

Solution Brief

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**Optimizing Data  
Replication:  
How Juniper Networks  
Accelerates Backup  
and Disaster Recovery**

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Large organizations today are faced with a dilemma. As enterprises increasingly seek to include remote global locations in day-to-day business operations, the need to centralize and consolidate data and applications becomes paramount. Without this degree of control over critical corporate resources, tighter global integration cannot succeed. As enterprises continue to expand, however, the challenge of gathering and centralizing data generated at widely distributed locations – and making that data consistently and reliably available to everyone across the enterprise – grows along with it.

This pursuit of global data availability and business continuity planning – not to mention federal regulatory compliance – is driving the need for more efficient data backup and replication strategies. As companies define increasingly strict Recovery Point Objective (RPO) and Recovery Time Objective (RTO) requirements, the need for more frequent and accurate data replication increases.

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*Network expenses account for as much as 40 percent of IT budgets.*

**Nemertes Research**

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Data replication is critical for making sure key information is readily available not only at corporate headquarters but also at remote locations. However, the lack of skilled IT support in remote locations, combined with stagnant or shrinking IT budgets, adds a layer of complexity to the problem. For most companies, their WANs are already at or near capacity carrying a wide variety of IP-based data, voice, and video traffic. The idea of adding to that traffic load with bandwidth-intensive data replication virtually guarantees that business-critical traffic of all kinds will suffer.

In response, businesses must find solutions that allow all applications – including e-mail, storage, ERP, and backup services – to efficiently utilize precious WAN resources. Such a solution must provide for reliable and comprehensive data replication services without adversely impacting more important or time-sensitive applications. And it must leverage the existing infrastructure without requiring substantial upgrades, redesigns, or investments that dilute the bottom line.

## **Common Problems and Conflicting Goals**

Data replication is a key component of any large company's overall IT strategy. Unfortunately, budgetary and performance issues threaten the implementation of an effective and reliable solution that provides remote locations the same level of service enjoyed by centralized users.

For most distributed enterprises, limited WAN capacity negatively impacts application performance, causing delays in time-sensitive transactions and generally throttling overall response times. While adding capacity via WAN upgrades to improve application performance is technically possible, it is neither financially desirable nor timely to achieve.

The issue of application performance reveals a classic IT dilemma. On the one hand, to remain competitive, businesses must continually develop and deploy new applications on a global basis while ensuring those applications are available consistently and without interruption across the business. On the other hand, IT organizations tasked with delivering this global availability are constrained by restrictive budgets and limited resources, especially at remote locations. With network expenses already consuming the lion's share of IT budgets – anywhere from 28 to 40 percent, according to Nemertes Research – the thought of incurring additional ongoing costs by investing in WAN upgrades to improve application performance is simply not realistic.

In most cases, adding more bandwidth would not resolve the challenges of data replication anyway. Once more bandwidth is available, the issue becomes ensuring that the right applications get access to that bandwidth.

Since increasing WAN capacity is not an option or even a full solution, the only alternative is to find solutions that better leverage – in many dimensions – the existing resources. The answer, in short, is WAN optimization.

WAN optimization enables businesses to utilize their existing WAN resources more efficiently, increasing capacity and improving application delivery without the addition of any new WAN capacity. Effective WAN optimization, however, provides more than just additional bandwidth – other key features such as compression, latency reduction, prioritization and bandwidth management, and path optimization must work together to improve overall WAN performance, resulting in greater reliability, availability, and performance of all applications. Best of all, WAN optimization can be achieved in a single investment, amortized over time, which dramatically reduces the overall impact on the IT budget.

WAN optimization is particularly effective for an operation like data replication. By deploying replication in conjunction with a WAN optimization solution, companies can enjoy the best of both worlds: new applications and global, reliable data availability combined with lower, or at least flat, WAN expenses. With the right WAN optimization solution, businesses can increase existing WAN capacity and reduce latency on critical applications and services such as data replication – all without expensive WAN upgrades. As a result, organizations can centralize their data stores, deliver higher data availability, and provide consistent application performance to remote users.

### **Enhancing Data Replication with WAN Optimization: What's Required**

WAN optimization has the potential to greatly improve data replication over WANs. However, to be truly effective, the WAN optimization solution must satisfy some very specific business and technical requirements. These include:

#### **Improving WAN performance for data-replication operations**

Compression, which significantly enhances the performance of data-replication operations over WAN links, is an absolute necessity for any effective WAN optimization solution. Rapid replication is essential for completing data backups within a reasonable timeframe as well as for getting backup sites up and running quickly for disaster recovery. Compression delivers an important tool for IT organizations under increasing pressure to minimize backup windows, accommodate escalating data volumes, and reduce backup error rates and “restarts.”

#### **Ensuring bandwidth availability for critical enterprise applications**

Optimizing WAN links to increase capacity is one thing; ensuring sufficient bandwidth is always available for critical application traffic is quite another. After all, increasing capacity is pointless if the extra bandwidth is consumed by non-essential communications. With QoS, a critical component of any WAN optimization solution, IT can prioritize application traffic such as voice over IP (VoIP) and allocate WAN bandwidth to ensure those applications perform consistently and predictably, unaffected by sudden “bursty” replication traffic sharing the same WAN link. Also, as businesses become more global, the WAN is used virtually around the clock. Therefore, IT must run data-replication and backup operations continuously to ensure data integrity and complete backups.

#### **Accelerating IP applications**

Effective WAN optimization solutions must include the ability to accelerate TCP/IP flows to allow for more frequent replication with optimal application performance across the WAN. Setting up TCP sessions quickly, dynamically adjusting TCP's window size for older systems, and substituting a more bandwidth-efficient reliable transport can all significantly reduce the time it takes to complete WAN transmissions when latency is impacting performance.

#### **Simplifying initial full-volume transfers**

Enabling the initial data-replication process to take place over the WAN, rather than requiring the use and distribution of tapes, can dramatically reduce the time it takes to transfer large databases from one location to another. An effective WAN optimization solution not only delivers this ability but also eliminates the problem posed by incompatible tape-based systems at different locations.

#### **Monitoring WAN performance**

Real-time WAN monitoring and reporting is essential for providing IT with instant visibility into network performance. Reports showing details such as top talkers, coupled with the ability to capture packets, can help IT understand and identify the root cause of problems and address them in a timely manner.

#### **Simplifying deployment with flexible options**

Given their limited resources and budgets, today's IT organizations are, by necessity, focused on operational efficiency. Therefore, an effective WAN optimization solution must be easy to configure and deploy, requiring no changes to existing applications, networks, routers, or WAN interfaces, and it must work transparently with IPsec VPNs and MPLS networks supporting QoS.

In addition to being easy to deploy and non-intrusive, the right WAN optimization solution must also offer multiple deployment options to meet the needs of the widest range of potential users. Some sites, for instance, have a link between the LAN backbone equipment and the WAN router, while others use a collapsed backbone with one device supporting both backbone connections and WAN interfaces. To be effective, WAN optimization platforms must work in either scenario. The device should also be able to work with a variety of data-replication models, including both one-to-one and cascading replication models.

## Juniper Networks: WAN Optimization for Data Replication Environments

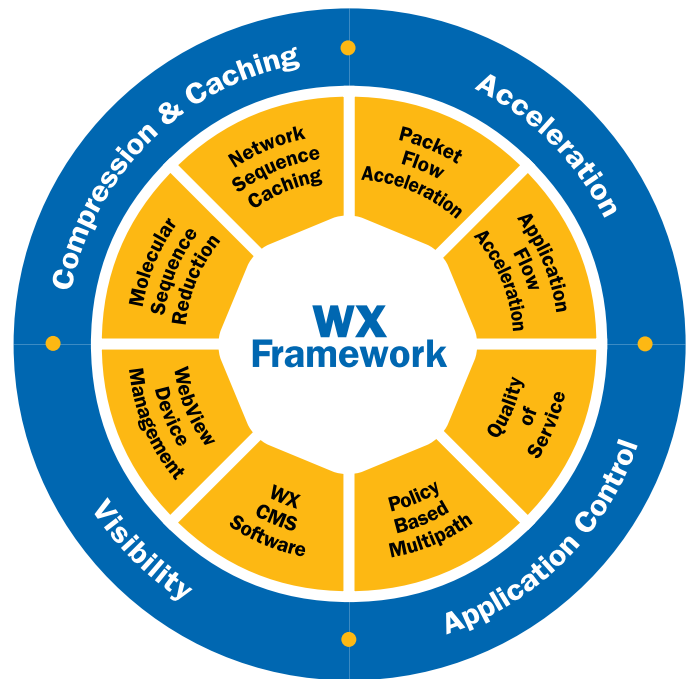
Juniper Networks offers a complete family of application acceleration platforms designed to improve application response times within central sites, to branch offices, and for remote users. Two members of that family – the WX™ and WXC™ application acceleration platforms – deliver the powerful WAN optimization capabilities that satisfy the demanding requirements of data replication.

The WX and WXC platforms are based on the unique WX Framework™, an interdependent and complementary set of technologies that, working together, enable complete WAN optimization and application acceleration. The WX Framework is organized into four categories – compression and caching, acceleration, application control, and visibility – that address specific obstacles to efficient application performance over the WAN.

The compression and caching component of the WX Framework includes next-generation compression capabilities via the patented Molecular Sequence Reduction™ (MSR™) and Network Sequence Caching technologies, which instantly increase WAN capacity by eliminating the transmission of redundant data patterns across wide-area links.

The acceleration component of the WX Framework includes the Packet Flow Acceleration™ (PFA™) technologies, which reduce the impact of latency on TCP-based applications, and the Application Flow Acceleration™ (AppFlow™) technique, which addresses the performance issues of higher-layer protocols.

The application control component of the WX Framework includes Quality of Service (QoS) and bandwidth-management tools that let IT prioritize business-critical applications and time-



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.

sensitive traffic, as well as Policy-Based Multipath™ (Multipath™) technology that allows IT to define which applications follow specific paths when multiple WAN links are available.

Finally, the visibility component of the WX Framework includes a variety of tools, including the WX Central Management System™

### Customer Success Story:

#### Banco Santander Central Hispano International

Business Benefits:

- 100% increase in replication speed and data reliability
- Reduced IT staff time dedicated to maintaining replication by 95%
- Saved \$60,000 in bandwidth costs in first year by avoiding network upgrade
- Peace of mind that critical data is available in real time and service would be uninterrupted even with site failure

The Miami headquarters of Banco Santander Central Hispano, Spain's leading financial institution, is the business center for the company's private-banking operations in the United States, Bahamas, Geneva, and London.

The Miami site is located in the heart of Gulf Coast hurricane country, so the bank needed a real-time data availability and protection solution that could ensure business continuity in case of site failure. Further compelled by regulatory requirements for data availability, Banco Santander Central Hispano needed to protect more than 40 GB of business-critical data traveling across its WAN.

To protect its business-critical data, Banco Santander Central Hispano implemented data replication, using Juniper Networks WX application acceleration platforms to transfer the data across the WAN to a backup facility. The devices doubled the performance of the data replication software and saved Banco Santander \$60,000 in bandwidth costs in the first year alone.

(CMS™) software, that provide IT staff with a single, unified view into their distributed applications and networks.

Working together, each of these technologies blend to seamlessly and transparently improve the performance and efficiency of the wide-area environment, enabling IT to meet the challenges associated with data replication over the WAN.

With the WX and WXC platforms incorporating the capabilities of the WX Framework, IT organizations struggling to deploy a cost-effective data-replication solution can:

### **Instantly increase WAN capacity to accelerate data replication**

Utilizing the MSR and sequence caching technologies to reduce the amount of traffic traversing the WAN link, the WX and WXC platforms deliver as much as a ten-fold increase in WAN capacity, providing sufficient bandwidth for IT to run the data-replication operations.

MSR compression identifies variable-sized, repeating patterns in the data stream across multiple packets, applications, or sessions and replaces those patterns with a label to reduce traffic on the WAN link. The labels and their associated patterns are stored in memory in the WX or WXC devices at both ends of the WAN link, where the data is restored and forwarded to its destination. No critical information is lost.

Sequence caching also uses labels to identify and store pattern sequences. Unlike MSR compression, however, sequence caching pattern sequences are stored on hard disks on the WXC platforms, increasing the size of the patterns that can be stored and recognized, as well as the time between repeated patterns.

Working together to eliminate repetitive network traffic, the MSR and sequence caching technologies combine to reduce data flow over WAN links by up to 90 percent, generating significant excess capacity that dramatically improves the efficiencies in WAN transmissions.

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*“By making it practical to take frequent, unobtrusive backups, the WX platform has eliminated more than 450 hours of annual downtime.”*

**Dale Defilippi**  
Systems Technology and Hardware  
Engineering Supervisor  
IGT

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### **Ensure bandwidth availability for critical enterprise applications**

The bandwidth-management tools available with the WX and WXC platforms – including QoS and bandwidth allocation – allow IT to prioritize applications across WAN links and allocate bandwidth among different applications to ensure that data replication does not interfere with more mission-critical transactions.

The WX and WXC platforms include easy-to-use, template-based QoS tools, enabling IT to define minimum and maximum throughput levels for data-replication processes as well as other high-priority business applications. By allowing IT to assign priority levels and define minimum and maximum throughput, the platforms ensure that backup traffic does not interrupt sensitive traffic such as VoIP or “bursty” applications. With the bandwidth-management tools, IT can also allocate a small

## **Customer Success Story:**

### **International Game Technology**

Business Benefits:

- Reduced backup times from 16 hours to three
- Decreased mirroring time from three hours to a few minutes
- Reduced development system synchronization from five days to a few minutes
- Eliminated 450 hours of downtime annually
- Enabled DR site to be up and running in 30 minutes

IGT is the world’s leading designer and manufacturer of slot machines – a \$4 billion company with more than 65 percent of the U.S. gaming market.

With plans to expand globally, IGT needed to upgrade its data-replication system and develop a disaster-recovery site to protect intellectual property developed in its Reno, Nevada

headquarters. The existing disk-to-tape system was too inefficient, too vulnerable, and required too much downtime, so IGT established a hot-standby site in Las Vegas with the ambitious goal of backing up all data within one hour of creation.

The initial solution provided sufficient backup, but sluggish WAN performance prevented IGT from meeting its data-replication goals. Data mirroring was taking three hours to complete and consuming more than half of the WAN bandwidth.

To improve the data replication process, IGT deployed WX application acceleration platforms in Reno, in its Las Vegas DR site, and at several international facilities. The platforms prioritize business-critical applications, apply bandwidth allocation to the data-replication process, and compress traffic across the WAN. With the WX platform, IGT has met all its data-replication goals and successfully deployed its DR site.

percentage of the WAN link to data replication and set the operation to run continuously, ensuring that backups will always complete and data integrity remains high – without negatively impacting other business applications.

### **Accelerate applications**

The innovative Packet Flow Acceleration (PFA) technologies dramatically improve application response times by minimizing the impact of WAN latency, enabling TCP/IP traffic to flow faster and optimizing frequent replications. PFA techniques can dynamically adjust the window size of older TCP clients, sending 64 KB window sizes between WX and/or WXC devices even if the sender or receiver supports only 16 KB. Local buffering within the devices ensures TCP hosts are never overrun.

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*“Juniper Networks delivers fast and cost-effective protection of our business critical data, ensuring day-to-day business continuity in the face of system failure.”*

**Eugene Rivera**  
 Technical Support Manager  
 Banco Santander

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Rather than slowing application response times while an application waits for acknowledgements on TCP, Active Flow Pipelining™, a component of PFA, utilizes a reliable, customized transport protocol in lieu of TCP on high-latency links. These PFA techniques allow IT to maximize utilization across the WAN, transparent to the applications and network equipment.

For higher-layer support, the AppFlow technology accelerates applications that are constrained by their own protocol behavior. Specifically, AppFlow addresses Microsoft Exchange, which uses the Messaging Application Programming Interface (MAPI), Microsoft file services, which uses the Common Internet File System (CIFS) protocol, and web-based applications using HTTP.

For MAPI and CIFS, which break files into multiple blocks that must be individually sent, received and acknowledged before the next block can be forwarded, the AppFlow technique accelerates performance by pipelining the data – simultaneously sending as many data blocks as needed to fill the available WAN capacity. The process eliminates the hundreds or even thousands of round-trip times (RTTs) required to complete a single transmission, enabling messages and files to be downloaded and replicated at near-LAN speeds.

For HTTP traffic, the AppFlow technique enables WX and WXC devices to learn and cache objects associated with URLs, which are typically sent one at a time when a web page is requested. The WX and WXC platforms confirm the freshness of each object or pre-fetch them when new or updated versions are available, in advance of the client’s request, allowing browsers to display web pages much faster.

### **Simplify initial full-volume transfers**

While the MSR and sequence caching technologies increase WAN capacity, the QoS and application-acceleration techniques enable IT to use the WAN link to transfer very large databases – a more efficient solution than traditional methods. Typically, IT sends tapes around to different locations to initialize replicated data stores, since performing this task over a non-optimized WAN link is prohibitively time consuming. The WX and WXC platforms allow IT to efficiently transfer this data over the WAN link without impacting business operations, adding a new level of convenience to the data- replication process – and eliminating the problems that arise when different locations have incompatible tape systems.

### **Monitor WAN performance**

The powerful real-time WAN monitoring and reporting capabilities in the WX and WXC platforms allow IT to identify top talkers, gather key valuable WAN and application statistics, and perform key troubleshooting and problem-resolution techniques such as packet capture. The intuitive GUI provides IT managers with instant visibility into WAN performance, including both real-time and historical views. Data and statistics gathered by the WX and WXC platforms can also be exported to third-party tools, enabling IT to use any NetFlow-compatible platform, including those from Concord or Micromuse, to perform detailed traffic analysis.

### **Easy, automated deployment**

Core WX and WXC platforms can be installed and configured in less than 10 minutes, saving IT considerable time and effort. The devices are transparent to existing applications, networks, routers, and WAN interfaces, as well as to IPsec VPNs, MPLS, and firewalls, making them a non-intrusive addition to any existing network environment.

Remote devices are even simpler to deploy. IT simply defines configurations for remote WX and WXC platforms in the WX CMS software. 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. This feature enables the devices to be deployed at sites lacking any IT staff.

### Flexible, reliable deployment

Rack-mountable WX and WXC devices interface with the network as a two-port LAN switch, deployed either in-line between a LAN backbone switch and a WAN router or off-path attached to a collapsed backbone device. Supporting 10/100/1000 Ethernet interfaces and installed behind external firewalls and encryption devices, the platforms process all corporate data before it goes to WAN transmission devices, ensuring the most efficient use of critical WAN links.

### Highly reliable platforms

The WX and WXC platforms integrate easily and seamlessly with high-availability environments and load-balanced networks. In the event of a traffic overload, they simply allow excess traffic to pass through, eliminating any bottleneck. If a device should fail, it automatically switches to bypass mode, allowing all traffic to flow across the WAN. This approach ensures uninterrupted business operations and eliminates the WX or WXC platform as a point of failure.

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*The QoS and bandwidth-allocation tools allow IT to prioritize traffic to ensure data replication does not interfere with more important transactions.*

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### Summary

Data replication is critical to any organization serious about data-center consolidation and disaster-recovery architectures. However, implementing an effective data-replication solution within a highly distributed enterprise environment, where mission-critical applications all compete for a limited amount of WAN bandwidth, is a considerable challenge. Frozen or shrinking budgets and limited IT resources, which effectively rule out any WAN upgrades, make such a challenge seem insurmountable.

Juniper Networks delivers application acceleration and WAN optimization solutions that enable IT to make the most of their existing WAN resources. The unique WX Framework not only multiplies the effective capacity of existing WAN connections but also accelerates applications and ensures that mission-critical traffic receives the bandwidth it needs, when it needs it, without impacting other applications. By increasing the capacity of existing bandwidth while providing guaranteed throughput for mission-critical applications, the WX and WXC platforms deliver sufficient resources to support data-replication operations over wide-area links – without requiring any changes or additions to the existing infrastructure.

The result? IT gains additional WAN capacity, faster and more reliable backups, improved application support, and optimized WAN throughput – all from a single platform.



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