# Citrix NetScaler VPX 9.2 for Microsoft Hyper-V

## Detailed Lab Report

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# Contents

## 1.0 Executive Summary

As more business applications become Web-based, and move from the enterprise data center to the cloud, making more efficient use of shared server and network bandwidth becomes a priority. Web applications are at the same time continuously evolving to become richer in content and complexity, which places ever increasing traffic demands on the server and network infrastructure. The consequences of this increased load on application performance are predictable and undesirable. In e-commerce, slow Web sites discourage customers and cause lost sales. For business, slow Web applications are an inefficient use of network resources and impact productivity.

Web application acceleration is crucial to improving the client experience and effective load balance network resources. Optimization of frequently accessed applications simplifies and streamlines their delivery. Reducing the number of round trip requests for data from the server to load a Web page frees up the server resources, thereby speeding up the intranet.

Citrix NetScaler VPX for Hyper-V, when used in conjunction with the Aptimize Accelerator for NetScaler, achieves the goal of improving the customer experience through reduced page load times, and provides effective load balancing and reduced bandwidth consumption for popular Web applications.

In our testing, NetScaler and Aptimize significantly improved page load times for both initial views as well as repeated views of SharePoint 2010 and a sample .NETapplication. Through content compression, and static and dynamic caching, NetScaler and Aptimize dramatically reduced the number of requests required to load and reload an application page, reducing traffic flow between the server and clients.

NetScaler improved performance over a domestic WAN link by reducing page view times by up to 50% for SharePoint and 80.5% for .NET, compared to non-accelerated views. Over a simulated international link with half the bandwidth and more than three times the round trip delay, the performance advantage was even greater. Up to a 70% reduction in page view times for SharePoint and 89% reduction for .NETwere recorded.

The optimization provided to Internet Explorer 7 clients was equal or better as that for Internet Explorer 8 clients.

Citrix has taken their already successful NetScaler MPX physical appliances by adding the NetScaler VPX line of virtual appliances. When used with the Aptimize Accelerator for NetScaler, it produces consistent, repeatable performance improvements for the next generation of Web-based applications.

We were very pleased with the performance exhibited by the NetScaler VPX for Hyper-V, and want to congratulate Citrix on continuing to develop cost-effective solutions for optimized delivery of business-critical applications.

Rob Smithers
CEO
Miercom

## 2.0 Overview

Miercom was engaged by Citrix to perform an independent validation of Citrix NetScaler VPX for Hyper-V virtual appliance and the Aptimize Accelerator for NetScaler, to evaluate its performance and efficacy in a variety of test configurations. We focused on the baseline performance of the applications before optimization was applied, and the improvement afforded by the combination of the NetScaler VPX and Aptimize Accelerator for NetScaler.

Application acceleration is advantageous for a number of reasons. Improved user experience can have a corresponding benefit to revenue for e-commerce. Effective load balancing allows a content provider to deliver the same experience to high and low traffic portions of their site while cost effectively managing their infrastructure. Compression reduces the bandwidth required to deliver content, allowing more traffic over the same network, while caching reduces the server load for frequent queries and speeds application response.

In this review, we looked at the effect of optimization provided by the combination of Citrix NetScaler VPX for Hyper-V virtual appliance and the Aptimize Accelerator for NetScaler. The focus was to record and validate the reduction in transmitted data, and the time for page loading for Microsoft SharePoint 2010 and .NET Web applications. The tests were run on Internet Explorer 7 (IE7) on XP, and Internet Explorer 8 (IE8) using Windows 7 to further document the improved optimization by NetScaler VPX.

### 2.1 About Citrix NetScaler

Citrix NetScaler integrates load balancing, security and application acceleration functionality to ensure applications are available, accessible and provide the best end-user performance.

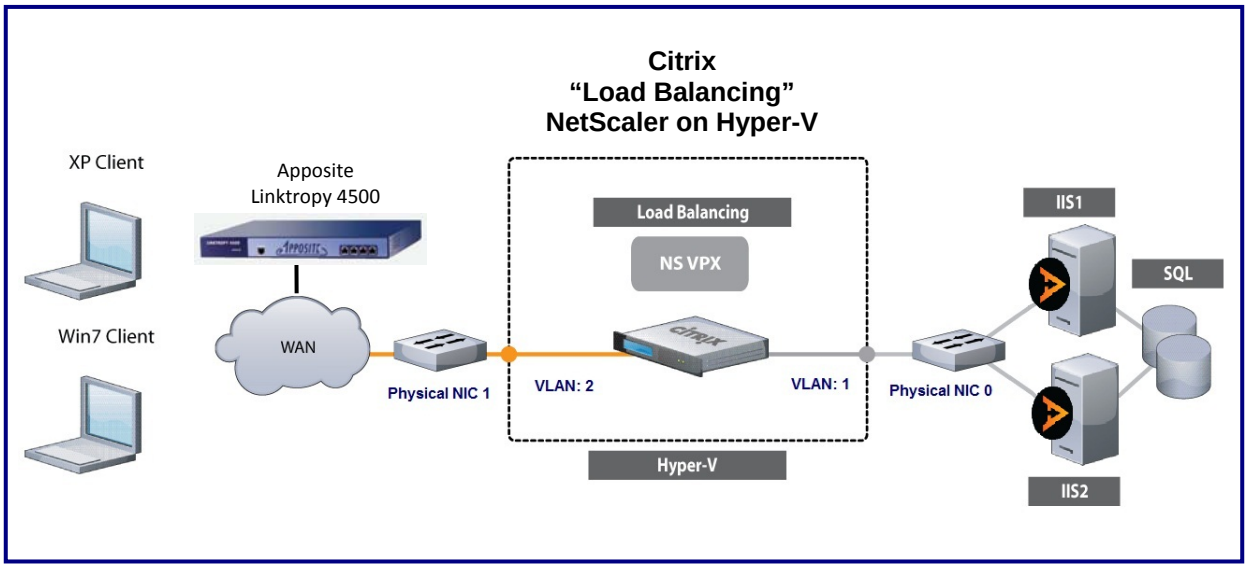
- Load balancing: As Microsoft's applications have become more sophisticated, their load balancing requirements have outpaced software and OS-based load balancing. Citrix NetScaler provides multiple persistence mechanisms, can load balance NATd traffic, Active Sync traffic and can pre-authenticate users.
- Security: The integrated NetScaler Web application firewall protects public facing SharePoint and .NET Web sites from application level attacks, and the integrated Access Gateway Enterprise SSL VPN provides employees secure remote access while out of the office.
- Application acceleration**:** NetScaler compression, caching and TCP optimizations accelerate Microsoft Web applications like SharePoint sites and .NET-based Web applications.

NetScaler is available as either purpose-built NetScaler MPX physical appliances or the cost-effective NetScaler VPX virtual appliances, including the free NetScaler VPX Express. NetScaler VPX provides the same load balancing, security and application acceleration functionality as NetScaler MPX appliances. This gives you the flexibility to deploy NetScaler as a device running in the network, or as a virtual machine running on the hypervisor of your choice.

## 2.2 Key Findings and Conclusions

- Citrix NetScaler and Aptimize Accelerator for NetScaler provide a 70% reduction in response times for application initial view while using SharePoint 2010 over a simulated international link
- NetScaler and Aptimize Accelerator for NetScaler provide a 96.5% reduction in page requests for repeat views of a sample .NET Web application over domestic and international links
- Sequential page loads times over impaired WAN conditions are reduced by up to 53%
- Network and server bandwidth are more effectively utilized
- IE8 optimization is equal to or better than IE7

## 3.0 Test Bed Diagram




## How We Did It

Citrix NetScaler VPX v9.2 virtual appliance was installed on Microsoft Hyper-V on an HP ProLiant server with 16GB of RAM and a 2GHz Intel Xeon processor. Aptimize Accelerator for NetScaler was installed as a plug-in to the servers running IIS.

Windows XP and Windows 7 clients were configured on a server chassis. Windows XP was configured to use Internet Explorer 7. Windows 7 was configured to use Internet Explorer 8.

A Linktropy 4500 WAN simulator by Apposite (www.apposite.com) was used to simulate domestic and international network conditions. Domestic links were simulated using a 3Mbps link bandwidth with 70msec of round trip time (RTT), 35msec in each direction. International links were simulated using 1.5Mbps link bandwidth with 250msec of RTT 125msec each direction.

WebPagetest, an open source Web site benchmarking tool (www.webpagetest.org), was used to automate the process of navigating through the different Web applications, and to collect and report the performance data for analysis.

In order to prevent the SharePoint server from going to sleep or idle mode, a background load of one page request per second was continuously sent during testing.

Each test case was run three times consecutively and the results obtained for each run were averaged to determine a final value.

The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measurement equipment. Contact reviews@miercom.com for additional details on the configurations applied to the System Under Test and test tools used in this evaluation. Miercom recommends customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a selection.

# 4.0 SharePoint and .NET Tests

## 4.1 SharePoint 2010 First View/Repeat View Test

This test established baseline performance values for initial view and repeat views of Microsoft SharePoint-based Web pages over simulated domestic and international WAN link conditions. WebPagetest, an open source benchmarking tool, was used to acquire the performance data, including page load times, page request counts, and bytes transferred. Browser caching was enabled. The test was performed using IE7 on Windows XP, and IE8 on Windows 7. Result values were averaged over three consecutive test runs.

### Observations (IE7)

With acceleration turned off, and simulating a domestic link of 3Mbps and 70ms of round trip time (RTT), the initial view of the SharePoint application took 7.1 seconds to fully load and had a request count of 64. A repeated view of the same application utilizing the browser cache took only 3.3 seconds with a request count of 27.

Enabling NetScaler and Aptimize Accelerator for NetScaler acceleration, the initial view of the application took 3.5 seconds to fully load, with a request count of 14. This represented a 50% reduction in load time and a 78% reduction in the page request count, compared to baseline. The repeat view with acceleration enabled took 2.2 seconds to load, with a request count of 1, representing a 33% reduction in application load time and a 96.3% reduction in request count.

Next, we used the Apposite Linktropy WAN appliance to simulate an international link, with a bandwidth of 1.5Mbps and 250ms of RTT. In our baseline unaccelerated configuration, initial view of the SharePoint application took 20.4 seconds to load with a request count of 64. A repeat view of the application took 6.5 seconds to load with a request count of 27.

With acceleration turned on, the initial view took 6.2 seconds with a request count of 14, representing a 70% reduction in page load time and a 78% reduction in request count. The repeat view of the page took 2.6 seconds and had a request count of 1, for a reduction of 60% in page load time, and a 96.3% reduction in the page request count.

| | **SharePoint 2010 First View/Repeat View Fully Loaded** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Internet Explorer 7** | | | | | | | |
| | **Domestic Link** | | | | **International Link** | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Initial View | **7.1** | **64** | **3.5** | **14** | **20.4** | **64** | **6.2** | **14** |
| Repeat View | **3.3** | **27** | **2.2** | **1** | **6.5** | **27** | **2.6** | **1** |

***Response times and page request counts for Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

## Observations (IE8)

The above tests were also run using clients configured with IE8 on Windows 7. The results were virtually identical to those obtained for the IE7 tests.

| | SharePoint 2010 First View/Repeat View Fully Loaded | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Internet Explorer 8 | | | | | | | |
| | Domestic Link | | | | International Link | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Initial View | **6.1** | **64** | **4.5** | **13** | **14.4** | **64** | **6.7** | **13** |
| Repeat View | **2.4** | **27** | **1.9** | **1** | **4.4** | **27** | **3** | **1** |

***Response times and page request counts for Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

## Conclusions

NetScaler VPX with Aptimize Accelerator for NetScaler provides impressive reductions in initial and repeat view page load times and round trip data transfers between clients and the server hosting SharePoint. Acceleration advantages as compared to baseline performance were observed to be more pronounced over our simulated international connection which provided half the bandwidth and more than three times the round trip delay of our simulated domestic link.

## 4.2 .NET First View/Repeat View Test

Baseline and optimized performance values were established for initial view and repeat views of a .NET Web application over simulated domestic and international WAN link conditions. The well-known DotNetNuke application was used as the sample .NET application. WebPagetest, an open source benchmarking tool, was used to acquire the performance data, including page load times, page request counts, and bytes transferred. Browser caching will be enabled for this test. The test was performed using Internet Explorer 7 on Windows XP, and Internet Explorer 8 on Windows 7. Result values were averaged over three consecutive test runs.

### Observations (IE7)

With no optimization enabled, and over a simulated domestic link with 3Mbps of bandwidth and 70ms of RTT, an initial page view took 5.3 seconds to load with a request count of 89. The repeat view of the page with browser caching enabled took 4.1 seconds, and reduced the request count to 86.

NetScaler and Aptimize Accelerator for NetScaler had a dramatic impact on page loading, reducing the initial load time to 2.2 seconds, 58% improvement, and the request count to 24, 73% improvement. Repeat viewing of the page took only .8 seconds, 80.5% improvement, and had a request count of 3, a 96.5% improvement.

We evaluated the baseline and optimized performance of the .NET Web application over a simulated international link with 1.5Mbps bandwidth and 250ms of RTT. With no acceleration, an initial page view took 16.1 seconds over this link and had a request count of 89. With browser caching, a repeated view of the same page took 13.6 seconds to fully load with a request count of 86.

Enabling NetScaler and Aptimize Accelerator for NetScaler acceleration, the initial page view loaded in 5.9 seconds, 63% improvement with a request count of 24, 73% improvement. The repeat page view took 1.5 seconds, 89% improvement with a request count of 3, 96.5% improvement.

| | **.NET First View/Repeat View Fully Loaded** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Internet Explorer 7** | | | | | | | |
| | **Domestic Link** | | | | **International Link** | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Initial View | **5.3** | **89** | **2.2** | **24** | **16.1** | **89** | **5.9** | **24** |
| Repeat View | **4.1** | **86** | **0.8** | **3** | **13.6** | **86** | **1.5** | **3** |

***Response times and page request counts for .NET-based Web pages for simulated WAN link conditions with no acceleration used (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

## Observations (IE8)

While the performance figures obtained with optimization enabled were virtually identical for IE8 when compared to those using IE7, we did observe that non-optimized page load times over both domestic and international simulated links were 50% faster when using IE8. Interestingly, the page request count was virtually the same for either browser.

| | .NET First View/Repeat View Fully Loaded | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Internet Explorer 8 | | | | | | | |
| | Domestic Link | | | | International Link | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Initial View | **2.7** | **88** | **9.1** | **88** | **2** | **22** | **5.3** | **22** |
| Repeat View | **1.9** | **85** | **6.3** | **85** | **0.5** | **2** | **1.2** | **2** |

***Response times and page request counts for .NET-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

## Conclusions

Repeatable results demonstrate that the combination of NetScaler and Aptimize Accelerator for NetScaler is highly effective in accelerating the performance of Web application page loading while also providing the load balancing necessary for Web site availability and scalability. The speed of .NET-based Web applications, as perceived by the user, is improved significantly, enhancing the user experience while the dramatic reduction in the amount of data that must be retransmitted offloads the servers, and increases network efficiency.

## 4.3 SharePoint 2010 Sequential Tests

Baseline and optimized performance values were established for a series of sequential SharePoint-based Web pages over simulated domestic and international WAN link conditions. WebPagetest, an open source benchmarking tool, was used to automate the process of drilling down through four sequential pages, and acquiring performance data, including page load times, page request counts, and bytes transferred. The test was performed using Internet Explorer 7 on Windows XP, and Internet Explorer 8 on Windows 7. Each test was run three consecutive times, and the results of these runs were averaged.

### Observations (IE7)

A simulated domestic WAN link with 3Mbps of bandwidth and 70ms of RTT was used. With acceleration disabled, we saw a baseline time of 15.3 seconds to fully load the final SharePoint drill-down page, with a request count of 116.3. Acceleration dropped the page load time to 10.4 seconds and the request count to 22, an improvement of 32% and 81%, respectively.

With a simulated international link, baseline results showed the time to fully load the final SharePoint drill-down page of 31.3 seconds with a request count of 118. Enabling acceleration reduced this time by 53% to 14.7 seconds, and cut the request count by 80% to just 23 requests.

| | **SharePoint 2010 Sequential Test Fully Loaded** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Internet Explorer 7** | | | | | | | |
| | **Domestic Link** | | | | **International Link** | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Sequential Test | **15.3** | **116.3** | **10.4** | **22** | **31.3** | **118.3** | **14.7** | **23** |

***Response times and page request counts for a series of sequential Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

## Observations (IE8)

Over a simulated domestic link, the differences between the generations of browser revealed themselves, as the non-optimized time to fully load the final SharePoint drill-down page using IE8 grew slightly longer, to 17.3 seconds, but the request count was much less, with 86.7 requests versus the IE7 request count of 116.3. Enabling optimization reduced the page load time to 9.6 seconds, an improvement of 45% over baseline, while the page request count was reduced to 5, an improvement of 94% over baseline. The optimized results on IE8 also demonstrated an 8% reduction in page load time and a 77% reduction in page request count compared to the older browser.

When an international link was simulated and NetScaler acceleration was not enabled, the optimization inherent in IE8 cut the page load time from 31.3 seconds with the older browser to 18.6 seconds. The request count was also reduced, from 118.3 with IE7 to 98 requests with IE8. When NetScaler and Aptimize Accelerator for NetScaler acceleration was enabled, the time to fully load the drill-down page was 10.6 seconds with a request count of 5.7. These values represent a 28% reduction in page load time and a 75% reduction in page requests over the values using IE7.

| | **SharePoint 2010 Sequential Test Fully Loaded** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Internet Explorer 8** | | | | | | | |
| | **Domestic Link** | | | | **International Link** | | | |
| | Non Optimized | | Optimized | | Non Optimized | | Optimized | |
| | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count | Fully Loaded Time | Request Count |
| Sequential Test | **17.3** | **86.7** | **9.6** | **5** | **18.6** | **98** | **10.6** | **5.7** |

***Response times and page request counts for a series of sequential Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration used (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

## Conclusions

Citrix NetScaler VPX for Hyper-V virtual appliance and Aptimize Accelerator for NetScaler provide an effective method for application acceleration of multiple drill-down pages in a SharePoint Web application. This is in addition to providing L4-7 load balancing for site availability and scalability.The improvements in application performance appeared most pronounced when the WAN link was restricted, as was the case for our simulated international link. NetScaler and Aptimize also were able to build on the efficiencies of Internet Explorer 8 to further improve the performance of the application and network, as compared to Internet Explorer 7.

## 4.4 Rendering Test Results

Baseline and optimized performance values were also established for initial view and repeat views for the time needed for the Web page to fully render. Note that full rendering of the page does not mean that the Web page had full functionality, such as clicking a link to access another page within the site. The tests were performed using IE7 on Windows XP, and IE8 on Windows 7. Result values were averaged over three consecutive test runs. Values are in seconds.

| | **SharePoint 2010 First View/Repeat View** | | | |
|---|---|---|---|---|
| | **Internet Explorer 7** | | | |
| | **Domestic Link** | | **International Link** | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Initial View | **5.3** | **2.8** | **13.1** | **5.0** |
| Repeat View | **2.8** | **1.9** | **6.2** | **2.4** |

***Rendering times were recorded for Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

| | **SharePoint 2010 First View/Repeat View** | | | |
|---|---|---|---|---|
| | **Internet Explorer 8** | | | |
| | **Domestic Link** | | **International Link** | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Initial View | **4.6** | **3.7** | **10.7** | **5.1** |
| Repeat View | **2.2** | **1.6** | **4.1** | **2.7** |

***Rendering times were recorded for Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration used (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

| | .NET First View/Repeat View | | | |
|---|---|---|---|---|
| | Internet Explorer 7 | | | |
| | Domestic Link | | International Link | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Initial View | **5.4** | **2.2** | **16.1** | **5.9** |
| Repeat View | **4.1** | **0.8** | **13.7** | **1.6** |

***Rendering times were recorded for .NET-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

| | .NET First View/Repeat View | | | |
|---|---|---|---|---|
| | Internet Explorer 8 | | | |
| | Domestic Link | | International Link | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Initial View | **2.7** | **1.8** | **9.1** | **4.7** |
| Repeat View | **1.9** | **0.6** | **6.3** | **1.3** |

***Rendering times were recorded for .NET-based Web pages for simulated WAN link conditions with no acceleration used (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

| | SharePoint 2010 Sequential Test | | | |
|---|---|---|---|---|
| | Internet Explorer 7 | | | |
| | Domestic Link | | International Link | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Sequential Test | **14.9** | **10.3** | **30.4** | **14.6** |

***Rendering times were recorded for a series of sequential Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration used (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE7 on Windows XP was used.***

| | SharePoint 2010 Sequential Test | | | |
|---|---|---|---|---|
| | Internet Explorer 8 | | | |
| | Domestic Link | | International Link | |
| | Non Optimized | Optimized | Non Optimized | Optimized |
| | Document Complete | Document Complete | Document Complete | Document Complete |
| Sequential Test | **17** | **9.5** | **18.2** | **10.3** |

***Rendering times were recorded for a series of sequential Microsoft SharePoint-based Web pages for simulated WAN link conditions with no acceleration applied (non optimized), and when NetScaler and Aptimize Accelerator for NetScaler (optimized) were applied. IE8 on Windows 7 was used.***

## 5.0 About Miercom

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