

Solution Brief

**Improving File Access
Across the WAN:
How Juniper Networks
Enables Centralized
Servers**

Estimates are that half to three-quarters of corporate data is located in remote offices. This decentralization poses data consistency, availability, and security challenges for enterprises and has implications for day-to-day operations as well as continuity of operations planning. Collaboration, for example, is difficult if architects, engineers, or business managers in remote offices don't have access to the same up-to-date data. Meeting regulatory requirements for data archiving is also difficult, since the lack of IT staff at remote sites means data backups are often not done in a timely, comprehensive fashion.

The most commonly used file access protocol – Microsoft's Common Internet File System (CIFS) – is inherently inefficient over the WAN.

The need for better control of data – which some refer to as putting structure around unstructured data – is driving many enterprises to centralize application servers and associated storage systems. Data centralization yields both business and IT benefits. Collaboration is greatly enhanced as users are guaranteed to be working off the same data set so enterprises can leverage the expertise of employees across the globe. Likewise, file sharing is simplified. Business decisions can be made more quickly because managers throughout the company, regardless of geographic location, have the same information at their fingertips.

Centralizing data also simplifies data backup and recovery, making it easier to implement a disaster recovery strategy and to comply with archiving regulations such as those mandated by Sarbanes-Oxley legislation. Consolidating servers in the data center provides IT savings by eliminating the need to manage these remote devices. With fewer servers, fewer software licenses are needed, and server administration, such as installing patches, is greatly streamlined.

LAN vs. WAN Performance and CIFS Inefficiencies

While centralizing servers yields a number of business and IT benefits, it also raises performance issues. Files that were once available to users on their local network now must be accessed across the WAN. Slower links, higher latency, and bandwidth contention are only part of the performance hit that remote users experience. Further complicating the issue is the fact that the most commonly used file access protocol, Microsoft's Common Internet File System (CIFS), is inherently inefficient over the WAN.

Based on the Server Message Block protocol, CIFS is the protocol Microsoft applications use to request file services from servers, supporting functions such as file access, file and record locking, and file change notification. CIFS breaks bulk file transfers into

many small data blocks – from 64 KB to as little as 256 bytes – and transmits these blocks serially. The client application and server exchange messages to acknowledge and verify each block that's transmitted; the client must wait for an acknowledgement of each block of data before sending the next. Upwards of 1,000 CIFS messages are exchanged during the process of copying a 1 MB Word file.

On a LAN, this protocol "chatter" has little impact on performance. However, WANs introduce latency that the protocol wasn't designed to handle. Application performance degrades as the client waits for each acknowledgement, and the higher the WAN latency, the worse the problem. What enterprises need is the ability to optimize WAN performance so that users can operate against centralized data as if it were local.

Beyond Point Solutions

A number of vendors have introduced Wide Area File Services (WAFS) products to address the problem of slow file access associated with centralized data. While these products accelerate CIFS, most are narrowly focused on only accelerating file access. Some are implemented as proxy servers, which maintain cached copies of files in branch offices and synchronize with centralized servers. Since clients interact directly with the proxy server at LAN speeds, performance is good.

However, IT must deploy and maintain the proxy servers as well as configure clients to talk to the proxy. If a proxy server fails, clients cannot access the centralized server; IT must re-direct all associated clients to another proxy server, application server, or data store. Proxy-based WAFS products enable enterprises to realize some business benefits of data centralization, but they do little to reduce the IT burden of managing remote servers. More importantly, as point solutions designed for accelerating file access, they do not address overall application acceleration or other WAN optimization requirements.

To support LAN-like access to centralized files, a WAN optimization solution must:

Reduce the negative impact of latency on file reads and writes

Latency is the primary cause of poor performance of CIFS-based file reads and writes across a WAN. A WAN optimization and acceleration solution must reduce the time needed for the CIFS round trips to increase productivity of remote employees.

Accelerate overall application performance

In addition to addressing inefficiencies in CIFS, a WAN optimization solution must accelerate all application traffic across the WAN to enable collaboration among distributed employees and ensure efficient use of the WAN link.

Operate transparently

To reduce the administrative and management burden on IT associated with remote servers, the optimization platform should not require changes to clients or the deployment of new hardware that requires administration similar to that for a server. In addition, the device should remain transparent to any changes in the CIFS protocol, simply forwarding any messages it can't understand as the protocol evolves.

In the event the acceleration platform has an outage, no reconfiguration of it, desktops, or servers should be needed. The optimization device should also not interfere with direct communications between the client and server, since caching data changes locally and then forwarding them in a batch to the central site can result in consistency issues.

Finally, an acceleration device must operate seamlessly within an existing WAN environment, regardless of the WAN transport or network topology, such as high-availability designs.

Ensure sufficient bandwidth for mission-critical applications

When servers are centralized, the volume of traffic traversing the WAN naturally increases and contention for bandwidth can become an issue. A WAN optimization solution should provide bandwidth-management and Quality of Service (QoS) tools that enable IT to allocate bandwidth for mission-critical applications and prioritize key traffic across the WAN.

Monitor remote file access and overall application performance

Since more traffic must traverse the WAN to reach centralized data, IT managers need tools that allow them to see file-acceleration metrics at a glance and easily monitor overall WAN traffic to quickly troubleshoot any problems that may arise.

Lower total cost of ownership

A WAN optimization solution should increase user productivity at the same time it decreases IT expenses associated with supporting remote offices. Because they're focused on a narrow protocol set, point solutions such as WAFS proxy servers aren't designed to improve overall WAN performance, so they deliver little bang for the buck. Due to client configuration dependency, proxy servers require a level of management that may eat into the cost savings that server centralization is intended to yield. For the optimal return on investment, IT should look for WAN optimization solutions that deliver the benefits of data centralization, simplify the branch office architecture, and help reduce WAN expenses and IT operations overhead.

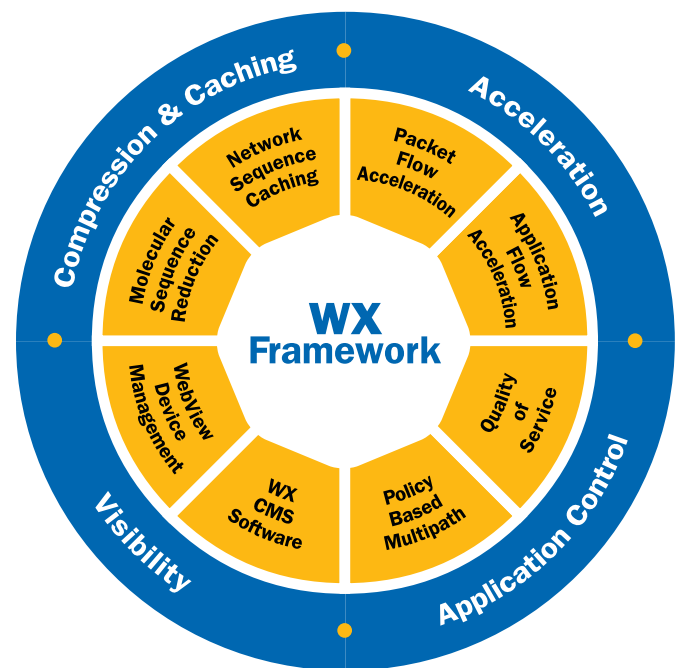
The Juniper Networks Solution

Juniper Networks delivers powerful compression and caching, acceleration, application control, and visibility capabilities through its pioneering WX Framework™. Incorporated into every WX™ and WXC™ application acceleration platform – two members of a larger family of solutions designed to improve application response times within central sites, to branch offices, and for remote users – the WX Framework fully supports data centralization requirements and enables seamless collaboration among employees in different locations.

Through the WX Framework, the WX and WXC platforms continuously share information with each other and have knowledge of the WAN link from both ends. This distributed stateful intelligence enables the platforms to tune their settings in response to changing conditions, ensuring maximum application performance in a dynamic WAN environment.

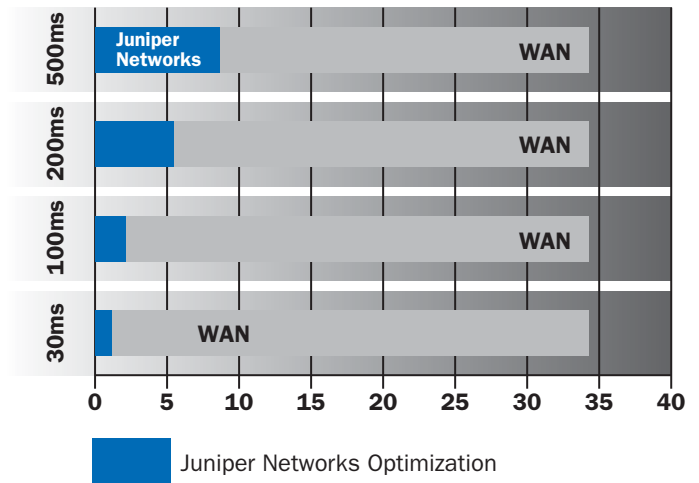
The integrated technology set of the WX Framework includes:

- The patented Molecular Sequence Reduction™ (MSR™) technology, next-generation compression capabilities that use pattern-matching techniques to reduce WAN transmissions and increase WAN capacity four-fold or more.



The WX Framework integrates key technologies that work together and influence each other, providing IT with distributed stateful intelligence about their WAN links and applications.

- The patent-pending Network Sequence Caching technique, which reduces the overhead of repeated file transfers by identifying large redundant data patterns and storing them on hard drives for long periods of time, thereby improving data reduction results.
- Quality of Service (QoS) and bandwidth-management tools that let IT prioritize mission-critical applications and time-sensitive traffic relative to other traffic types.
- Packet Flow Acceleration™ (PFA™) technologies that enable IT to accelerate performance of TCP-based applications by reducing the impact of latency.
- Application Flow Acceleration™ (AppFlow™) techniques that optimize application-specific protocols for Exchange, Microsoft file services, and web traffic, improving the response times of applications using MAPI, CIFS, and HTTP.
- Policy-Based Multipath™ (Multipath™) selection technology, which allows IT to define which applications follow which paths when multiple WAN links are available and supports automatic migration to an alternate path if performance degrades or a link fails.
- Management and monitoring tools such as the WX Central Management System™ (CMS™) software, which provides a single, unified view into application and network behavior; automates device configuration and deployment; and produces executive-level reports that aggregate network performance information.



Optimized WAN Performance

The WX and WXC solutions optimize WAN performance, making more efficient use of limited bandwidth and opening up capacity for mission-critical applications.

With the WX Framework, the WX and WXC platforms support LAN-like access to centralized files. The product family's rich set of WAN optimization capabilities:

Reduce the negative impact of latency on file reads and writes

The AppFlow technique accelerates CIFS reads and writes. When a CIFS client opens a file, it initiates a series of read requests. The WX and WXC platforms at the remote and central sites work together to determine that a file is being opened and, based on the available WAN bandwidth, request the appropriate

Customer Success Story:

Financial Services Firm

Business Benefits:

- Enabled centralization of time-sensitive data for real-time access around the globe
- Improved user productivity and accelerated remote file access
- Produced huge cost savings by eliminating distributed servers and avoiding remote IT costs

Providing up-to-date research and customer data to a global network of brokers is critical for this New York-based financial services firm. Unfortunately, WAN-imposed delays made long-distance file sharing highly inefficient, not to mention frustrating for users.

To speed up the process, the company adopted a distributed file replication service, installing servers in offices around

the world. All data was replicated nightly, allowing brokers to access files locally, at LAN speeds.

However, while access was fast, users found the data they were using was frequently outdated. In an industry where 24 hours can make a world of difference, hours- or days-old reports are virtually worthless.

In response, the firm reverted back to a centralized model. While the change ensured brokers were accessing the latest data, it also reintroduced the performance problems the firm had before.

Enter Juniper Networks. The firm installed WX application acceleration platforms equipped with Application Flow Acceleration™ (AppFlow™) technology at headquarters and in remote offices across the U.S. The AppFlow technology dramatically reduced remote file access times, cutting downloads from more than a minute to less than 10 seconds. Brokers now had real-time access to the most recent research data – and no waiting.

number of reads needed to fill the WAN link. By the time the client requests these data blocks, they are already stored on the client-side WX/WXC device and are forwarded at LAN speeds. The process for CIFS writes is the same, with the WX or WXC devices acknowledging the appropriate number of writes to keep the WAN link full.

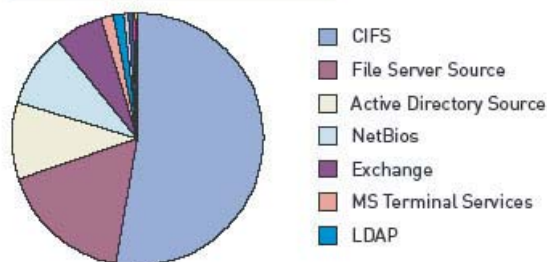
The AppFlow technology reduces the negative effect that latency has on CIFS and accelerates data transmission, enabling collaboration and increasing productivity for remote users. A 1 MB document, for example, that would take 20 seconds to copy over a 512 KB link with 100 ms of latency takes only two seconds with AppFlow acceleration.

Accelerate overall application performance

Beyond simply accelerating CIFS, the WX and WXC devices instantly increase WAN bandwidth and accelerate all application traffic. MSR and sequence caching technologies reduce the amount of traffic traversing the WAN, providing a four-fold to as much as a 20-fold increase in WAN capacity. MSR compression identifies variable-sized repeating patterns in the data stream across multiple packets, applications, or sessions, and replaces those patterns with a label.

Sequence caching also uses labels in place of repeated pattern sequences. Unlike MSR, however, sequence caching technology uses hard disks to store the patterns, so it can store longer patterns and store them for a longer period of time. As a result, sequence caching can eliminate repeated patterns even when the previous data was sent weeks earlier. In contrast to file caching and many WAFS proxy servers, the sequence caching technique can recognize and eliminate repeated data even when a file has been modified.

Percent Traffic by Application



Application Name	% Traffic	Percent Reduction	Bytes In	Bytes Out
CIFS	52.8%	92.5%	675,449,967	47,833,641
File Server Source	16.8%	79.5%	215,294,766	43,307,856
Active Directory Source	10.1%	72.1%	128,552,335	35,854,544
NetBios	9.5%	95.6%	121,032,553	5,377,710
Exchange	6.1%	56.6%	77,887,903	33,624,636
MS Terminal Services	1.6%	NA	20,145,809	20,340,200
LDAP	1.4%	92.6%	16,180,275	1,309,454

Application Improvements

The AppFlow technology dramatically improves the performance of applications over the WAN, reducing traffic levels for some applications by as much as 93 percent.

Another tool, Pre-Sync, allows files to be automatically transferred across the WAN on a scheduled basis. With Pre-Sync, the sequence caching dictionary is pre-populated with the patterns for these files, enabling maximum traffic reduction the first time a user requests the data.

In addition, the WX and WXC devices provide acceleration techniques for TCP as well as Exchange- and web-specific protocols, boosting performance of all applications that rely on these protocols.

Operate transparently

Unlike WAFS proxy servers, which require changes to clients, the WX and WXC platforms accelerate applications in a non-intrusive manner in any existing network environment. WAFS proxy servers introduce another complication in that they interrupt the communications between the client and the server, making those two different conversations. As a result, if the CIFS semantics change, the WAFS proxy server may not understand the protocol, whereas the WX or WXC device retains the direct communications between the clients and the server.

The devices are also transparent to existing applications, networks, routers, and WAN interfaces, as well as to IPsec VPNs, MPLS, firewalls, and encryption technologies. The devices can operate in any network topology, from collapsed backbone to high-availability designs. Should a WX or WXC platform fail, it automatically switches to a bypass mode, allowing all traffic to flow across the WAN untouched. This approach ensures uninterrupted operations and eliminates the platform as a potential point of failure.

Ensure sufficient bandwidth for mission-critical applications

With server and data centralization, contention for WAN bandwidth increases as more – and different types of – data vie for the WAN pipe. To ensure that mission-critical applications, such as finance, get sufficient bandwidth, the WX and WXC platforms provide easy-to-use, template-based bandwidth-management tools, including QoS and bandwidth allocation. With these tools, IT staff can prioritize applications and allocate bandwidth among different applications, defining minimum and maximum throughput levels for mission-critical and delay-sensitive applications, such as Voice over IP (VoIP).

QoS classifications can be made by looking at a variety of factors, from IP headers and TOS/DiffServ information to the actual payload content. The WX and WXC platforms have the ability to see and preserve the QoS markings applied by devices elsewhere in the network.

The WX and WXC platforms fully support data centralization requirements and enable seamless collaboration among employees in different locations.

Monitor remote file access and overall application performance

The WX Framework features a set of management tools designed to help IT managers achieve maximum WAN optimization with minimum management overhead. These tools include WebView – secure, web-based software that’s built into each WX and WXC platform for device-level management – and the WX CMS software, which provides system-wide control and monitoring and enables automated deployment of WX and WXC platforms. With WX CMS, IT can configure and manage multiple WX and WXC platforms from one central location and gain a unified view into key metrics, including application acceleration, compression and caching performance, WAN utilization, QoS, and bandwidth allocation.

Powerful real-time WAN monitoring and reporting capabilities in the platforms allow IT staff to identify top talkers, gather WAN and application statistics, and perform troubleshooting and problem-resolution activities such as packet capture. The intuitive WX CMS interface provides instant visibility into WAN performance, including both real-time and historical views. Application acceleration reports provide insight into the performance of key protocols and applications. Individual reports for CIFS show the actual time for transactions between a client and server along with an estimate of the time savings provided by the AppFlow feature.

Lower total cost of ownership

The WX Framework provides broad application acceleration and WAN optimization well beyond CIFS acceleration, delivering the benefits of data centralization over existing WAN links, simplifying the branch office architecture, and helping to reduce WAN expenses and IT operations overhead.

WX and WXC platforms can be installed and configured at data centers in less than 10 minutes, saving considerable time and effort. Remote devices are even simpler to deploy. IT defines configurations for remote platforms in the WX CMS software. Personnel at remote sites simply connect the device to electrical power and an Ethernet network and the rest of the configuration is automatic. When the remote device boots up, it automatically requests a temporary address, looks up the central WX CMS server, downloads its configuration, and begins operation. The WX CMS software also automates license management.

Meeting the Full Requirements for Server Centralization

Data centralization provides both business and IT benefits. Collaboration among employees is improved as users gain access to a consistent, shared data set. With the data integrity and simplified file sharing that data centralization provides, enterprises as diverse as architecture firms and medical facilities can leverage employee expertise anywhere in the world.

Server consolidation also simplifies data backup and recovery, enabling enterprises to easily comply with data archiving regulations and meet disaster recovery and business continuity objectives. IT benefits from having fewer file servers and remote storage devices to manage, fewer software licenses to buy and administer, and fewer remote support headaches.

To achieve the benefits of data centralization, enterprises need an optimization solution that directly addresses the latency problems incurred by using CIFS across a WAN as well as other performance issues, such as bandwidth contention, that arise with server centralization. A full-featured WAN optimization platform is required.

With its suite of application acceleration and WAN optimization mechanisms, the WX and WXC application acceleration platforms give remote offices LAN-like access to centralized corporate data, eliminating the need for enterprises to manage remote servers and storage systems.



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