Appeon Advantages Over Citrix

An Appeon Whitepaper

Appeon® for PowerBuilder®

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1 Moving to the Web

There are many advantages to move your IT systems to an n-tier Web architecture based on the open J2EE standard or Microsoft's .NET. Probably the biggest advantage and most common reason are being able to extend the reach of your applications (business processes) to your employees, partners, customers and other external parties. Moving to the Web with proven enterprise-class architectures such as J2EE and .NET ensures that you can provide ubiquitous access to your applications. It also ensures that your system will be scalable, secure, reliable, and easy to maintain. The bottom line is increased profits and long-term competitive advantage that ensure your company will remain strong in the landscape of the future.

1.1 Ubiquitous access

In simple terms, ubiquitous access means that anyone, anywhere, and at anytime can use your application. A Web application is able to deliver ubiquitous access if it does not require any software installation or configuration before the application can be used and can be accessed over all network connection types and qualities. However, not all Web technologies that are in use today deliver ubiquitous access. Specifically, Web-based technologies such as Java Applets and browser plug-ins that require the client-side installation, broadband network connections, special configuration, and subsequent updates, can limit access to your Web application. The only Web technologies that are widely accepted and proven to deliver ubiquitous access are the HTML, JavaScript, XML, and HTTP standards.

1.2 High scalability

Scalability ensures you can invest in a system with confidence you will not outgrow it. Server clustering enables you to start out with one server and easily expand to handle any number of users. In the real world, however, clustering capability does not distinguish a scalable system from one that will not scale. Rather, it is the amount of load (number of users) a single server can handle. The reality is that there are practical limits from a cost, physical space, and system management perspective how large a server cluster can become in a particular organization. Only a system that can handle large number of users on a given server can truly scale instead of ending up in the trash down the road.

1.3 Strong security

The Web standards HTML, JavaScript, XML, and HTTPS/SSL are in use by the largest enterprises, governments, and the roughly 1 billion Internet users worldwide for good reason. Unlike client-installed software and browser plug-ins, applications that use only these Web standards are secured by the rigid Web browser security sandbox. This sandbox cuts off access to anything outside of the Web browser, such as the client hard disk and Windows registry. All data transmissions between the Web browser and server can be encrypted up to 128-bits with HTTPS/SSL. This level of encryption is so secure that the USA government forbids exporting Web browser software with 128-bit encryption overseas. Web applications that comply with the Web browser security sandbox and work with HTTS/SSL deliver the strongest security available.

1.4 Bullet-proof reliability

The n-tier Web architecture helps safeguard against the two key points of failure in any networked system - the server, and the network connection between the client computer and the server. Specifically, failover and the stateless nature of the n-tier Web architecture makes it so fault tolerant. A redundant server configuration with failover guarantees that a server will be online to handle client requests 24x7. The stateless or connectionless HTTP protocol was designed for the Internet where unstable network connectivity is likely. As such, Web applications that use HTTP and do not require persistent network connectivity can operate reliably even if the network connection fails momentarily. Lastly, the stateless middle tier of Web applications enables the server to gracefully handle bursts of heavy usage. If your organization cannot compromise on reality, settle for no less than the proven n-tier Web architecture.

1.5 Simplified maintenance

An easy to maintain system will reduce your IT expenses and free up valuable IT resources, but most importantly, it will ensure that your tens, hundreds, or thousands of users remain productive - working. Web applications run within the de facto Web browser and generally do not require installation of any additional software or special configurations. This eliminates the need of deploying your client/server applications to every desktop, and redeploying this to every desktop each time a change is made to the application source code. It also reduces the IT support calls and corresponding end-user downtime associated with client application malfunctions, configuration problems, and troubleshooting other client problems. The only sure way to know your organization will not have maintenance headaches is to not introduce any additional client software.

2 How Appeon Stacks up Against Citrix

Both Citrix and Appeon allow your users access your application through a Web browser. Appeon does this by deploying a bona fide n-tier Web application based on J2EE technology to a J2EE application server. Citrix accomplishes this by projecting an "image" of the Windows desktop application that is running on the Citrix server to the Citrix ICA client software, which needs to be downloaded and installed to the client computer. In other words, Appeon is built on the n-tier Web architecture whereas Citrix is not.

	Appeon Server	Citrix MetaFrame Server
Ubiquitous access		
Server deployed applications can be accessed over the Web (Internet/intranet)	✓	✓
Supports users with dial-up and other narrowband network connections	✓	✓
Can serve (reliably) users of any geographical location	✓	
Works with most public Web terminal configurations	✓	
Does not require installation of any additional client software (besides Web browser)	✓	
Scalability		
Maximum users per server CPU	75-100	25-30
Memory requirement per CPU	512 MB	1024 MB (minimum) 2048 MB (better)
Supports clustering and load-balancing	✓	✓
Boosts database scalability	✓	
Security		
Supports HTTPS/SSL data encryption	✓	✓
Compatible with common enterprise firewall configurations	✓	
Does not create possibility of new security vulnerabilities (from new client software)	✓	
Reliability		
Supports server failover	✓	✓

Application connectivity reliable over poor quality network connections	✓	
Server reliable when busy (near stress point)	✓	
Maintainability		
All application code modifications are made at the server	✓	✓
Eliminates need to support any additional client software (besides Web browser)	✓	
Does not require system administrator to perform per-user configuration at the server	✓	

2.1 Accessibility

Appeon-deployed Web applications use only standard HTML, JavaScript, and XML on the client side and therefore can be used from any Windows client computer with the already-installed Web browser. As for Citrix, the need to install the Citrix ICA client software means that a Citrix-deployed application generally cannot be used within a high-security browser environment or anywhere where installing client software is not allowed. This includes almost any Internet terminal open to use by the public.

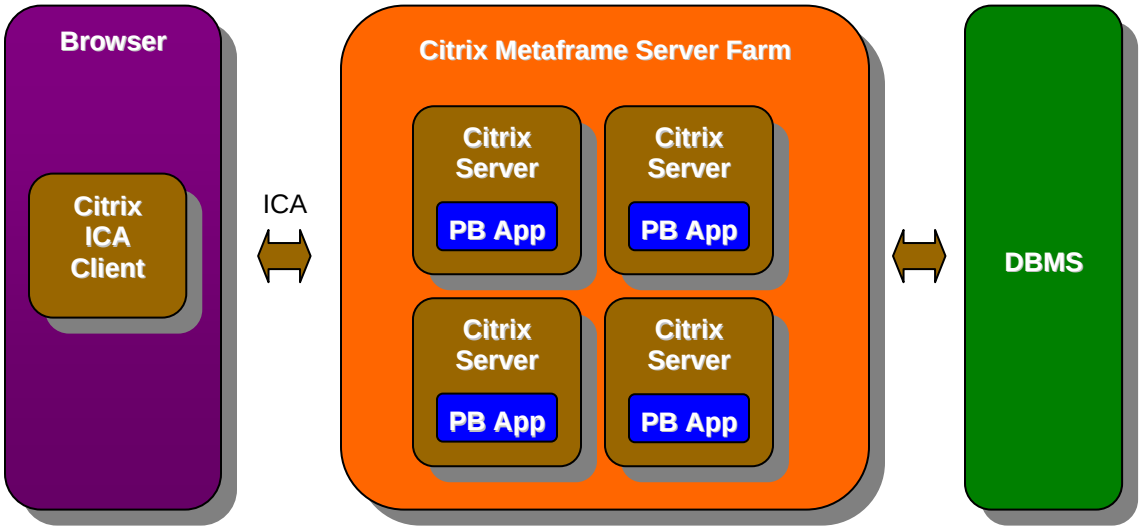
Citrix's dependency on a persistent connection is another factor that limits accessibility of Citrix-deployed applications. The reality of access over the Internet is that disruptions in connectivity are frequent, and an application that cannot cope with these interruptions will in practice be unusable over many routes and entire geographical locations. Organizations with user base that is dispersed globally, especially in Asia, Middle East, and South America, will find that connectivity is not stable from all locations.

Because only Appeon employs the n-tier Web architecture, only Appeon provides ubiquitous access to your application anywhere in the world.

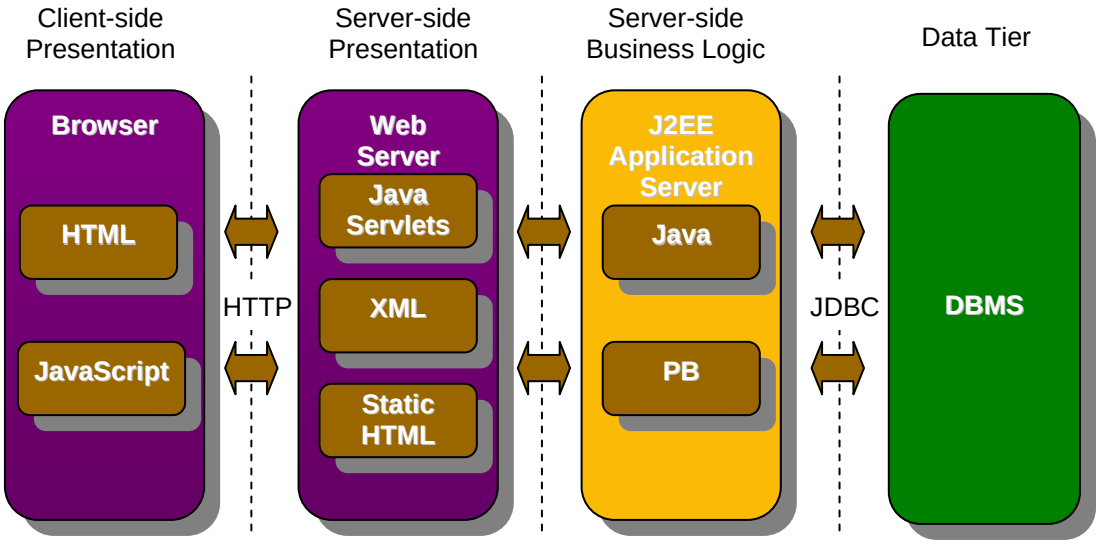
2.2 Scalability

Appeon produces a highly scalable n-tier Web application, supporting far more users than Citrix for a given set of server resources. Web applications deployed to Appeon Server can support 75-100 concurrent users per CPU while Citrix server can support only 25-30 -- for every one Appeon Server, Citrix would require you to deploy 3-4 servers. The greater scalability of Appeon arises from its architectural differences with Citrix.

To understand why Citrix is not scalable, we need to dig a little deeper into the Citrix architecture. The Citrix architecture retains the basic two-tier architecture of the original client/server application, relaying an "image" of the presentation layer from the fat PowerBuilder client running on the MetaFrame server to the ICA client software. In this model, each additional user session requires an additional instance of the fat client to run on one of the MetaFrame servers. This architecture puts a very high demand on server CPU and memory resources since applications built for the client/server architecture are designed to run on its own independent machine rather than a shared server and multiple instances.



Appeon, on the other hand, automatically re-architects the original PowerBuilder client/server application to create a true n-tier Web application using J2EE technology that deploys to a J2EE application server:



The n-tier Web architecture of Appeon can also boost database performance and scalability by taking advantage of connection cache/pooling technology of the J2EE application server. This technology enables the application server to establish a pool of database connections that applications can share. This reduces both the total number of database connections required as well as the overhead of creating and destroying database connections. This technology has been shown to boost database scalability by as much as 10 times.

See Appendix A for more information about the scalability of Appeon Server and Citrix MetaFrame Server.

2.3 Security

2.3.1 Appeon does not introduce possibility of new security vulnerabilities

The need to install software on every client machine introduces security risks. Any executable code installed on the client machine presents the potential for exploitation, especially if it interacts with the network. Unlike Appeon, Citrix requires you to install additional client software, Citrix ICA client, to every client computer. This violates the Web browser security sandbox that is designed to protect the roughly 1 billion Internet users from malicious attacks. In fact, critical security problems have been discovered in the Citrix ICA client in the past: http://seclists.org/lists/bugtraq/2001/Dec/0140.html.

2.3.2 Appeon is firewall friendly

Another area of differentiation in security capabilities is in data transport. Both Citrix and Appeon can support encrypted HTTPS communication to protect sensitive data. However, only Appeon operates entirely through standard Web ports (80/443) and therefore can work with a standard firewall configuration. To operate through a firewall, Citrix requires that additional ports be opened to the outside world, which introduces potential security risks.

2.4 Reliability

2.4.1 Appeon operates reliably regardless of network quality

Appeon utilizes the HTTP protocol and operates in a stateless fashion, which are prerequisites for reliable operation over the Internet. A disruption in the network connection for an Appeon Web application will not cause the user to lose their session. You could even unplug your network cable or telephone line from your modem, plug it back in, and Appeon would still work. You cannot do this with Citrix.

The reason Citrix is unstable over a high latency or unreliable network connection is that it requires a persistent TCP/IP connection to be maintained for the entirety of each ICA session. Any interruption in the connection, or even long network latency, can cause users to lose their session. If the network connectivity is very poor, which is the case in parts of Asia, the Middle East, and South America, you may not be able to keep the application up for more than a minute at times.

Appeon does not require or depend on network stability. It delivers reliable operation regardless of network latency or stability, which are must-haves when applications are deployed outside of a LAN environment.

2.4.2 Appeon Server is stable even when under high load

As the capacity of an application's server hardware resources is exceeded, application's performance is expected to degrade, but the system should not become unstable and begin to drop users' sessions unpredictably.

In scalability tests run at Appeon labs, it was discovered that Citrix does not operate reliably when the server is stressed. Citrix drops existing sessions once the server reached its stress point which was 32 concurrent users in this particular test. This makes Citrix a poor candidate for use in a non-controlled environment where the number of users can fluctuate close to or beyond the stress point and such unreliable operation is unacceptable.

As is true of any well designed n-tier Web application, Appeon-deployed Web applications will simply take longer to respond to users when server capacity is exceeded but still operate reliably. In scalability tests run at Appeon labs, Appeon remained stable even when several times the intended number of users used the system simultaneously. Appeon gracefully handled all existing connections and can even accepted additional new connections but with slower response times.

See Appendix A for more information about the behavior of Appeon Server and Citrix MetaFrame Server under heavy load.

2.5 Maintainability

2.5.1 Appeon truly eliminates need to support additional client software

Both Appeon and Citrix deliver your application from a central server, where it can be updated with no need to deploy to individual clients. However, only Appeon allows your organization to make the application available to all clients with only a standard Web browser.

Citrix requires the ICA client package that varies between 1MB to 53MB in size depending on the version. This must be installed on every client machine before the application can be accessed.

Installing software on every user machine is a deployment headache for IT staff, who must make sure that the software is installed and configured correctly on every user machine that might access the application. Furthermore, this installation process needs to be repeated whenever the Citrix software is upgraded.

The need for installation of client software negates the zero-deployment benefit of Web applications, which is a key driver for moving to the Web in the first place.

2.5.2 Appeon requires no per-user configuration

Due to the nature of Citrix's screen scraping technology, where applications running on MetaFrame Server appear to run on the client, certain configuration items must be matched between the client and the server. This creates deployment hassles for IT staff responsible for maintaining the application, as they may need to perform maintenance not only when the application is rolled out or upgraded but also any time a new end user is added or an existing end user changes his or her configuration.

For example, for client-side printing Citrix requires that printer drivers be installed on both the client and server side. This means that whenever a client installs a new printer and wants to use it through Citrix, he must contact IT staff who then have to manually install the printer driver on the server side. A similar rule is true for input locales, which must be manually installed on the server side whenever end users install them on the client side.

Appeon-deployed Web applications work with and obey system and browser settings on the client side. For example, Appeon supports client-side printing by generating PDF documents or directly printing from the Web browser to the client-connected printer. As such, Appeon does not require any special per-user configuration or matching of configuration between the client and server.

3 Conclusion

Citrix is designed to quickly provide remote access to existing applications using only the original unmodified executable file. It achieves this goal well. However, because Citrix does not re-architect the target application – it only provides services to forward the application's user interface over a network – there are serious limitations to how well it can deliver on the benefits of moving to the Web.

Organizations whose needs are fairly limited – those with a small number of internal users confined to a LAN environment, and who do not need a Web platform for their future or just are not prepared to make the investment to migrate to the n-tier Web architecture – may find that Citrix is indeed an adequate solution. However, for organizations whose requirements go beyond simple remote access of non-mission critical client/server applications, Citrix may fall short of the mark.

Appeon moves PowerBuilder applications to the n-tier Web architecture and J2EE faster than anything else, typically converting 80-95% of existing application code automatically. It also transforms PowerBuilder into the most productive Web development tool for the J2EE platform, cutting down the development workload by at least 4 times compared to typical JSP authoring tools or even Microsoft's ASP.NET. For a PowerBuilder migration to the Web, Appeon may initially require more effort than Citrix – there are usually parts of client-server applications that need to be modified to work in a standard Web environment. But for PowerBuilder organizations that want to embrace the n-tier Web architecture and J2EE, Appeon is unquestionably the lowest-cost, lowest-risk and fastest way to get there.

Appendix A: Scalability Testing Results

This section contains the results of tests performed to compare the scalability of Appeon Server and Citrix MetaFrame Server.

Testing Methodology

Our testing scenario used a large, real-world application provided by an Appeon for PowerBuilder customer. This application contained 130 windows and 738 DataWindow objects. The total size of the application was over 40 Megabytes.

We defined a series of six user transactions on this application that invoke a variety of server operations. We then simulated different numbers of users simultaneously logged into the server executing these transactions.

Testing Environment

We used identical hardware for the Citrix and Appeon tests:

Appeon Server machine

Hardware:

- 2.0GHz Intel Pentium 4 Processor
- 1GB physical memory
- 10/100 MB Network Interface Card

Software:

- Windows 2000 Server, Pack3
- SQL Anywhere 7.03
- EAServer 5.0.0 Advanced Edition
- PowerBuilder 8.0.4 Build#10656
- Appeon 2.8 for PowerBuilder
- Oracle9i Client

Citrix MetaFrame Server machine

Hardware:

- 2.0GHz Intel Pentium 4 Processor
- 1GB physical memory
- 10/100 MB Network Interface Card

Software:

- Windows 2000 Server, Pack3
- Citrix MetaFrame XP Presentation Server (Enterprise)
- PowerBuilder 8.04 Build#10656
- Oracle9i Client

DBMS machine

Hardware:

- 2.0GHz Intel Pentium 4 Processor
- 1GB physical memory
- 10/100 MB Network Interface Card

Software:

- Windows 2000 Server, Pack3
- Oracle 9i DBMS

Test Results

The first chart shows the change in CPU utilization as the number of users is increased for Citrix and Appeon Server:

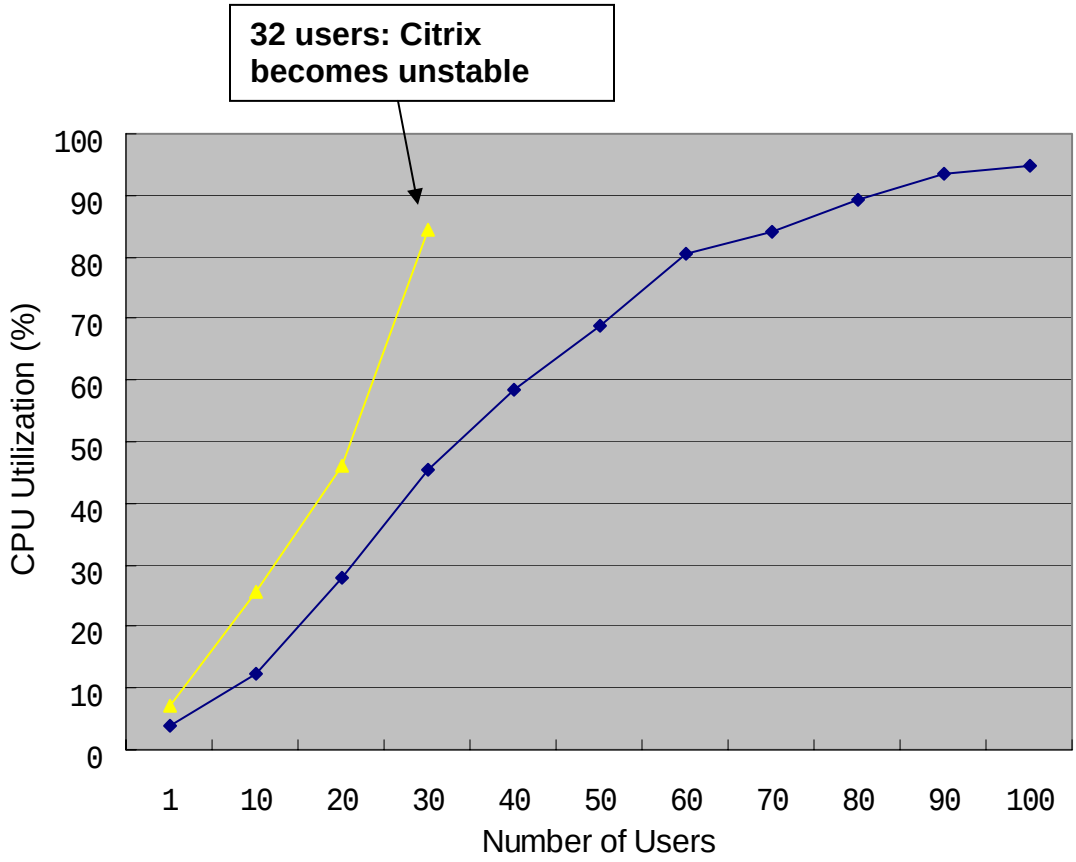


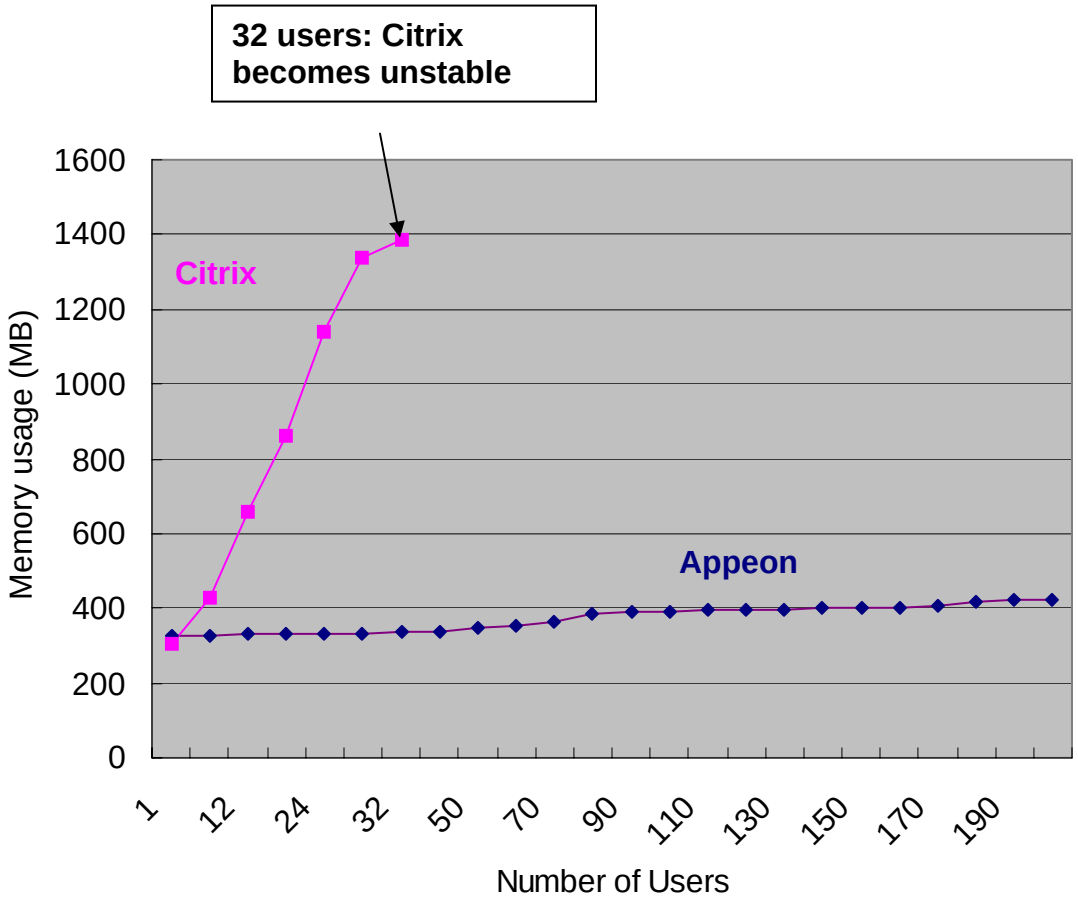
Figure 1: Number of users vs. CPU utilization, Appeon and Citrix

Two facts are clear from this graph. First, CPU utilization increases much more quickly for Citrix than for Appeon. With 30 users on the system, Appeon's CPU utilization is approximately 45% while Citrix is near 85%. Appeon did not reach this level of utilization until more than 80 users were using the system simultaneously.

Second, Citrix becomes unstable when the system is fully loaded. We were unable to continue testing Citrix after reaching 30 users because after this point, Citrix began dropping connections and the system became unusable. The Appeon server became fully loaded (near 100% CPU utilization) at 100 users, but even after this point the system

remained stable and did not drop connections. In fact, in testing we have been able to put as many as 700 users on Appeon Server without errors or lost connections.

The second chart shows the growth in memory usage as we increased the number of users for Citrix and Appeon:



Clearly, Appeon is a far more efficient user of memory than Citrix. With 32 concurrent users (the maximum we could achieve with Citrix), Citrix was using more than 1024 MB of memory. It had basically depleted all physical memory and was running on virtual memory. At the same load of 32 concurrent users, Appeon was using a measly 20 MB of memory. With over 100 concurrent users on the system, Appeon was using under 100 MB of memory. The physical memory was never close to being depleted and virtual memory was not necessary. Whereas Citrix requires gobs of memory as each new concurrent user is introduced, Appeon essentially remains flat for all practically purposes.

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