitigates latency issues by virtualizing applications for end-users. Actual applications reside on data center servers and only mouse movements, keystrokes and screen updates traverse the network. Therefore, even data-laden and graphics-heavy applications perform better, keeping users active and productive.

By caching static information — rather than refreshing the content with each network transmission — and compressing data, NetScaler lets end-users perform the same tasks with less impact on the network. And NetScaler's load-balancing capabilities eliminate network bottlenecks that frustrate end-users' ability to carry out tasks during peak demand.

Tech Terms

Caching: temporarily storing oft-used data on local disks, which minimizes time and bandwidth spent retrieving data over the network. Frequently requested application data can also be cached on the server to avoid processing repeated requests and minimize strain on the server.

In addition, dynamic caching of frequently requested data at the server speeds application performance for users across the network.

Another piece of the NetScaler package — Citrix AppExpert Visual Policy Builder — allows IT administrators to easily apply network policies that improve traffic flow and security. For example, administrators can use the policy builder to cache or compress data in a way that makes sense for the organization without having to understand or deal with application coding.

ESRI and Citrix are working together to further enhance GIS performance across the network and provide security specific to GIS.

ESRI/Citrix solutions also deliver flexible connectivity options that can be vital during emergency operations. For instance, responders may need to access critical systems through an Internet connection or a piece of hardware not managed by their agency. The ESRI/Citrix solution enables the network to safely interface with any mobile device a responder might use. Citrix's advanced access

Use Case: Hurricane

When a hurricane approaches, emergency responders are already in overdrive, planning evacuations and working to ensure the safety of impacted residents. As a hurricane passes through, responders must have the tools to immediately assess the damage and get to work providing medical service where necessary, repairing infrastructure and restoring day-to-day life for the community.

But how do you access critical GIS data needed to support those tasks if a jurisdiction's entire IT shop has been wiped out? Centralized ESRI GIS combined with Citrix failover capabilities allow critical applications to continue operating from back-up facilities. Therefore, governments ensure that first responders have vital GIS data when the chips are down.

The efficiency and ease of use provided by Citrix's application delivery tools enable responders and displaced decision-makers to take care of the tasks at hand without fumbling for multiple passwords that otherwise may have been noted under their keyboard in a now-flooded office building. With ESRI/Citrix business continuity solutions, responders gain access to GIS — and other enterprise applications — with a single sign-on, and interact with systems in the same manner and efficiency as they would in the office.

capability lets the network quickly adjust to those foreign tools, without compromising security. Administrators can also apply security policies based on end-user scenarios, so the organization can efficiently balance usability and security based on its needs.

Finally, NetScaler protects networks from malicious attacks by acting as a proxy for legitimate client requests and blocking illegitimate ones. The solution includes high-performance, built-in defenses against denial of service attacks. Therefore, suspect transmissions don't even reach the server layer of the ESRI/Citrix solution, minimizing server strain. Legitimate surges in application traffic that would otherwise overwhelm application servers, are automatically handled with configurable Surge Protection and Priority Queuing features.

The NetScaler Application Firewall also provides protection against the growing number of application-layer attacks. Basing its security model on good application behavior, the Application Firewall blocks behavior that deviates from that model. Furthermore, the NetScaler Application Firewall's Adaptive Learning Engine can make security recommendations based on a specific application's behavior.

It's All About the End-User

It's difficult to predict when a crisis will force government workers to relocate, or where emergency responders will need to conduct field operations. But ESRI/Citrix solutions reliably deliver GIS data to users under nearly every circumstance.

Citrix Presentation Server efficiently delivers applications and updates to whomever needs them in the field — and these applications offer the same visual and functional experience as in the office. The solution's load-balancing and caching capabilities produce high performance in spite of the often limited bandwidth available to mobile workers.

Citrix recently ran tests on NetScaler in conjunction with ESRI that revealed a significant boost in end-user productivity. The tests showed a 41 percent to 67 percent gain in completed transactions per hour and increased central processing unit effectiveness. The project also measured a 21 percent to 43 percent improvement in average response times.

Mobile devices often become a government's primary tool during a crisis. The ESRI/Citrix solution keeps those devices from being a security risk, freeing end-users to focus

Use Case: Earthquake

After an earthquake, responders must contend with any number of secondary disasters, such as fires, toxic leaks, broken water mains, downed power lines, and destroyed homes and infrastructure.

No one can predict where all of the trouble spots will be, but GIS is essential for mapping out fault lines that not only help scientists predict where future quakes will happen, but help identify areas that are most likely to be affected by aftershocks. Furthermore, GIS maps visually depict the location of municipal infrastructure such as water mains and power lines that could be damaged.

In this type of emergency, it is essential for a large number of responders, scientists, government decision-makers and more to have unfailing access to GIS. Geospatial data is essential for quickly assessing the possibilities of aftershocks, rerouting traffic when transportation structures are broken or destroyed, and repairing broken infrastructure.

A centralized and remotely mirrored GIS ensures government officials involved with the immediate response and the recovery effort have access to necessary data. Citrix application delivery systems equip the GIS infrastructure to handle spiraling demand when large numbers of responders sign on simultaneously. And Citrix conferencing solutions allow officials to coordinate their actions.

The Citrix Application Delivery Platform comprises:

• **Citrix Presentation Server™,** the market leader for centralizing deployment and management of enterprise applications, provides secure, on-demand access to users anywhere, on any device and any connection.

• **Citrix Access Gateway™,** an advanced, easy-to-use and cost-effective SSL VPN appliance with secure access control, manages who accesses company information and what they can do with it.

• **Citrix Password Manager™** is the most secure, efficient and easiest-to-deploy enterprise single sign-on solution for access to all applications.

• **Citrix® NetScaler® Application Delivery System** combines the features and functions of traditional data center point products — load balancing, caching, compression, SSL acceleration, attack defense, SSL VPN, content switching, application firewall, access gateway — into a single network appliance, built from the ground up to optimize delivery of Web applications.

• **Citrix® GoToMeeting™** is the easiest, most secure, most cost-effective and fastest solution available for online meetings, training sessions and collaborative gatherings.

• **Citrix® GoToAssist®** remote technical-support solution enables support staff to view and control the desktop of a user over the Internet to provide troubleshooting, training and problem resolution.

on completing their tasks. End-users can access any application through Citrix Presentation Server, while that application remains safely housed in the government's data center. No application code or data resides on the end-user's hardware, minimizing the security risk of lost or stolen mobile devices. And Citrix SSL VPN keeps intruders from intercepting or eavesdropping on remote user transmissions.

Tech Terms

SSL: Secure Sockets Layer, a commonly used security protocol that uses cryptography to secure data passed over the Internet.

Emergency responders demand solutions that deliver quick, hassle-free access to any application they might need. Multiple sign-on requirements are a common nuisance for any IT user. Citrix Password Manager enables end-users to access required applications through a consolidated interface and single sign-on.

Tech Terms

VPN: Virtual private network, a private network that exists over the public Internet using security measures, such as SSL.

Citrix GoToAssist improves the reliability and availability of end-user devices by enabling IT support staff to perform remote troubleshooting. And Citrix GoToMeeting conferencing tool enables users to collaborate and coordinate efforts without meeting in a physical location, which can be essential when an emergency renders an organization's normal premises unusable.

Ultimately, Citrix application delivery mechanisms provide end-users with the information and functionality they need without compromising security or effectiveness in the field. Governments that rely on ESRI's centralized GIS delivered through Citrix application delivery mechanisms ensure business continuity from the data center to the end-user.

Use Case: Large Wildfire

GIS is an essential tool for responders when wildfires strike. Emergency crews can draw population data, residential locations, and wind speed and direction information from a GIS application to map the extent of the disaster and suggest evacuation strategies. GIS can even be integrated with reverse 911 systems to alert affected residents of imminent evacuations.

ESRI's centralized GIS architecture allows crews in different locations, as well as decision-makers in a central location, to draw on consistent data for planning and responding to rapidly changing fire conditions. The consistent data and delivery tools provided by the ESRI GIS over Citrix application delivery appliances also ensures that public information officers working with the media to provide information to citizens have accurate and up-to-date information.

Preparedness in Pasadena

ESRI and Citrix help the city of Pasadena ensure business continuity during emergencies.

Earthquakes, wildfires, windstorms — in Southern California, they're taken with a grain of salt. But once in a blue moon, these events take on epic proportions.

From the deadly 6.7 magnitude Northridge earthquake in 1994 to the devastating wildfires in the San Gabriel Mountains nearly a decade later, communities in Los Angeles County have responded proactively, dusted themselves off, rebuilt and gone back to business as usual.

Cities in L.A. County have plenty in common, including coordinated emergency preparedness and response. For many, this evokes images of police officers and firefighters doing their duty. As any city official can tell you, however, there's much more to it than that.

Just 10 miles north of downtown Los Angeles, the city of Pasadena is a stellar example of how technology and emergency preparedness go hand in hand. Designed especially for concerns ranging from local disasters to emerging global issues, the city's ESRI-based GIS provides information about critical infrastructure to the organization during emergencies. These include detailed maps of Pasadena's sewer network; water and power public utility information; a reverse 911 application that can call land-line phones citywide or within a specific distance of a hazard with updates during or after emergencies; mapping that can be accessed by public safety officers in the field; identification of critical data associated with selected properties within neighborhoods affected by disasters; and much more.

To ensure this vital information is available in emergencies, the GIS database is housed in a hardened facility with generator backup power. The GIS database has a replicated copy running in the city's primary data center. Oracle's DataGuard is used to automatically switch users from the primary GIS database to the failover database.

Pasadena has gone to great lengths to migrate maps and asset information once stored on paper drawings in hallway file drawers. Most of these sources have been scanned and are now accessible via ESRI Web-based services and desktop GIS applications.

"Reliable access to information from any location is critical for seamless maintenance of vital infrastructure during emergencies and normal operating conditions," said John Pratt, the city's chief information officer. "ESRI and Citrix provide a number of solutions that enable information technology to work effectively."

Pasadena's recent agreement with ESRI reduced the number of applications running on end-user machines and freed up resources tied to hardware and software maintenance, resulting in savings that can be invested in improved continuity and security.

Pasadena is distributing mapping applications via ESRI Web-based software available to anyone within the city with a network connection. The city is also moving toward distributing many other thick client applications — mapping and non-mapping — via Citrix. The central management of enterprise applications via the Web and Citrix represents a fundamental change in the use of technology for Pasadena.

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