Resource Guide

An Essential IT Guide:

Evaluating Juniper WAN Application Acceleration Platforms

Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, CA 94089 USA
408 745 2000 or 888 JUNIPER
www.juniper.net

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Introduction

Thank you for your interest in the Juniper Networks WAN application acceleration (WX/WXC) platforms. The purpose of this document is to provide a simple and methodical approach to testing the application acceleration features of WX/WXC WAN optimization platforms.

The WX and WXC application acceleration platforms improve the performance of any IP-based application over the WAN, as well as specific applications that are hindered by inherent efficiencies of their underlying protocol. The best way to determine the effectiveness of an application acceleration solution is to test it in your own environment, and this evaluation guide describes how you can deploy the solution in your network and see the types of performance benefits your organization can realize.

This document provides a high-level overview of the WX and WXC evaluation process. If you would like more information, ask your Juniper systems engineer for a copy of the detailed Juniper "WX/WXC Evaluation Guide for WAN Optimization & Acceleration Appliances," which provides a more thorough description of the evaluation procedures. To schedule a full evaluation, please contact your Juniper sales representative or contact Juniper at +1 (408) 745-2000.

Testing Compression, Caching and TCP/CIFS Acceleration

The tests described in this evaluation guide will demonstrate the benefits of three specific WX/WXC features: compression, caching, and TCP/CIFS acceleration.

Compression and Caching

The Molecular Sequence Reduction™ (MSR™) compression technology utilizes a dictionary-based algorithm for recognizing redundant data patterns and replacing that data with a label, reducing the amount of traffic traversing the WAN. The MSR technology, which uses DRAM memory for storing data patterns, is most useful for applications that use short, chatty transactions.

The Network Sequence Caching feature is a dictionary-based technique similar to MSR technology in that it recognizes redundant patterns, replacing them with labels for WAN transmissions. However, sequence caching uses hard drives as the storage repository for data patterns, making it effective for recognizing very large patterns – whole files, bulk file transfers, data base replication) – over longer periods of time.

Both the WX and WXC platforms support MSR technology, while only WXC devices include the hard drives necessary to support sequence caching. Therefore, for testing purposes, Juniper recommends customers evaluate the WXC platform to gain a full appreciation for the WAN acceleration capabilities.

From a testing perspective, you will observe little compression with the WXC on the first pass of a file but will see 95 percent or better compression results on the second and subsequent passes. You will observe varying compression rates with the WX on the first pass, somewhat better results on the second pass, and the greatest reduction on the third pass. This reflects the learning of patterns in the memory- and disk-based dictionaries and represents the benefit of learning patterns that yield compression and caching results for another application flow to the same destination.

TCP Acceleration

TCP ensures reliable data transport by breaking transmissions into smaller segments, called windows, and sending them sequentially to the requester. Each window must be received and acknowledged by the receiving host before the next window is sent.

Depending on the size of the file and the window size, a single message could require hundreds or even thousands of round trips (send window, acknowledge, send next window) to complete — not very efficient over the WAN.

Juniper WX/WXC platforms offer an Active Flow Pipelining (AFP) feature that removes this limitation by building a tunnel between WX/WXC devices and using a more efficient and reliable transport protocol that is not slowed by link latency.

Application-specific Acceleration

For applications that are constrained by the inherent inefficiencies of their underlying protocols, such as Microsoft file services, which uses the Common Internet File System (CIFS), the Juniper Application Flow Acceleration™ (AppFlow™) technology provides protocol-specific acceleration capabilities. A flexible and extensible platform, AppFlow addresses the inefficiencies of numerous protocols to accelerate multiple applications — unlike other products that only accelerate file-services protocols as members of a WAN optimization sub-market called Wide Area File Services (WAFS). For more on this subject, read the "Evolution of Wide Area File Services (WAFS): Toward Transparent, Comprehensive WAN Optimization" white paper available on the Juniper web site.

The Test Setup Requirements

The following describes the minimum requirements for successfully demonstrating the compression, caching, and TCP/CIFS acceleration benefits of the WX/WXC platforms.

Minimum requirements:

- Two WXC 500 platforms
- WX operating system (WXOS) 5.2 software or greater
- Copy of the WX/WXC Quick Start Guide
- Copy of the WX/WXC Operators Guide

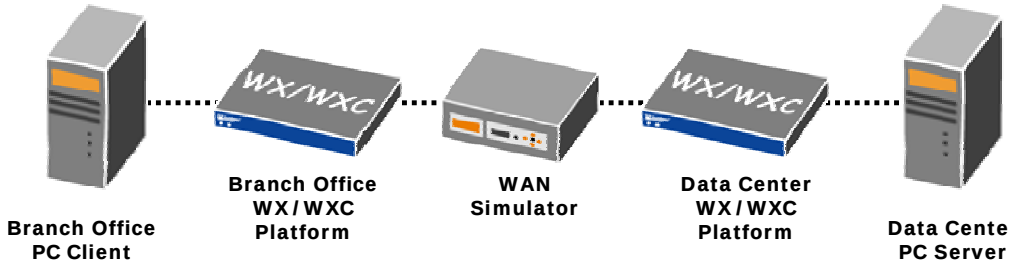
TCP acceleration testing:

- WAN simulator (e.g., Shunra [name])
- 2 PCs (Windows, Unix, Linux, etc.)
- FTP server
- FTP client
- Any specific applications you want to test

CIFS and MS Office application testing:

- WAN Simulator
- One Windows 2000 server with SP4 or Windows 2003 server
- Two Windows XP client PCs with Service Pack 2
- Microsoft Office 2003 applications

WXC Quick Inline Lab Setup for TCP and CIFS Acceleration Testing



There are two basic installation options for the WX/WXC devices. The simplest way to install a WX/WXC device is inline with the data path, where the platform is transparent to the network traffic. The WX/WXC products can also be installed in an off-path mode, where the platforms sit on a separate subnet and the WAN router redirects traffic to be optimized.

The example provided here describes a very basic quick inline setup that will allow you to easily perform basic testing and verification on WX/WXC devices. If you have more complex setup and testing requirements, you may want to contact your systems engineer or look for detailed configuration examples in the product manual.

WX/WXC Registration Server

When configuring the WX/WXC devices, you will be asked to configure a registration server, which communicates the availability and capabilities of all WX/WXC platforms in the network. Any WX/WXC platform can be the registration server.

When configuring the registration server, you will be asked to assign a password. Make a note of the password, because you will need it when configuring the other WX/WXC device later. Keep in mind that the registration server password is different from the admin password, and all devices need to use the same password to communicate with the registration server.

Establish a Test Network

Establish a network configuration similar to what is present in your current network and where you plan on deploying the devices. Below are some typical network bandwidth and latency configurations. You can configure the bandwidth and latency on your WAN simulator to emulate these types of environments. Contact your sales engineer or the detailed evaluation guide for more information about configuring the WAN simulator.

Office Type	Link Speed	Latency
Regional branch office (close to data center)	1500kbps	10 - 20ms
Domestic branch office (other side of country)	768 - 1500kbps	30 - 50ms
Transcontinental branch office	384 - 1500kbps	60 - 80ms
Intercontinental/international branch office	128 – 1500kbps	150 – 400ms

Configuring the WXC Devices with Quick Setup

For the WXC 500 devices, use the front panel to set the IP address, Subnet Mask and Default Gateway and then connect it to the network.

For WXC devices without a front panel, you will need to connect a PC via the console port to perform initial configuration. See the Quick Start Guide for more details. For detailed set-up instructions, see the detailed evaluation guide.

Testing Methodology

Basic testing will consist of file transfers from server to client and from client to server. FTP will be used for the initial compression and caching tests, since most FTP clients provide detailed information on the amount of time it takes to transfer a file and the amount of data transferred, providing a simple and highly accurate way to measure performance. The TCP/CIFS acceleration testing will consist of opening a file from a remotely mounted drive inside an MS Office application or dragging-and-dropping a file from a remotely mounted drive to the hard drive of the client PC.

All testing described in this evaluation guide will follow a common three-phase approach in order to ensure accurate results. Those phases include:

Phase I: Baseline. The baseline test, performed while the WXC devices are turned off, determines the network's natural behavior.

Phase II: Cold Testing. Cold testing is performed with the WXC devices enabled, but before the file patterns have been learned by the dictionaries (first pass of file) in order to demonstrate first-pass performance improvements.

Phase III: Warm Testing. Warm testing is performed after the dictionary cache has been warmed by the second pass of file. This test will show dramatic performance improvements vs. the baseline and cold testing results when sending the original file and then a modified version of the file.

The following examples describe three different tests you can perform to learn the compression, caching and TCP acceleration capabilities of the WX/WXC platforms. These tests include:

- TCP/FTP file transfers
- CIFS (copy) file transfers
- CIFS application testing

Note: Once the dictionary cache has been fully warmed, you may want to do some additional testing to verify the results. However, the dictionary must be cleaned first before the verification tests can be performed. This is accomplished via the GUI by going to **Admin / Reboot** and pressing the "clean reboot" button.

Test 1: TCP/FTP Transfers

Phase I: FTP Baseline

This test is performed with a simulated WAN environment to establish how the network behaves without benefit of compression or acceleration. To perform the baseline test, FTP the files from the server PC to the client PC and record the time; then FTP the files from the client PC back to the server PC and record the time again.

- **Step 1:** Configure the WAN simulator to provide the bandwidth and delay characteristics representing your test scenario.
- **Step 2:** Connect the WXC devices by inserting them inline, between the client PC and the WAN simulator and between the server PC and the WAN simulator. Do not power up the WXC devices at this time.
- **Step 3:** Make sure the PCs are connected and can ping each other. Once established, verify that the ping times on the PCs match the latency you configured on the WAN simulator.

Phase II: FTP Cold Testing

This test is performed with the WXC devices powered on and configured for compression and acceleration, but before any test traffic has been exchanged between the two PCs to demonstrate any benefits that first-pass compression and TCP acceleration will have on the test traffic. To perform this test, FTP the files from the server to the client PC and record the time; then FTP the files from the client PC to the server PC and record the time.

Note: If the transfer time is slightly longer than the original file transfer, it could be that the file is either random data or is already highly compressed. However, the file should be reduced dramatically (95+ percent) in the next transfer since its pattern will be stored in the dictionary.

Phase III: FTP Warm Testing

This test is performed after the test files have already been copied from the server PC to the client PC and then from the client PC back to the server PC, which warms the dictionary of the cache. In Phase III, you will see a dramatic reduction in the time it takes to transfer files between devices. To perform this test, FTP the files from the server to the client PC, record the time, and then FTP the files from the client PC back to the server PC and record the time again. You should see a dramatic improvement in the file copy speed — in most cases, somewhere in the neighborhood of 95 percent.

Next, make some random changes to the test file, change the file's name, and send it back and forth again. Depending on the extent of the changes, performance should be similar to the first warm testing, even though the file has been modified.

Reviewing TCP Acceleration and Compression Results Using Built-in Reports

If you conducted your tests as described above, you should see some distinctive patterns in the reports described later in the Data Reporting and Network Visibility section. The first pass will show lower throughput, compression, etc., while the second pass will show dramatically higher compression, throughput, etc. These results will be most noticeable if using large files that are highly compressed or have random data.

Protocol-specific Application Acceleration (CIFS)

Specific application acceleration techniques are required for protocols like CIFS, which run on top of TCP but maintain their own set of rules and flow control.

Like TCP, CIFS-based applications require multiple transactions to complete a given task. However, due to their complexity, the number of round trips is even higher. For instance, when opening a file, CIFS requests file attributes such as who owns the file, when it was created, when it was last accessed, etc. Each of these requests is a separate transaction that requires a response before the next request can be sent.

The WX/WXC AppFlow technology understands the behavior of the upper-layer CIFS protocol and uses that knowledge to increase performance. When a file is opened, the AppFlow technology knows that several smaller transactions will follow and pre-fetches the additional items. That way, when the client requests the subsequent data blocks, they are already available on the client-side WX/WXC device. This pre-fetching greatly accelerates transaction times over the normal request-response process.

Typical CIFS Acceleration Results

For this evaluation, test results will vary based on file size and how the files are accessed. CIFS has more overhead than FTP, and factors such as operating system version, application (Word, Excel, etc.) and application version can affect the results. In general, any copy function (drag-and-drop, copy-paste) should produce a 90 percent performance improvement or more, although it is not uncommon to see increases in the 95 to 99 percent range. Likewise, when opening or saving Word or Excel files, expect to see an 80 to 90 percent performance improvement, with a 95 percent improvement a distinct possibility.

For comparison purposes, you may want to test CIFS with a combination of drag-and-drop and copy-and-paste operations. Regardless of the method used, the results should be similar in terms of throughput; differences are due to variables such as when the timer was started and stopped.

Testing CIFS Acceleration

Before attempting CIFS acceleration, first make sure you are getting proper FTP acceleration and compression. The TCP acceleration features must be working for CIFS acceleration to work. Also, SMB signing should be disabled on the PCs and/or in the checkbox for CIFS acceleration.

Another tip: You need to see the beginning of the CIFS transaction for CIFS acceleration to take place. Unmap all drives on the client PC and then re-map them or reboot your PC.

Finally, make sure you are using supported operating systems (Windows 2000, 2003 and XP) for clients and servers. If you want to test an operating system that is not currently supported, your sales engineer can help set up the testing.

Phase I: CIFS Baseline

To perform this test, copy/open the files from the server PC to the client PC and record the time, then copy/save the files from the client PC back to the server PC and record the time again.

Phase II: CIFS Cold Testing

To perform this test, FTP the files from the server to the client PC and record the time; then FTP the files from the client PC back to the server PC and record the time again. (Files need to be copied in both directions to warm the dictionary cache for the next testing phase.) This will demonstrate any benefits that first-pass on-the-fly compression and TCP/CIFS acceleration will have on the test traffic.

Phase III: CIFS Warm Testing

This test is performed after the test files have already been copied from the server PC to the client PC and from the client PC to the server PC, warming the dictionary of the cache. This phase will produce dramatic improvements in the time it takes to copy and paste files.

Once the file has been copied back and forth, make a series of random changes within the file and change the file name. Then copy the file from the server PC to the client PC and from the client PC to the server PC. Depending on the extent of the changes, performance should be similar, if not identical, to the original warm testing, even though the file has been modified.

CIFS Application Testing (Word, Excel, etc.)

Applications can open files either from within the application itself or by double-clicking the file to launch the associated application. Typically these will provide similar acceleration results, but you may want to test both methods.

Phase I: Application Baseline

To perform this test, copy/open the files from the server PC to the client PC, record the time, then copy/save the files from the client PC back to the server PC and record the time again.

Phase II: Application Cold Testing

To perform this test, FTP the files from the server to the client PC and record the time; then FTP the files from the client PC back to the server PC and record the time

again. (Files must be copied in both directions to warm the dictionary cache for the next testing phase.) This will demonstrate any benefits that first-pass on-the-fly compression and TCP/CIFS acceleration will have on the test traffic.

Phase III: Application Warm Testing

This test is performed after the test files have already been copied from the server PC to the client PC and from the client PC to the server PC, warming the dictionary of the cache. In this phase, you will see dramatic reductions in the amount of time it takes to open and save files between devices. Application performance improvements are a bit more variable than file copy transactions; typical results show a 70-90 percent performance increase.

Now make a series of random changes within the file, change the file name, and copy the file again. Depending on the extent of the changes, performance should be similar, if not identical, to the original warm testing.

Reviewing CIFS Acceleration and Compression Results Using Built-in Reports

If you conducted your tests properly, you should see some distinctive patterns in the reports described in the Data Reporting and Network Visibility section. You will see the first-pass result with lower throughput, compression, etc. and the second pass with dramatically higher compression, throughput, etc. This will be most noticeable if using large files that are highly compressed or random data for your samples.

Since CIFS acceleration is a bit more involved, in order to get the complete picture, you need to understand all the pieces involved and where you should be looking to verify your results.

CIFS acceleration is composed of three parts: compression, AFP, and CIFS-specific acceleration (AppFlow). Compression and AFP occur on the side that is compressing the file (the side where the file is coming from). AppFlow acceleration occurs on the side that mapped the drive to the remote side. This is typically the client side, but since CIFS allows anyone to map a drive, it could be the server side as well.

The following shows where you will see the statistics in a typical client-server setup:

When copying files from the server to the client (file open):

- AFP statistics will be on the server side
- QoS outbound statistics will be on the server side
- Compression statistics will be on the server side
- CIFS acceleration statistics will be on the client side

When copying files from the client to the server (file save):

- AFP statistics will be on the client side
- QoS outbound statistics will be on the client side
- Compression statistics will be on the client side
- CIFS acceleration statistics will be on the client side

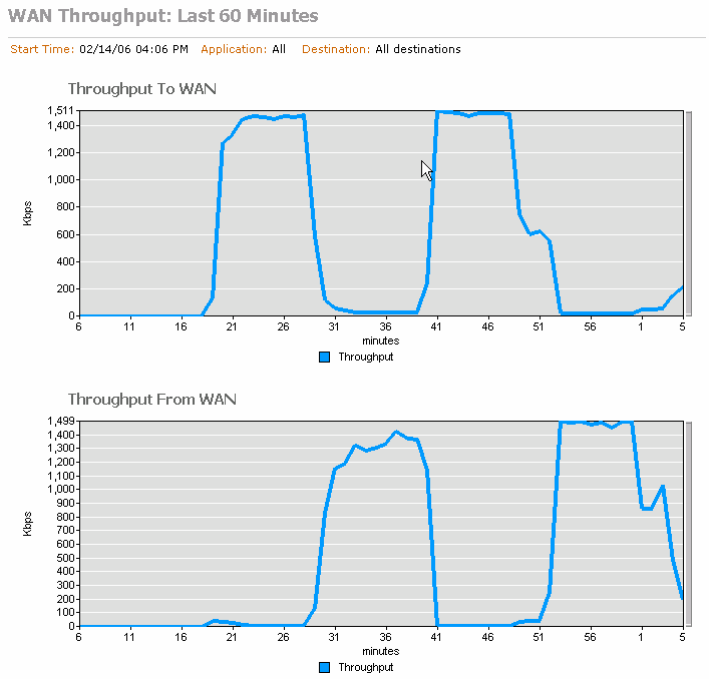
Data Reporting and Network Visibility

The WX/WXC products, in conjunction with the WX Central Management System™ (CMS™) software, offer a number of useful reports and graphs that provide unprecedented visibility into WAN performance. Examples of some of these reports and graphs are shown below; for a complete list and description of all available reports, see the Monitoring and Reporting section of the WX/WXC Operators Guide.

The WX/WXC platforms allows for filtering of all reports as applicable by timeframe, application and destination. The ability to filter traffic by destination is especially powerful as it provides visibility into the network's traffic patterns, not just traffic types and quantity like most devices.

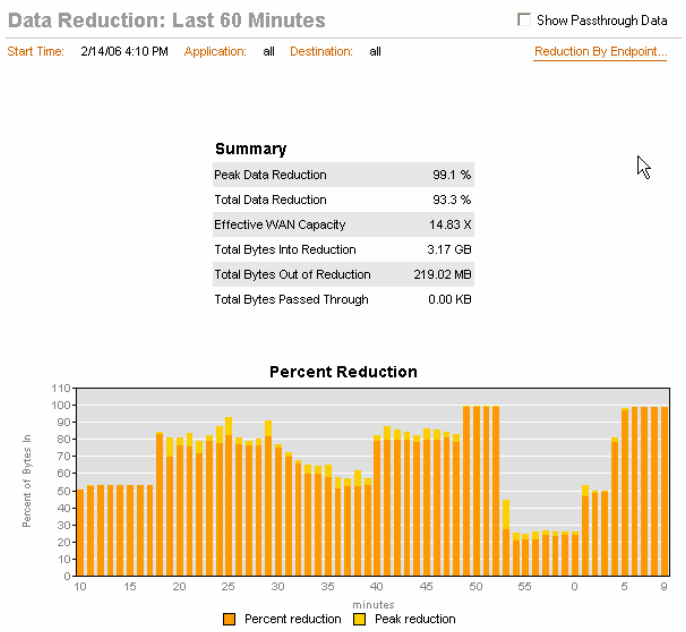
WAN Throughput Graph

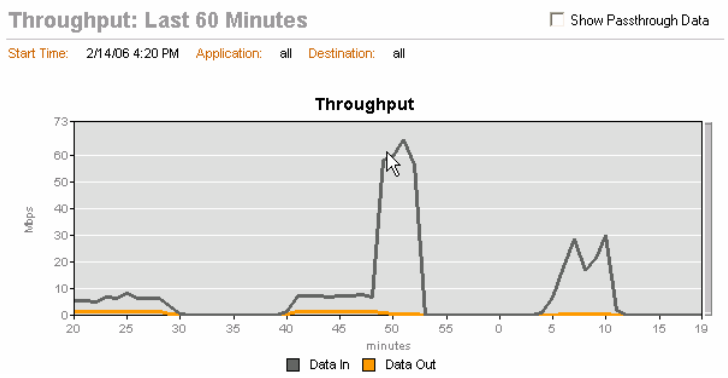
The WAN graphs available under **Monitor / WAN** provide throughput data to and from the WAN, Performance Reporting (latency and loss), and Application breakdown.



Reduction Graphs

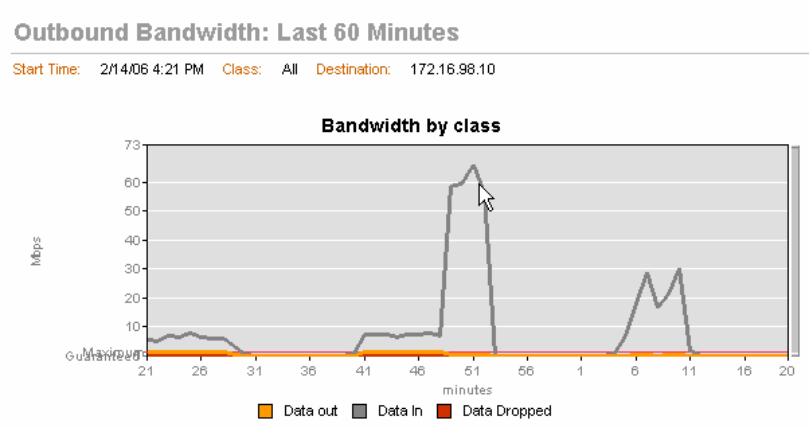
The Reduction graphs, available under **Monitor / Reduction,** show traffic reduction levels by percentage, byte count, packet count, application breakdown, throughput in vs. throughput out, etc.





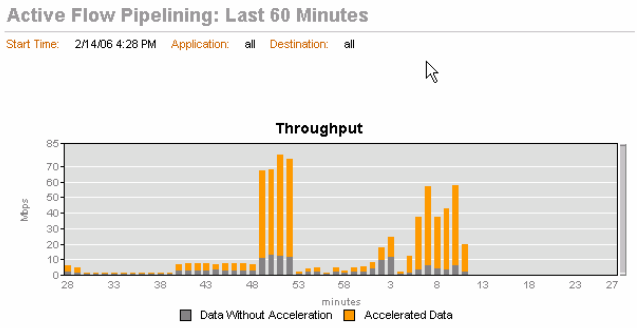
QoS Graphs

The QoS graphs available under **Monitor / QoS** show the traffic rate in vs. the traffic rate out, dropped packets, and dropped bytes.



Acceleration Graphs

The Acceleration graphs available under **Monitor / Acceleration** provide charts showing the amount of TCP acceleration, CIFS acceleration, MAPI acceleration, etc.



Application	Total TCP Sessions (count)	Accelerated Sessions (count)	Traffic (MB)	Average Session Throughput (Mbps)		Acceleration Factor
				Actual	w/o Accel.*	
CIFS	0	0	3114.91	17.72	3.20	5.5 X
AOL	0	0	0.00	0.00	0.00	0.0 X
CVS	0	0	0.00	0.00	0.00	0.0 X