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# SAP and Citrix: Deployment Best Practices Delivering Performance, Security, Availability, and Cost Benefits Enterprise- wide

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# 1 Introduction

CIOs and IT experts are facing ever-increasing new requirements from the business experts for extending their services to be available everywhere around the world. They still need to consolidate data centers and business applications in order to lower costs, pay attention to new compliance rules, and much more. IT has to support the *extended enterprise* (Fig. 1), which does not end any more at the doorstep of a headquarter datacenter or any organizational boundaries of an enterprise. Company employees, business partners, and customers are all end users of IT and demand secure and low response-time access to business applications from wherever they are. In addition, Web-service-style message traffic in between application components is very much on the rise due to the need to facilitate inter- and intra-company business application integration. "The network" becomes the increasingly important glue in between more and more globally distributed and used business application components and end users.

SAP addresses modern business needs through enterprise service-oriented architecture (enterprise SOA) architected solutions (efficient and open building blocks that you can reuse to build composite applications). Similar, new Application Delivery (AD) and WAN Optimization (WO) technologies have become available for the global network infrastructure. Citrix and SAP would like to present jointly in this paper how modern application and network technologies could be combined to form productive SAP® business application landscapes which perform well and securely when used globally. The work is based on the results of a project in the Enterprise Services Community (ES Community) program, where a number of leading network, test solution vendors and SAP teamed up for building a production-like enterprise SOA application landscape, including the simulation of remote end users and applications.

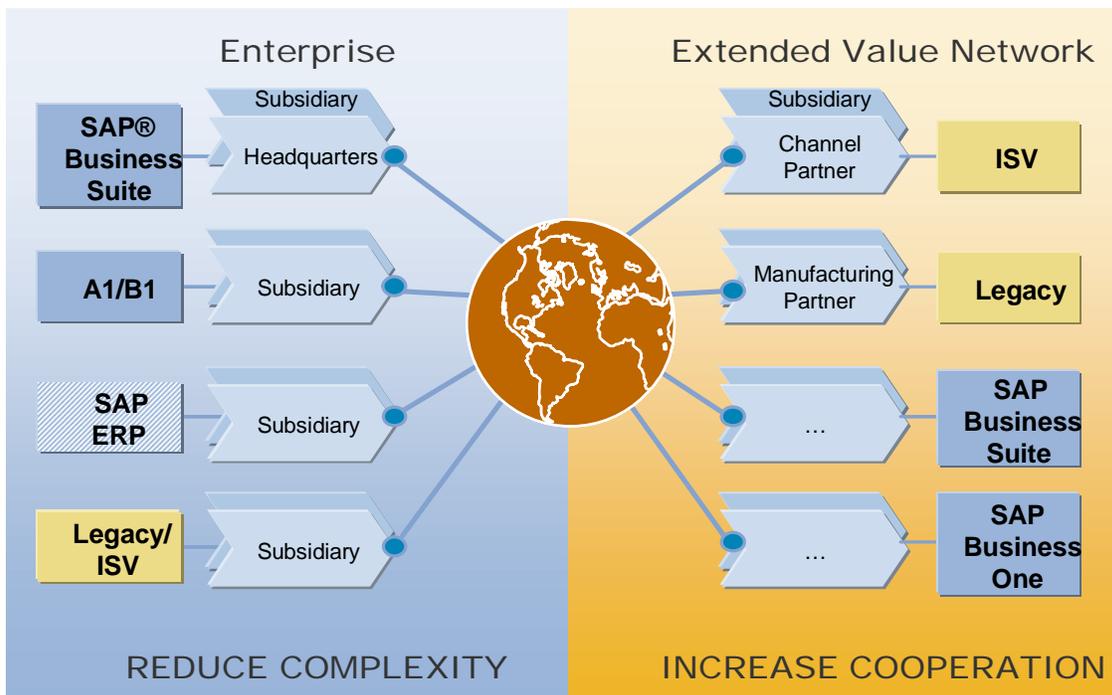


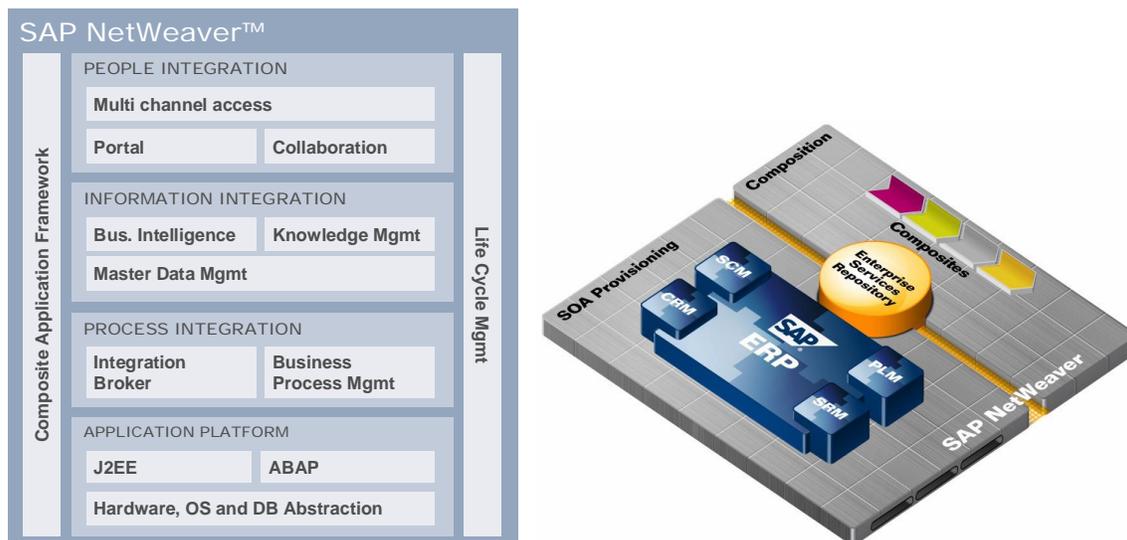
Fig. 1: Extended Enterprise

## 2 How the Test Landscape Was Derived

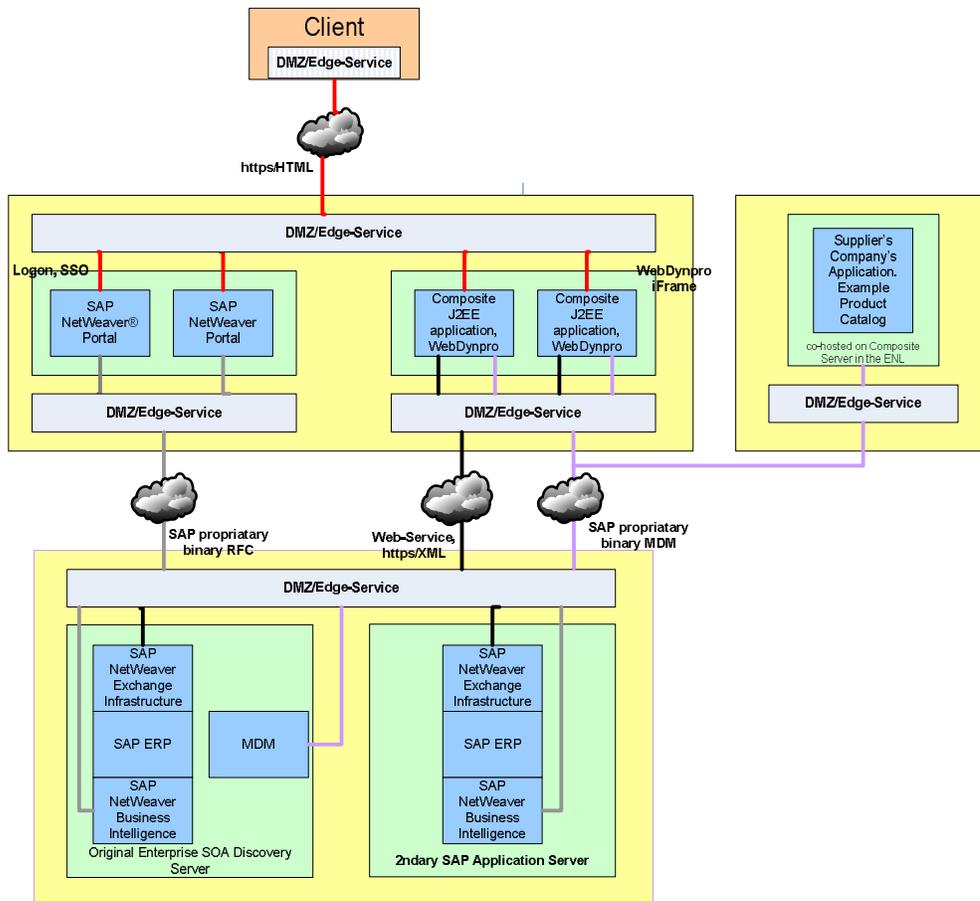
The goal of the test landscape design was to incorporate many of the features customers would need to use enterprise SOA-based SAP applications productively. In detail this meant:

- Using the integration components of the SAP NetWeaver® technology platform (Fig. 2 left side) like the SAP NetWeaver Portal component for people integration.
- Using the SAP Composite Application Framework (SAP CAF) tool to build integrated business processes (Fig. 2 right side)
- Building a production-like application and network infrastructure with secure access, simulated WAN traffic, and scalable multi-instances deployments of all SAP NetWeaver and business application components (Fig. 3)

The first two points were fulfilled by using SAP [Discovery System](#) software, which is a one-server deployment of SAP NetWeaver, SAP CAF, and SAP ERP backend applications. A number of enterprise SOA-based business scenarios are implemented out of the box on the SAP Discovery System, which greatly reduces the effort for building a test landscape.



**Fig. 2: left: SAP NetWeaver® Technology Platform; right: building Business Scenarios Based On enterprise SOA Principles**



**Fig. 3: Test Landscape**

**Blue = SAP application components, Green = physical hardware servers, Yellow = emulated datacenter environment, Orange = individual remote end user or end users in a branch office**

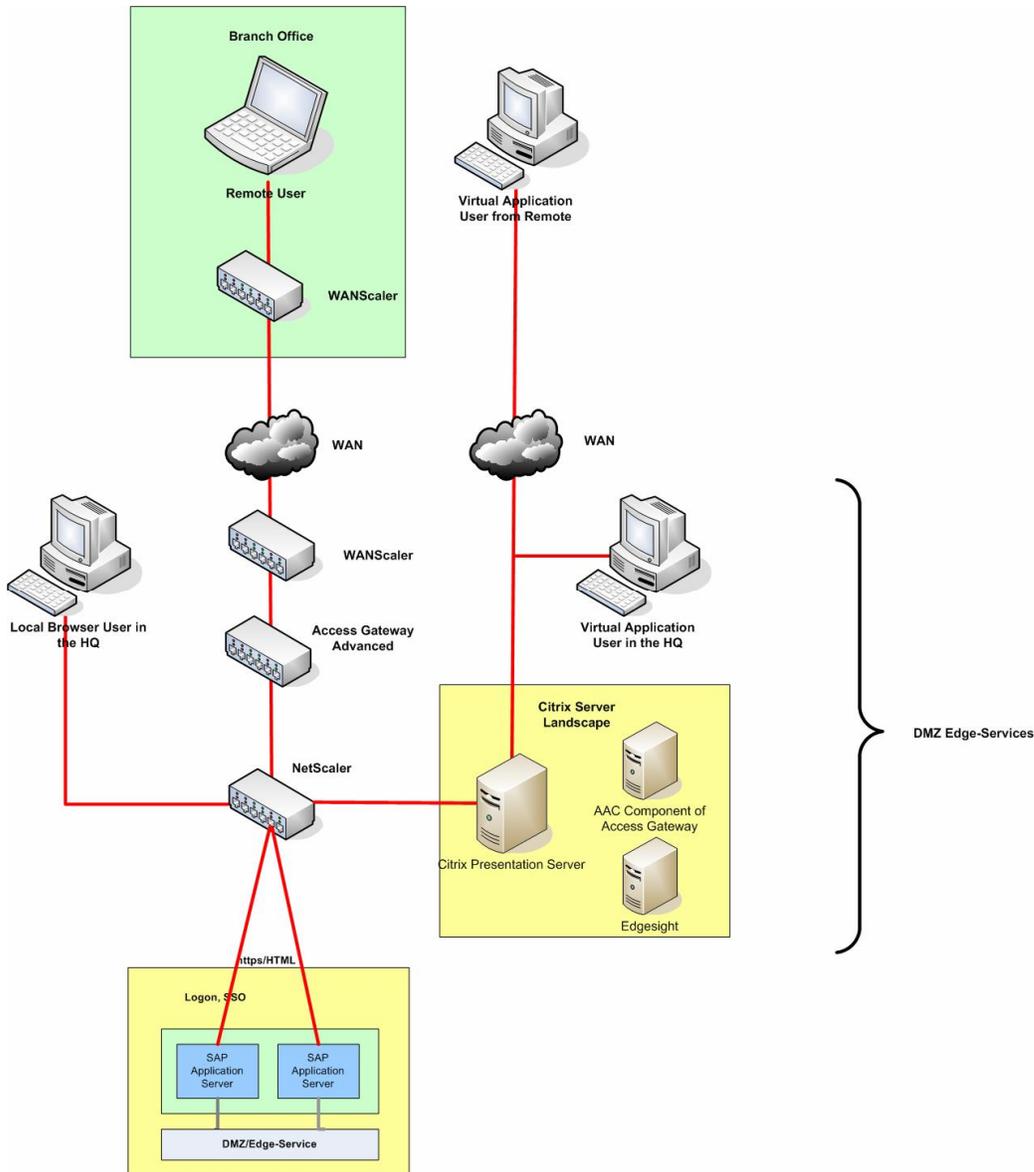
To create a more production-like infrastructure, the SAP Discovery System was redeployed onto four hardware servers as shown in Fig. 3. Most components were deployed with two instances. A real production landscape might have a very large number of instances for any component, depending on the processing volume requirements. Doubling instances for components also achieved higher availability in the application landscape through added failover capability.

To include aspects of the global use and deployment of enterprise SOA applications, the hardware servers were grouped in different simulated data centers. A fifth server was then added to represent the remote end-user community. In turn, this crucial step adds the need for a number of network services, which would typically reside in an edge environment or demilitarized zone (DMZ) inside the data centers. If end users reside in a branch office, a small edge environment/DMZ might also be implemented at the end users' location.

In between data centers and remote end users, customers would use company intranets or the Internet. Such long-distance network connections were simulated using a WAN emulation appliance manufactured by Shunra Software Ltd. This emulator can be configured for the various latency, bandwidth, and package-loss conditions of real-world WAN connections.

HP LoadRunner was used to automate virtual user sessions. LoadRunner simulated end users executing business scenarios, which in turn triggered Web-service inter-component network traffic throughout the application.

SAP's enterprise SOA opens the doors to increasing adaptability and ongoing innovation. To get the most from your investment, however, you need an infrastructure that ensures the secure, speedy, and cost-effective delivery of Web-based resources. A Citrix Application Delivery Infrastructure provides tools to help you meet this need.



**Fig. 4: Citrix Solutions in Test Landscape**

Figure 4 summarizes all technologies Citrix provides for Application Delivery and WAN Optimization of SAP applications. The following sub-chapters explain the functions of the different Citrix appliances one by one.

## 2.1 Offloading the Burden on the Portal and Accelerating Performance

Ensuring the best application performance begins at the source: the SAP NetWeaver Portal server. Offloading generic, CPU-intensive tasks such as Secure Sockets Layer (SSL) encryption/decryption, TCP connection management, and data compression to a dedicated application delivery appliance enables the SAP NetWeaver Portal to support more simultaneous connections and users. Another proven strategy—caching frequently accessed data—further reduces the burden on the Portal. And intelligently distributing application traffic among multiple backend servers enables SAP administrators to maximize server resources, simplify management, and lower operating expenses by eliminating or delaying the need to purchase extra SAP servers. As an added benefit, these techniques will also increase performance for other Web-based applications, as well as Web services, which might be used in enterprise SOA solution deployments.

Citrix NetScaler® demonstrated the ability to support all these tasks. Deployed in front of the SAP NetWeaver Portal (and the SAP composite server, which played a role in the testing as well), it combines the features and functions of traditional data center point products into a single network appliance, built from the ground up to maximize application performance.

## 2.2 Optimizing WAN Links

Fine-tuning the SAP NetWeaver Portal improves performance enterprise-wide—but doesn't, on its own, completely restore full LAN speed to far-flung WAN users. The separation between these users and the applications and data on which they depend has widened through globalization and data-center consolidation. Today, users can be hundreds or thousands of miles from the nearest application server, introducing network congestion and latency problems, which reduce application responsiveness and end-user productivity.

Most IT professionals are familiar with the effect network bandwidth has on performance. However, bandwidth is not the only, nor necessarily even the most important, factor in network performance:

- **Latency**—The time it takes for a data packet to travel from transmitting to receiving system, latency leaves its mark on all applications, but particularly on those based on Web technologies like HTTP. The typical Web page is composed of dozens of separate objects—.jpg and .gif images, JavaScript code, cascading style sheets, and more. Each of these objects must be requested and retrieved separately, one after the other. Numerous round trips across the network are required and each block of data requires an acknowledgement before the next block can be sent. The inherent chattiness of these Web technologies can result in excessively long page-load times. And the further a user is from the SAP data center, the greater the typical latency. This affects all web applications, not just an SAP NetWeaver Portal.
- **Packet Loss**—Lower-quality WAN lines can also cause occasional TCP/IP packet losses. As little as one-percent loss can have a drastic effect upon response time. This is because the TCP window size is reduced when packet loss happens. The window size is the amount of received data that can be buffered during a connection. The sending host can send only up to that amount of data before it must wait for an acknowledgment and window update from the receiving host. Therefore, reducing the window size increases the number of round trips, and therefore latency, often by a significant factor.

TCP optimization minimizes one of the greatest single causes of WAN-induced latency by eliminating the effects of HTTP and TCP chattiness. Establishing persistent connections to reduce the number of connection setups and teardowns, eliminating delays due to sequencing through pipelining, optimizing throughput by maximizing TCP/IP window size, and eliminating retransmit delays resulting from packet loss—all are TCP optimization methods.

In addition to optimizing the TCP protocol, WAN Optimization technologies apply acceleration techniques like pre-fetching and pipelining data blocks and Web objects to improve the

performance of applications that use chatty protocols and formats such as HTTP/HTML and SOAP/XML.

Citrix WANScaler® can automatically apply to each data flow, a combination of performance-boosting techniques depending on the application, data, and network conditions—including Adaptive TCP Flow Control, multi-level compression (disk, L2 cache, and memory based), protocol acceleration, and granular traffic management with Layer-4 service-class policies. Though servers may be deployed thousands of miles away, WANScaler can help deliver LAN-like performance across the enterprise.

WANScaler compression technologies include more than simple file compression. De-duplication, for example, recognizes repeated data patterns at the block or file level and replaces duplicated blocks with small symbols, greatly improving throughput. Whether across town or halfway around the world, users often share a lot of common information: they may be running the same transaction screens, for example, or processing similar reports on the same business data. A symmetric solution, WANScaler sends a token that tells the WANScaler appliance on the other side of the cloud to insert the repetitive data from its local cache—thereby limiting congestion on the network—instead of sending this data numerous times across the WAN.

As with WAN optimization solutions in general, WANScaler is not able to apply compression to encrypted traffic because in order to compress traffic it must be able to inspect the underlying data. Normal flow control is still available to encrypted traffic.

## 2.3 Accelerating Performance for All Users via Virtualization

Instead of transferring massive amounts of data through the corporate WAN every time a remote user wants to run an application transaction, application virtualization reduces network congestion by installing the user-interface client in the data center and transmitting only the display pixels users need to see. A branch office or mobile user can interact with an application running at the data center without latency issues, chatty protocols, and large data transfers getting in the way of peak performance. The only information that traverses the network is optimized screen output and input from the user's keyboard and mouse. IT costs are reduced by avoiding application installation at client PCs.

Under virtually any network conditions, browser application virtualization provides value for web based transactions. And application virtualization is secure by design, keeping applications and data (temporary browser cache etc) behind the data center firewall. You have complete control over what data, reports, etc. can be cached or saved outside your protected network—thereby eliminating inadvertent data “leakage.”

Citrix Presentation Server™ offers application virtualization as well as application streaming for optimal security and SAP performance. Running on Microsoft Windows Server and UNIX operating systems, Presentation Server supports virtually any custom or commercially packaged Windows, UNIX, Java, and Web application, regardless of infrastructure diversity. And the Citrix Independent Computing Architecture (ICA) network protocol offers built-in 128-bit Rivest Cipher (RC5) encryption so network traffic between users and servers cannot be intercepted.

## 2.4 Ensuring Secure Remote Access

Without question, remote access is a critical component of an enterprise application. Mobile users (including internal employees, consultants, business partners, and customers) require secure and easily configured access to corporate applications over the Internet. Connectivity to corporate applications through VPNs and SSL encryption has become the industry standard for secure access to public-facing applications.

Deployed in the DMZ, Citrix Access Gateway™ is a universal SSL VPN appliance that provides a secure, always-on, single point of access to all applications and protocols. Via an easy-to-use

Web client, Access Gateway automatically controls access to applications on a role-based, case-by-case basis. You can specify which access methods each authorized user must employ to access each type of data in your system. You can also configure profiles to look for a properly locked-down endpoint machine with all the appropriate safeguards in place, and can quickly shut that machine's access down if a security issue is encountered.

Access Gateway seamlessly reconnects users to their documents when they change locations and devices or lose connectivity. Integrated endpoint scanning ensures user devices remain safe for connection to the corporate network.

## 2.5 Monitoring Performance End to End from the User Perspective

The final critical element of any strategy for improving performance is a method for monitoring how well the application is performing. Such technology enables a quick response when problems occur, to ensure reliability. But while most companies have sophisticated system management tools that provide an enterprise view of their servers and networks, they lack a similar view of application performance and availability as experienced by the end user. As a result, they lack the real-time visibility needed to manage the delivery, performance, and availability of the mission-critical business applications end users require every day.

Citrix EdgeSight® measures performance and availability from the user's perspective to shift the IT focus from technology and systems to achieving business goals. IT organizations have the insight, data, and tools they need to ensure that all IT resources are operating at peak efficiency—so that end users may do the same.

## 3 Results and Analysis

An SAP landscape can encompass everything from very transactional operations (for example, Financial Accounting [FI], Sales and Distribution [SD], and so on) to operations requiring large data transfers (Business Intelligence [BI], Knowledge Management [KM], or large web-service/XML-related data transfers). In any such case, a typical scenario starts with an end user requesting the SAP NetWeaver Portal login page, then submitting user/password credentials and getting the Portal's first page, commonly referred to as the "welcome" page. From there, the user typically navigates through a few steps to a more specific interaction, which then triggers activities in other enterprise SOA components like composite applications or the architecture backend.

For the ES Community network lab project, SAP provided test scenarios that reflect the most typical SAP usage cases and the common SAP workflow described above. Tests consisted of:

- **Large data transfer**—To simulate a user's-eye view of the effects data transfers can have across a variety of access scenarios, a test script was devised where the key measurement was the time it took users to download a 5 MB PowerPoint file stored on the Knowledge Management component of the SAP NetWeaver Portal server.

Measurement: Response time

- **Small data transactions**—Of an SAP customer's thousands of daily transactions, many may contain very small amounts of data. Web service calls, for example, can be quite small. To benchmark Citrix products against these smaller data transactions, an SAP enterprise service from the Procurement module, Get-Supplier-ID, was selected. The key measurement was time required to return a list of five approved vendors for a product from the SAP composite server.

Measurement: Response time

- **Resource consumption at the SAP NetWeaver Portal**—Citrix used a LoadRunner system to simulate 500 concurrent users, each of whom logged on to the Portal, viewed the homepage, logged off after approximately 100 seconds, logged back on again, and so on—during the course of an entire evening. The test measured the portal’s ability to maintain connections to these users and to handle handshakes related to SSL encryption and other basic housekeeping tasks required just to keep a user’s connection alive. Citrix measured the baseline for SAP’s utilization when its products were and were not active.

Measurement: CPU offload

For the response-time tests, different network types were compared. The goal was to simulate realistic connectivity situations in SAP deployments.

Differentiation between network types was made by:

- Bandwidth
- Latency—The mentioned values are the added latency for a single package. Latency is measured in milliseconds at round-trip time, which means a “ping” would show double the amount of wait time.
- Packet loss—The Shunra WAN Emulator deleted some packages randomly.

Network Scenario	Network Quality	Access Example
LAN	<ul style="list-style-type: none"> <li>• Bandwidth: 100 Mbps</li> <li>• Packet Loss: none</li> <li>• Network Latency: none</li> </ul>	LAN environment at head-quarters
High-quality WAN backbone (short or medium distance)	<ul style="list-style-type: none"> <li>• Bandwidth: 45 Mbps</li> <li>• Packet Loss: 0%</li> <li>• Network Latency: 30 ms (round trip: 60 ms)</li> </ul>	Users within North America or within Europe
Moderate-quality WAN backbone (long distance)	<ul style="list-style-type: none"> <li>• Bandwidth: 45 Mbps</li> <li>• Packet Loss: 1%</li> <li>• Network Latency: 150 ms (round trip: 300 ms)</li> </ul>	Access between Asia and North America
Remote-worker or branch-office connection	<ul style="list-style-type: none"> <li>• Bandwidth: 768 Kbps</li> <li>• Packet Loss: 1%</li> <li>• Network Latency: 150 ms (round trip: 300 ms)</li> </ul>	Access from home offices, etc.

### 3.1 Large Data Transfer (Knowledge Management Component)

The large data transfer test measured response time during download of a 5 MB PowerPoint document from the Knowledge Management component of the SAP NetWeaver Portal.

#### 3.1.1 Accelerating LAN and WAN Performance

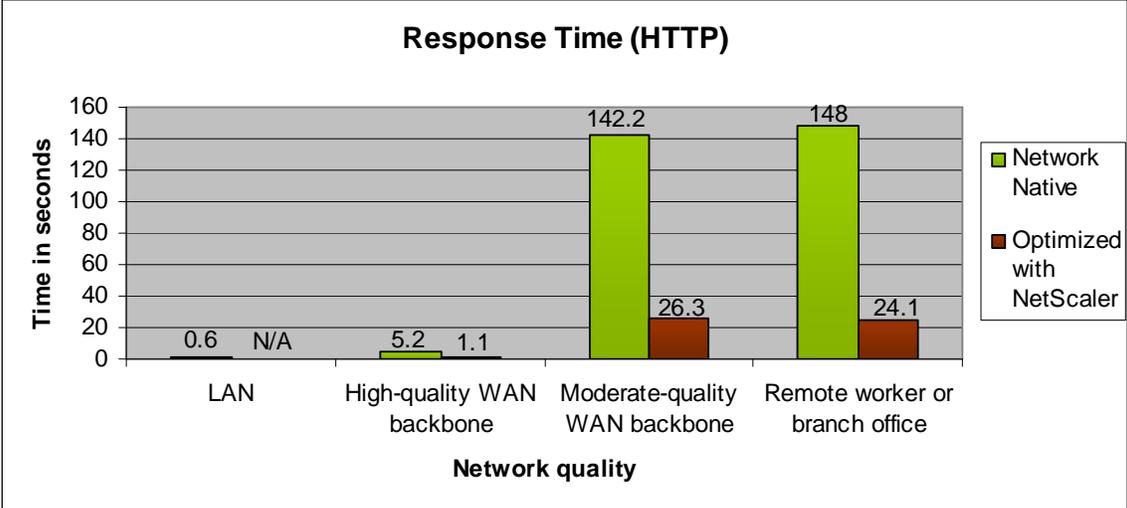
For the tests involving NetScaler and WANScaler, HP LoadRunner was used as the load-generating and response-time measurement tool.

NetScaler improved response time mainly through TCP optimizations and its caching and compression features. Each measurement had five iterations, and the documented results are the average response-time numbers for document download.

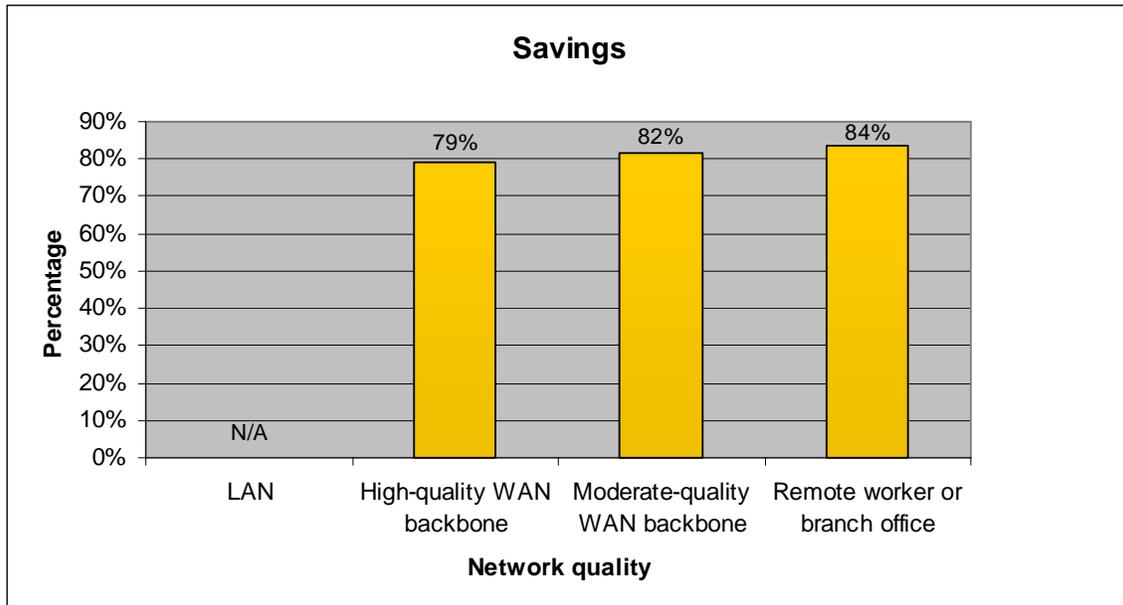
Results Using HTTP				
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Only</b>	0.6 s	5.2 s	142.2 s	148 s
<b>Optimized with NetScaler</b>	N/A	1.1 s	26.3 s	24.1 s
<b>Savings</b>	N/A	79%	82%	84%

Testing showed that adding a single, centrally located NetScaler appliance in front of the SAP NetWeaver Portal server can improve large-file download times by about 80 percent. Even across the near-perfect conditions of a company LAN, response time improved. Across the lowest-quality network, NetScaler took more than two minutes off the time required to download the file.

**Absolute Values**



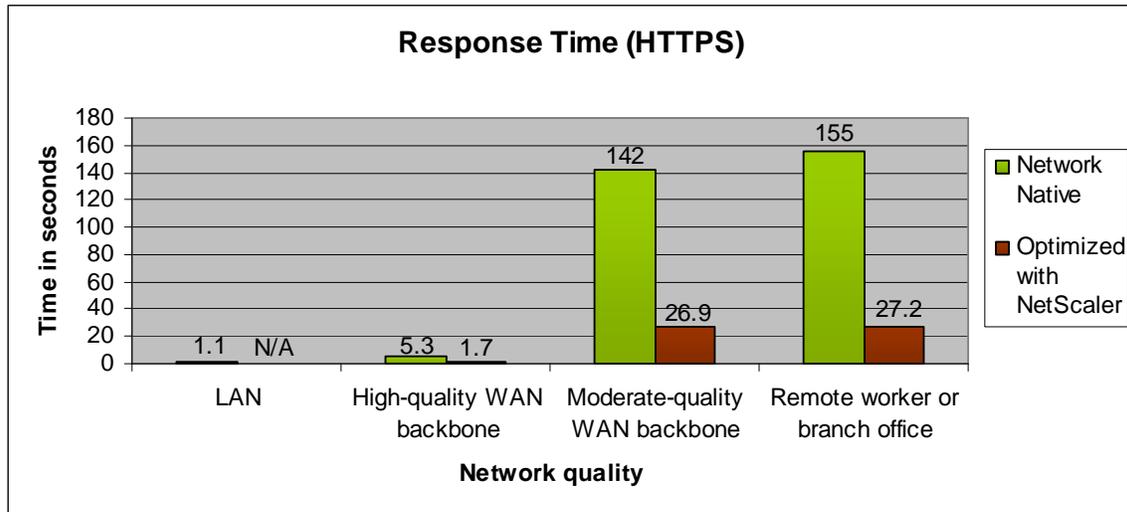
## Relative Values



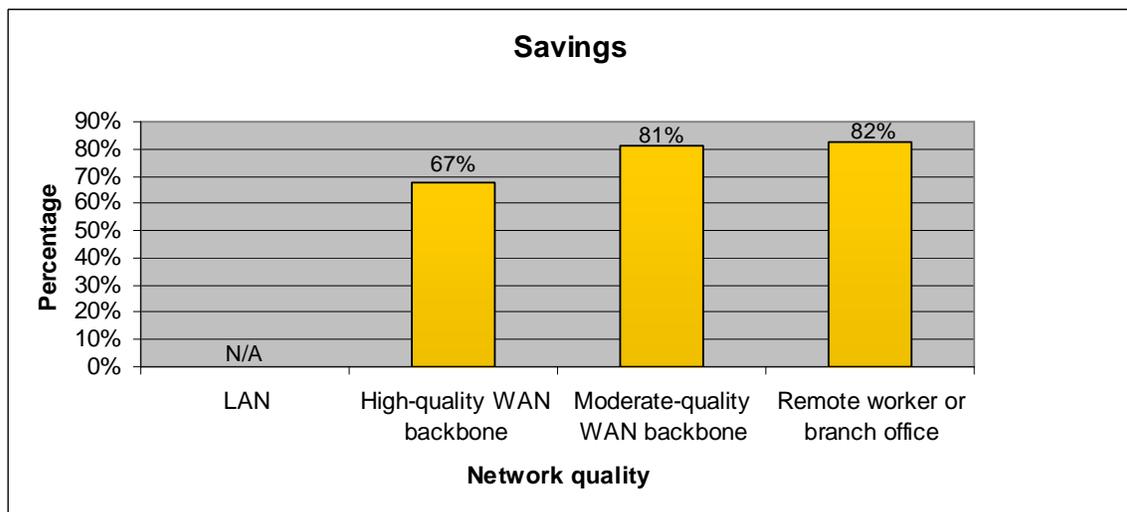
<there is some glue text missing here. Is https with or without SSL offload?>

Results Using HTTPS				
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	1.1 s	5.3 s	142 s	155 s
<b>Optimized with NetScaler</b>	N/A	1.7 s	26.9 s	27.2 s
<b>Savings</b>	N/A	67%	81%	82%

## Absolute Values



## Relative Values



### 3.1.2 Optimizing WAN Performance

As mentioned earlier, WANScaler delivers response-time improvement based on compression and network flow control. In addition, WANScaler's multi-level compression feature enables it to serve the complete document with LAN speed directly from the memory on the client site. Determining whether an object is captured in compression history requires only one round trip to the WANScaler sitting at the headquarters site.

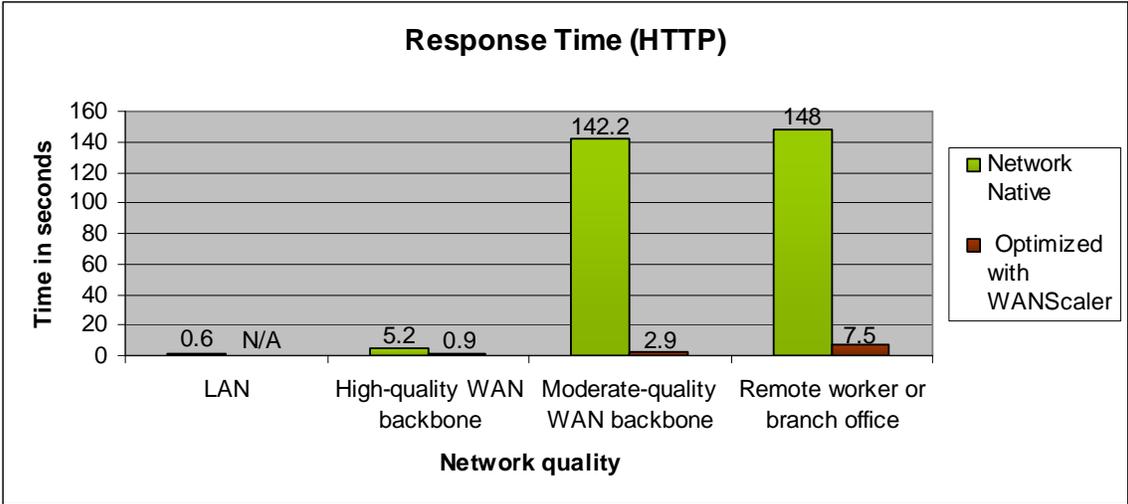
For the multi-level compression to work, two users need to request the same or similar data. (Remember as well that the data cannot be encrypted.) However, while some applications exist to serve more-or-less static content to a large population of users, in an enterprise resource planning (ERP) setting it is common for only one person to be focused on a particular business challenge. SAP ERP solutions therefore often have a high degree of content that is unique to individual users. To reflect this prevalent SAP scenario, the first ESC test for WANScaler eliminated data caching.

Because WANScaler optimizes WAN traffic, there is no measurement for a LAN environment.

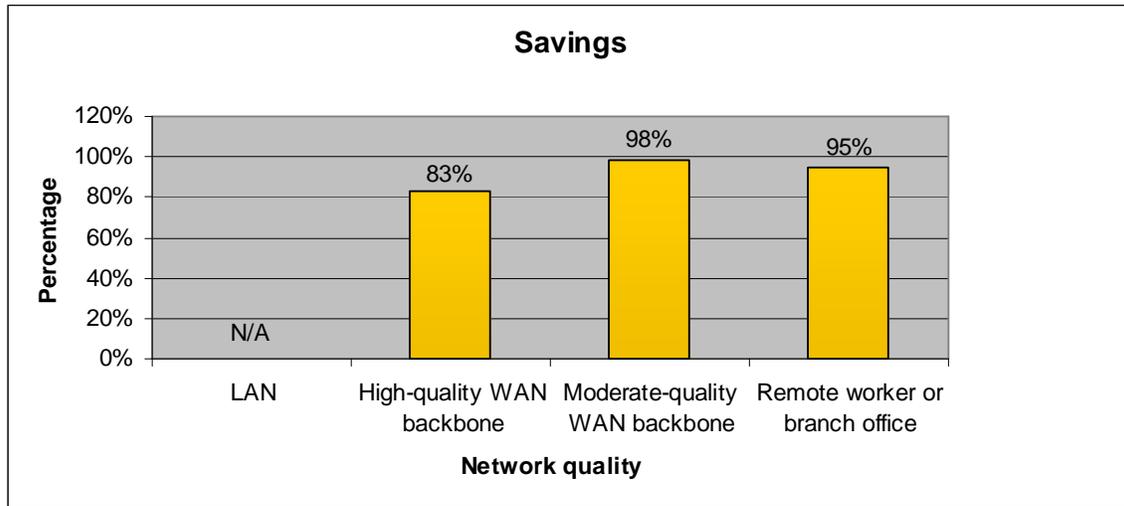
Results Using HTTP				
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	0.6 s	5.2 s	142.2 s	148 s
<b>Optimized with WANScaler</b>	N/A	0.9 s	2.9 s	7.5 s
<b>Savings</b>	N/A	83%	98%	95%

As the table illustrates, over the lowest-quality network WANScaler was able to further reduce response time—down to about 8 seconds. It delivered LAN-like performance regardless of the network connection.

**Absolute Values**



## Relative Values

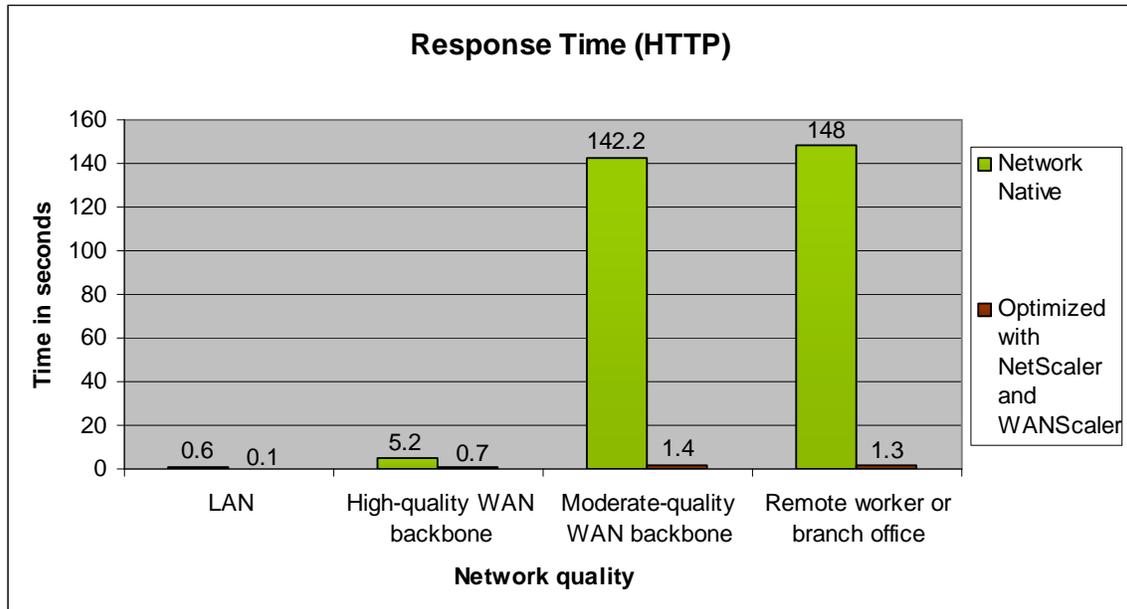


In the next test, NetScaler and WANScaler were run together on the sample networks. This is a typical-use case. The average response times are a result of first-time data transfer *and* subsequent caching. While SAP users often work with unique content for their individual business purposes, they may also run the same transaction screens, process similar reports on the same business data, or in some other way share a lot of common information. Caching this information enables the lowest-possible response times.

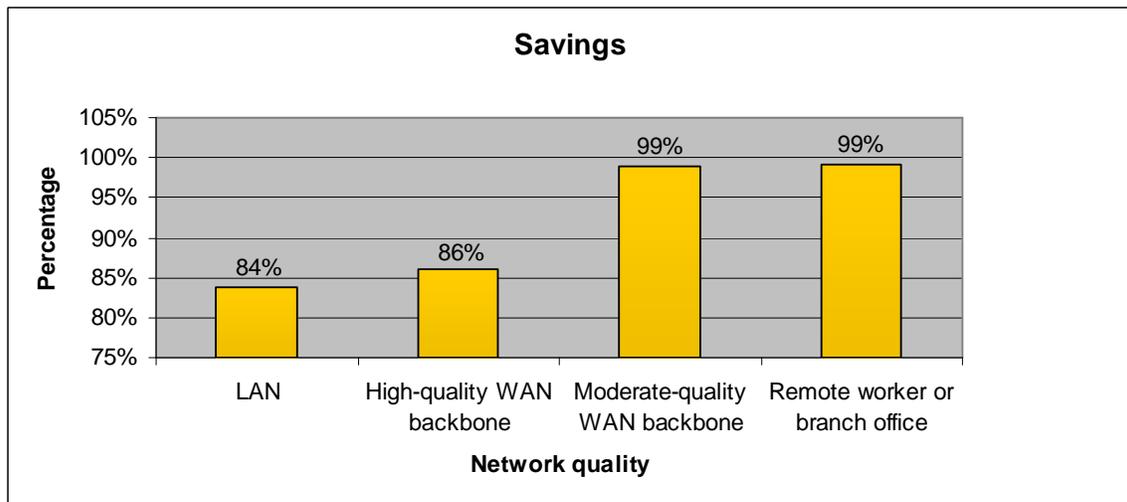
Results Using HTTP				
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	0.6 s	5.2 s	142.2 s	148 s
<b>Optimized with NetScaler and WANScaler</b>	0.1 s	0.7 s	1.4 s	1.3 s
<b>Savings</b>	84%	86%	99%	99%

In combination, NetScaler and WANScaler shaved WAN response times until they were virtually indistinguishable from response times on a LAN. NetScaler's caching and WANScaler's multi-level compression helped reduce response times by as much as 99 percent.

## Absolute Values



## Relative Values



### 3.1.3 Accelerating Performance for All Users via Virtualization

For Presentation Server, two necessary changes were made to the response-time test:

- **Time to view, rather than time to download, was measured.** As mentioned earlier, in a Presentation Server–based installation the data is typically centralized at headquarters. In the worst-case scenario, then, during download the SAP NetWeaver Portal transfers data to the remote user or branch office via the small-piped connection, but Presentation Server stores the application and data centrally: the file does not need to be downloaded to be viewed. Instead, an image is streamed to the user of any page he/she chooses to view. Thus, for this test, opening of the document and viewing pages was the response-time measure.

- Manual stopwatch timings were used.** Because Presentation Server delivers pixels rather than the application to the user, this test requires a completely different recorded script for HP LoadRunner to drive ICA sessions at the local browser and properly virtualize users. Time constraints, however, prevented creation of this script. Instead, time was measured manually with an electronic stopwatch. Measurements were performed five times, and the reflected values are the average of these times. Therefore, times below include browser rendering times of the 5MB Power Point. This was not the case in the earlier LoadRunner measurements, which measure only application server and Wide Area Network response time contributions and so some variance in baseline times were observed.

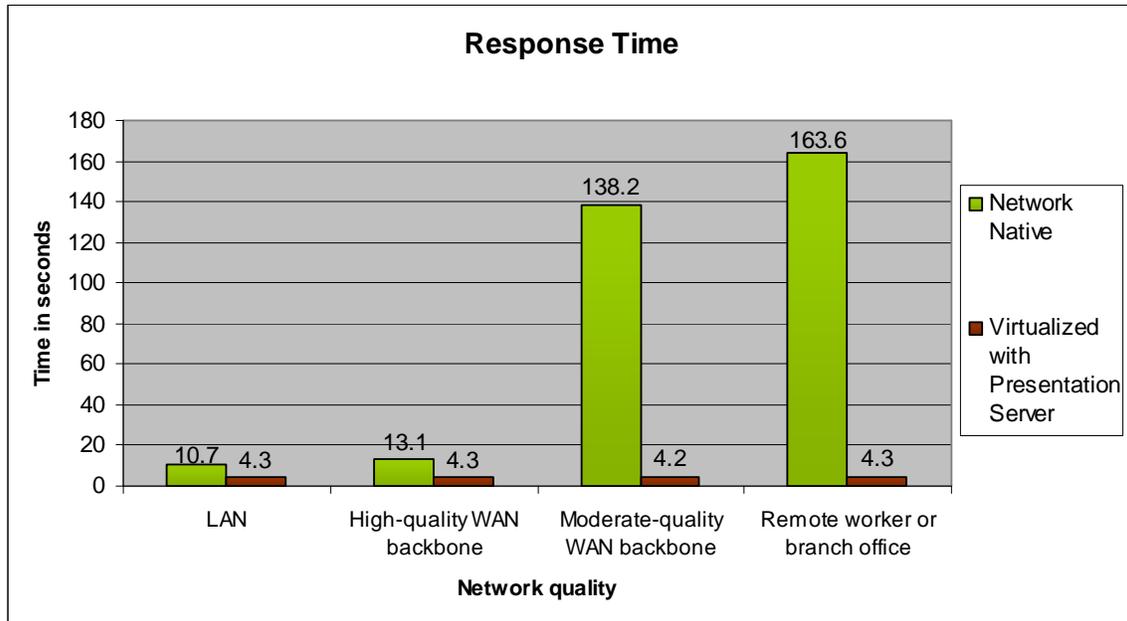
For these manual timings, the Native tests were conducted with a browser on a laptop. For the Presentation Server tests, the browser was on a multi CPU server.

	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	10.7 s	13.1 s	138.2 s	163.6 s
<b>Virtualized with Presentation Server</b>	4.3 s	4.3 s	4.2 s	4.3 s
<b>Savings</b>	60%	67%	97%	97%

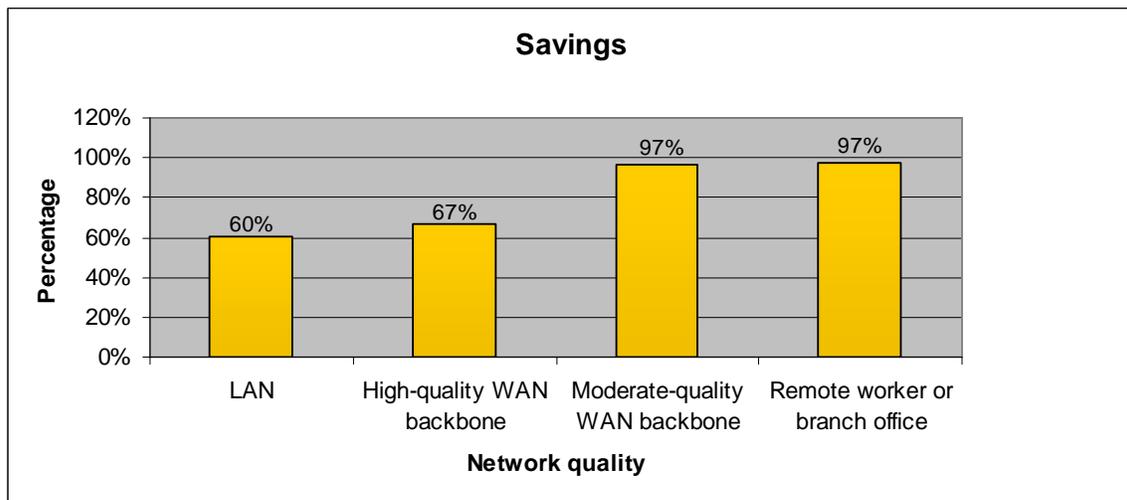
Testing found that Presentation Server response time remained stable across the various networks. Without Presentation Server in play, a remote worker had to wait 163 seconds to open the PowerPoint document via the SAP NetWeaver Portal. The document is cached at the client, so the change to the next slide was performed locally with quick response. With Presentation Server on the network, the user needed only 4 seconds to see the first slide. The change to the next slide took a similar amount of time, because the next screen update had to be sent.

To illustrate the security benefits inherent in the architecture, consider that when using a local browser to access the SAP NetWeaver Portal directly, a copy of the viewed document is might be stored in the browser cache depending on caching policies configured in the Knowledge Management component. If the laptop is lost or there is an intrusion, the file can then be unveiled to an unauthorized person. Because Presentation Server transfers only pixel information, the document is not copied to the client side. It remains safe in the data center. And Presentation Server also offers built-in encryption to further protect your business-critical data.

## Absolute Values



## Relative Values



### 3.2 Transactional Data (Get-Supplier-ID)

As mentioned earlier, to benchmark Citrix products against smaller data transactions, an SAP enterprise service from the Procurement module, Get-Supplier-ID, was selected. The key measurement was time required to return a list of five approved vendors for a product from the SAP composite server.

The provided script for the Get-Supplier-ID test case produces only a very small amount of data. This is due both to the nature of this specific transaction and to the amount of data in the SAP backend systems used during the test. In this case, for example, only five supplier IDs are the output of the transaction. Even in the scenario for the remote worker, the available bandwidth is not a real limiting factor for the data from the SAP backend systems.

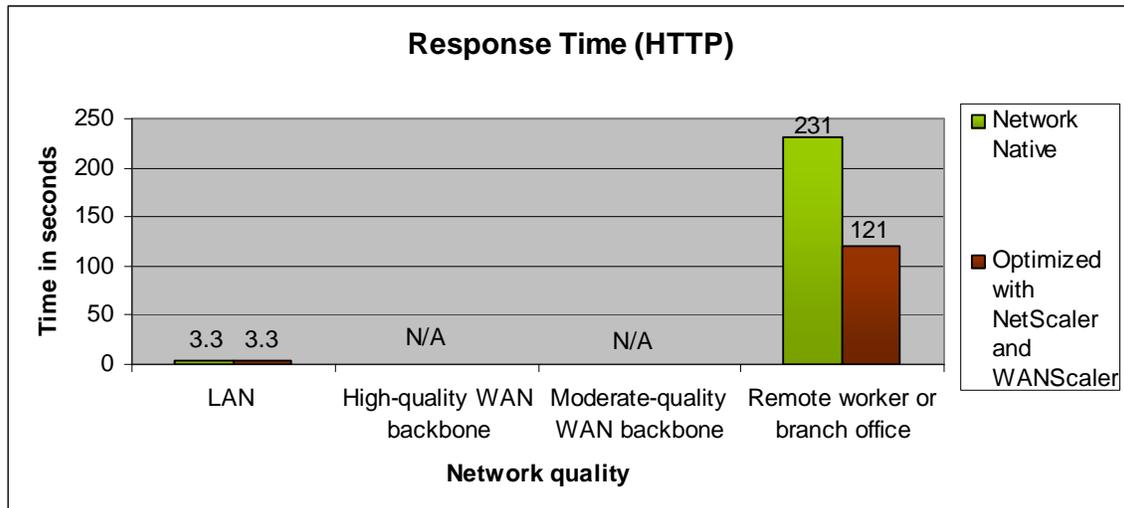
### 3.2.1 Optimizing Congested WAN Links

To optimize traffic by flow control or compression there must be data to work with. In this test case, that data workload was small. However, in practical use, additional traffic is typically competing with SAP traffic on the same wire. So to simulate practical use, the NetScaler + WANScaler test employed the freeware IPerf application to generate additional traffic, enabling 97 -percent congestion on the line.

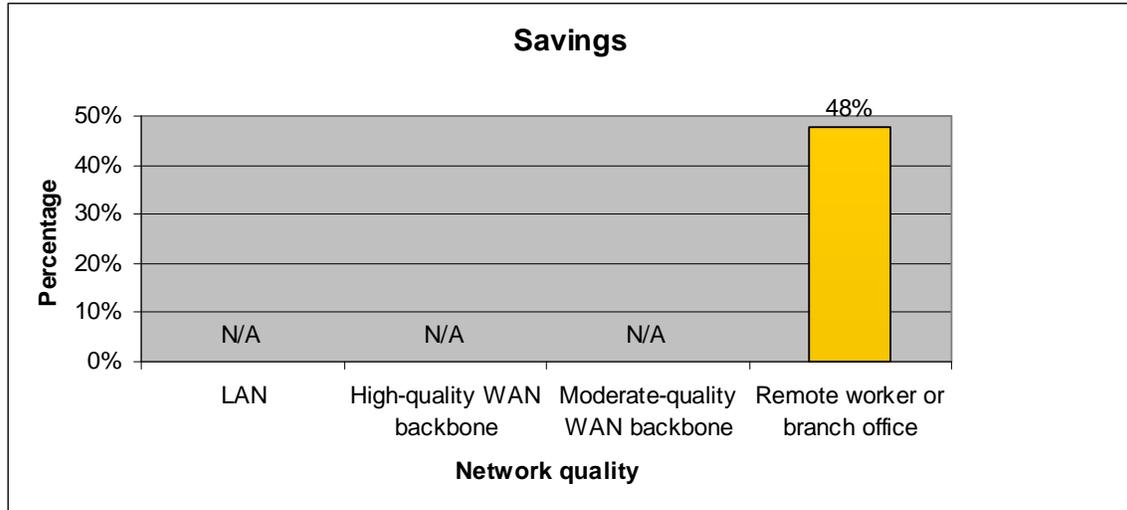
Results Using HTTP				
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	3.3 s	Not tested	Not tested	231 s
<b>With NetScaler and WANScaler</b>	3.3 s	Not tested	Not tested	121 s
<b>Savings</b>	0%	N/A	N/A	48%

Time constraints prevented measuring all network variants, so the variants with the biggest difference in response-time results were measured instead. These results showed that WANScaler's flow control capabilities reduced SAP response time by approximately fifty percent. On the congested network, WANScaler was able to control how much data any one IP packet transmitted. It then packaged and sent like data together, allowing the network to perform at or near its maximum potential, while NetScaler provided workload improvements for the SAP servers in the data center.

#### Absolute Values



## Relative Values



### 3.2.2 Accelerating Performance for All Users via Virtualization

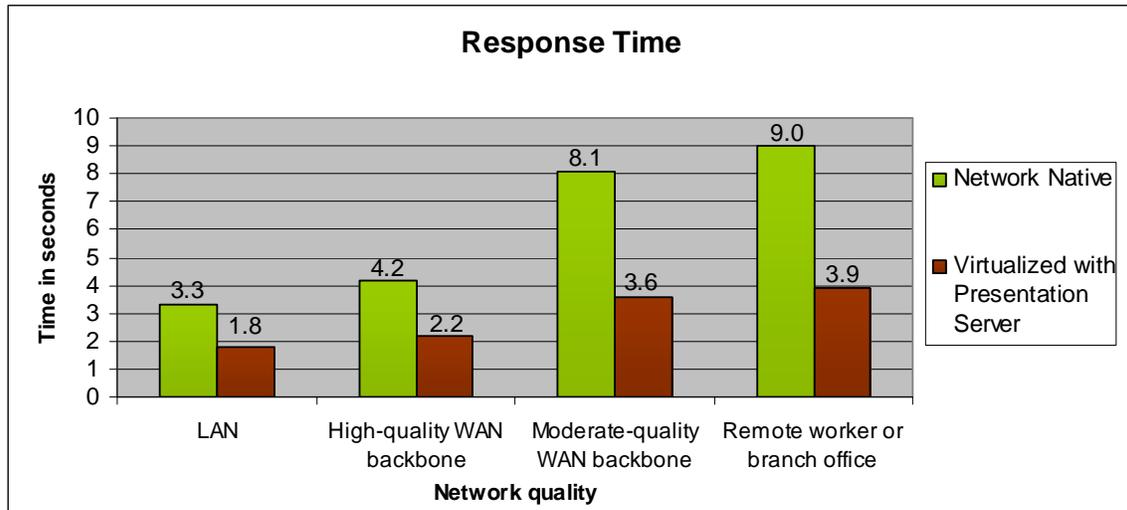
Presentation Server does not use flow control or compression to generate benefits. Instead, as mentioned earlier, Citrix puts the browser on the server in the data center and uses the ICA protocol to deliver results to users. Thus, Presentation Server can demonstrate value even in environments where the network is not loaded and flow control is not necessary.

This Presentation Server Get Supplier ID test was tool based, rather than manual: HP LoadRunner scripts were run.

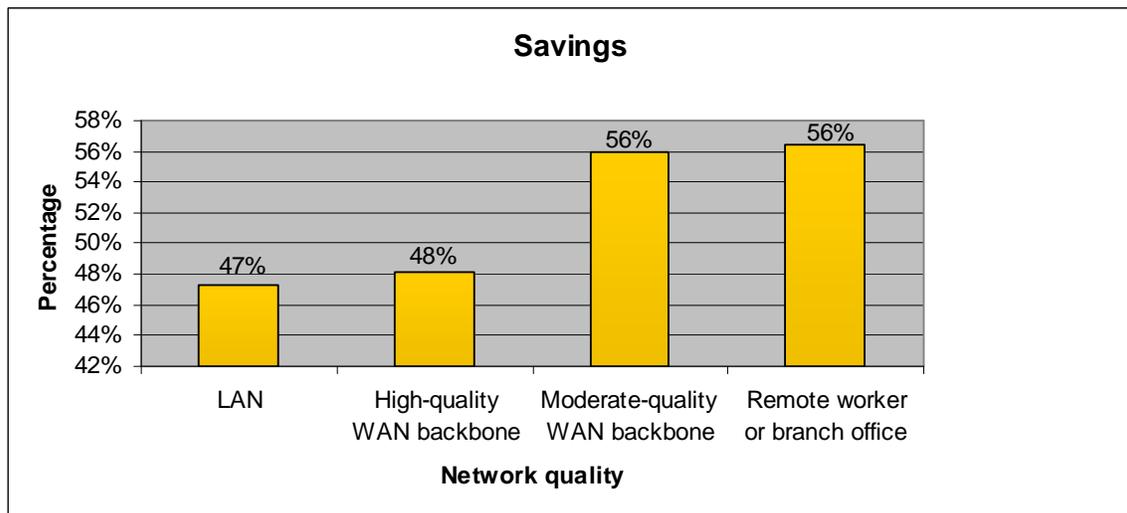
	LAN	High-Quality WAN	Moderate-Quality WAN	Remote Worker/Branch
<b>Network Native</b>	3.3 s	4.2 s	8.1 s	9.0 s
<b>Virtualized with Presentation Server</b>	1.8 s	2.2 s	3.6 s	3.9 s
<b>Savings</b>	47%	48%	56%	56%

In this testing environment, Presentation Server was able to reduce response time by about 50 percent, independent of the quality of the network, while also increasing security. Under virtually any network conditions, Presentation Server provides value for enterprise services.

## Absolute Values



## Relative Values



### 3.3 Offloading from SAP NetWeaver Portal (500-User Load Test, Logon and Logoff)

In addition to optimizing the traffic to the client, NetScaler is able to reduce resource consumption and optimize the use of Web servers such as the SAP NetWeaver Portal. The following capabilities make this possible:

- **TCP/IP offload**—NetScaler establishes and controls the TCP/IP connections to the Web browser on the client side, and multiplexes this into the few connections necessary to keep the Web server alive.
- **SSL offload**—NetScaler takes over SSL encryption/decryption, too, saving more CPU cycles on the SAP NetWeaver Portal.
- **Load balancing**—NetScaler can act as a load balancer in front of several SAP portals.

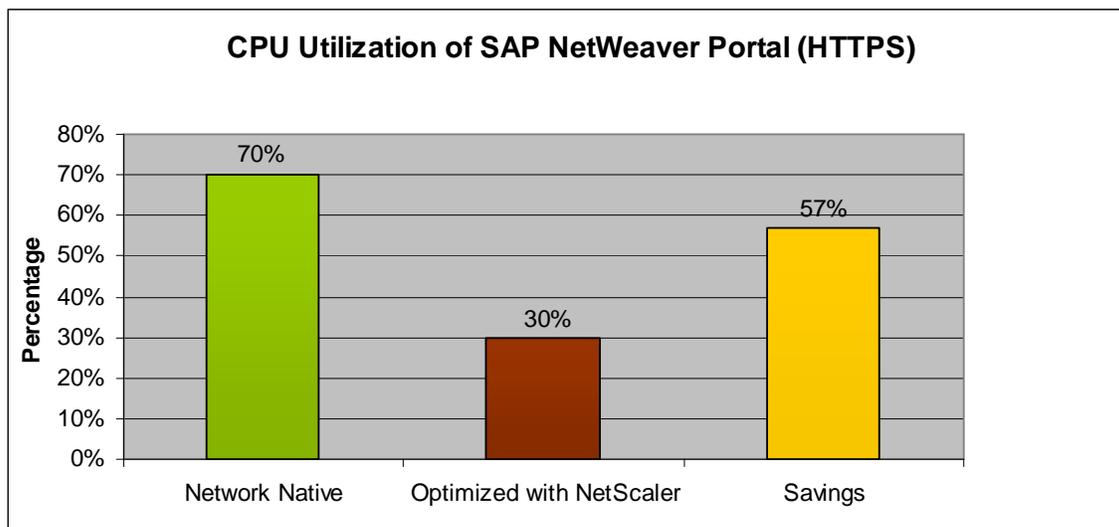
In this test HP LoadRunner was used to simulate 500 users performing logon to and logoff from the SAP NetWeaver Portal. These operations are CPU intensive for the portal, because of the usually large welcome page content involved.

The test was conducted using HTTPS, and the measurement of CPU consumption was performed with the Windows-OS tool Perfmon.

Results Using HTTPS	
	CPU Utilization
<b>Network Native</b>	70%
<b>Optimized with NetScaler</b>	30%
<b>Savings</b>	57%

The test found that NetScaler was able to reduce the portal's CPU load by 57 percent. In other words, the SAP NetWeaver Portal served more than twice the number of users with the same CPU load when NetScaler was used to offload basic housekeeping tasks.

### Absolute Values



The many benefits of Citrix optimization and virtualization technologies catalogued through all of the testing are as follows:

- Individually, Citrix NetScaler and Citrix WANScaler optimization technologies reduced end-user response times for very data-intensive transactions between about 80 and 95 percent, depending on network conditions. When used in tandem (and with WANScaler's compression history in play), response times were reduced by as much as 99 percent. The benefits of NetScaler and WANScaler tended to be greatest when data load was heavy or network quality poor, but a single NetScaler appliance enabled marked improvement even across the near-perfect conditions of a LAN.

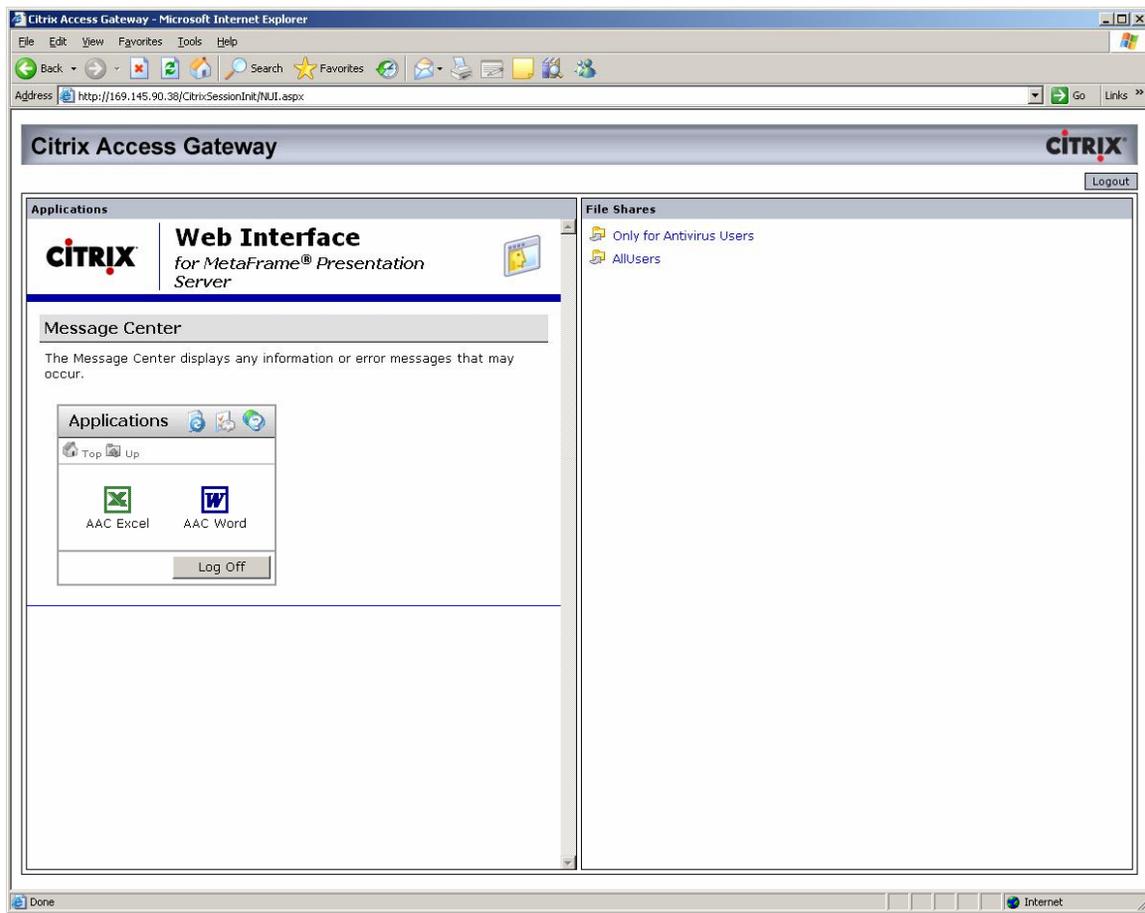
- Citrix Presentation Server provided more than just deployment, cost, and security benefits via its virtualization capabilities: it also reduced response times by 60 to 97 percent, depending on the transaction and network quality.
- For SAP NetWeaver enterprise services transactions with small data payloads, WANScaler, NetScaler, and Presentation Server improved performance on congested networks by approximately 50 percent.
- NetScaler reduced SAP NetWeaver Portal CPU utilization by more than 60 percent for a login/logout test, showing data center costs saving capabilities.

## 4 Ensuring Secure Remote Access

This next test highlighted the ability of Access Gateway to scan an endpoint and provide granular access to resources. The first step was to allow the endpoint (for example, a laptop) to be scanned via a Web page hosted on the Access Gateway appliance. After that, the Access Gateway client was downloaded and run.

Depending on the results of the scan, access was provided to:

- The defined network segments
- Specific published applications from a Citrix Presentation Server
- Specific network shares

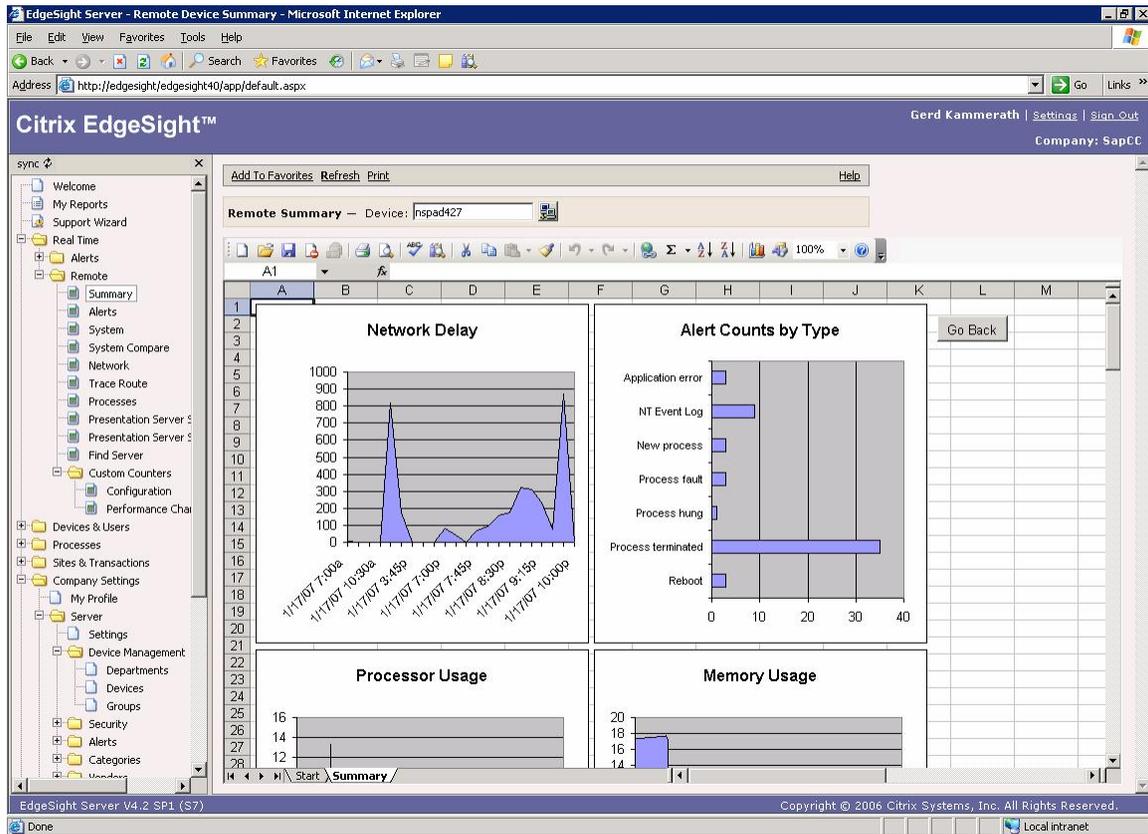


McAfee antivirus software was used to demonstrate that Access Gateway grants granular access to different resources. If the antivirus software was active, users got access to all network segments and special shares. If, however, the software was not active, users were allowed to access only a single network segment and a public share.

Access Gateway was even able to monitor the client on a permanent basis. If, for example, the security-relevant service was stopped, Access Gateway suspended access to the complete network. Once the security application was started again, the Access Gateway client detected that change and the complete network connections were restored automatically.

## 5 Monitoring Performance End to End from the User Perspective

The Citrix EdgeSight solution shifts the IT focus from technology and systems to end users and achieving business goals. During testing, Citrix demonstrated the ability of EdgeSight to provide insight into application performance, end to end, from the user's perspective by monitoring performance on the LoadRunner machine, which itself represented a standard native client and the performance of Citrix Presentation Server. EdgeSight displayed data about response times at the client, uncovered network wait times, and recorded any system messages regarding errors, etc. In addition, it was able to collect a variety of configuration data.



## 6 Summary

Globally, end users of an enterprise SOA-based SAP application landscape can benefit greatly from technologies that optimize Wide Area Network connections to your application servers by compensating network congestion and latency-ridden and packet loss effected network links.

The very same technologies can also be applied to accelerate inter application network traffic over long distances as it is more and more demanded by enterprises which want to collaborate with other companies like their suppliers.

Front-end software virtualization in the datacenter is another method to not only improve network performance but also to prevent critical business data and documents from leaving the datacenter, a much wanted added security mechanism.

This white paper details multiple blueprints for deploying Citrix application delivery infrastructure solutions into enterprise SOA-based SAP landscapes based on hands-on Citrix and SAP test lab collaboration in the ES Community. Test results for the following network solutions have been listed in the previous chapters:

- **Citrix NetScaler**—Deployed in front of application servers, Citrix NetScaler provides load balancing and offloads security and management services so that application servers can cater swiftly to more users. Server availability and scalability improve, and fewer application servers are necessary in the data center, lowering your total cost of ownership.
- **Citrix WANScaler**—WANScaler complements NetScaler capabilities, applying targeted performance-boosting techniques to reduce the effects of limited network bandwidth, network latency, and packet loss. WANScaler can reduce response times even for end users thousands of miles from the data center.
- **Citrix Presentation Server**—Presentation Server virtualizes application delivery over the network, enabling a branch office or mobile user to interact with applications running in the data center without transferring data through the oftentimes sluggish corporate WAN. This approach improves security and simplifies management to lower costs, while also improving the end-user experience.
- **Citrix Access Gateway**—A key consideration in developing a successful application delivery strategy is making it easy for users to securely access their applications from any location. Citrix Access Gateway provides application-layer access to the exact application resources each user needs. Access Gateway can even grant you control over which actions a user can perform within each application, based on his or her unique access scenario.
- **Citrix EdgeSight**—The success of any application delivery strategy also rests on the ability of IT to monitor the experience of end users with regard to application performance. Citrix EdgeSight gives you visibility into exactly what the application experience feels like for end users, making it much easier to maintain service level agreements with business stakeholders, spot bottlenecks before they become issues, and quickly diagnose problems when they do occur.

## 7 References

### 7.1 SAP References

SAP Developer Network (SDN): <http://sdn.sap.com/>

ESC: <http://esc.sap.com/>

SAP Discovery System: <https://www.sdn.sap.com/irj/sdn/developerareas/esa/esadiscovery>

First ESC Network Group paper:

<https://www.sdn.sap.com/irj/servlet/prt/portal/prtroot/docs/library/uuid/805d8c2d-0e01-0010-a694-a94109e88f2a>

## 7.2 Citrix References

Citrix home page: <http://www.citrix.com>

Citrix and SAP: <http://www.citrix.com/sap>

Citrix and SAP best practices: <http://www.citrix.com/sapwhitepaper>

## 7.3 Other References

SDForum Press Release:

[http://www.sdforum.org/SDForum/Assets/PDFs/Newsletters/Final\\_SDFnews\\_FebMar07.pdf](http://www.sdforum.org/SDForum/Assets/PDFs/Newsletters/Final_SDFnews_FebMar07.pdf)