

Creating the Worldwide LAN

WX and WXC Application Acceleration
Platform System Overview



IT is under pressure to provide LAN-quality application delivery throughout the distributed enterprise. Juniper Networks plays an important role in enabling IT to meet that goal.

Juniper Networks delivers solutions that improve enterprise business efficiencies by resolving the technical limitations of WANs – solutions that:

- Increase business productivity through improved application performance
- Provide unified insight into distributed networks and applications
- Reduce IT expenses



The WX Framework: Blueprint for Application Acceleration

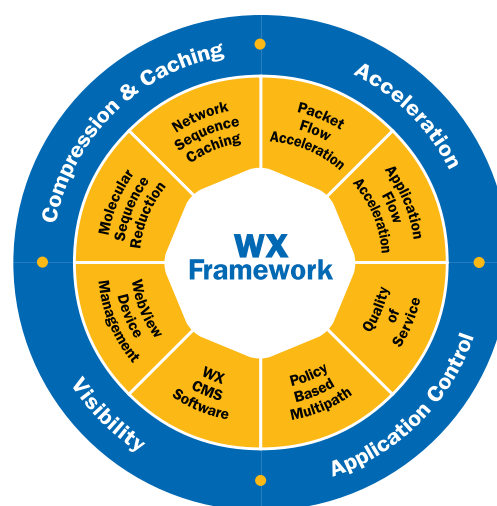
Several initiatives have become critical to IT's ability to improve economics while simultaneously increasing application performance and more tightly integrating distributed business processes.

Juniper Networks WAN application acceleration platforms directly benefit IT staff involved in the following key business initiatives

- application rollout and web enablement
- data center and server consolidation
- disaster recovery and backup
- regulatory compliance

Juniper Networks enables IT to meet these critical business initiatives through its WAN Acceleration (WX™) Framework. The WX Framework™ integrates several interdependent technologies – including next-generation compression, sequence caching, TCP, application- and protocol-specific acceleration, bandwidth management, path optimization, and visibility – into a family of WAN application acceleration platforms. To date, IT has had to make do with discrete point products that perform just one or two of these key functions. But when these features work in concert, IT can achieve the greatest success in meeting the enterprise's goals.

The WX Framework provides the foundation for the WX and WXC™ application acceleration platforms, which make it easy and cost-effective for IT to provide the enterprise-class application acceleration and delivery needed to support new applications and branch-office access to centralized resources. The WX and WXC platforms deliver a consistent set of features, though the WXC line offers one additional hardware-dependent capability called Network Sequence Caching. Two software applications – the WX Operating System (WXOS™) software and the WX Central Management System™ (WX CMS™) software – deliver these key system features.



WX Framework

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



WX Product Family

The market-leading WX product family provides enterprises with a scalable approach to improving application delivery. The product line is best known for its pioneering next-generation Molecular Sequence Reduction™ (MSR™) dynamic compression technology and TCP acceleration capabilities, yielding dramatic increases in WAN capacity and application- and protocol-specific performance. The products also feature application- and protocol-specific acceleration for Exchange, Windows file services, web applications and SSL-encrypted traffic. The combination of increased bandwidth and faster response times delivers customers a very rapid and quantified return on investment.

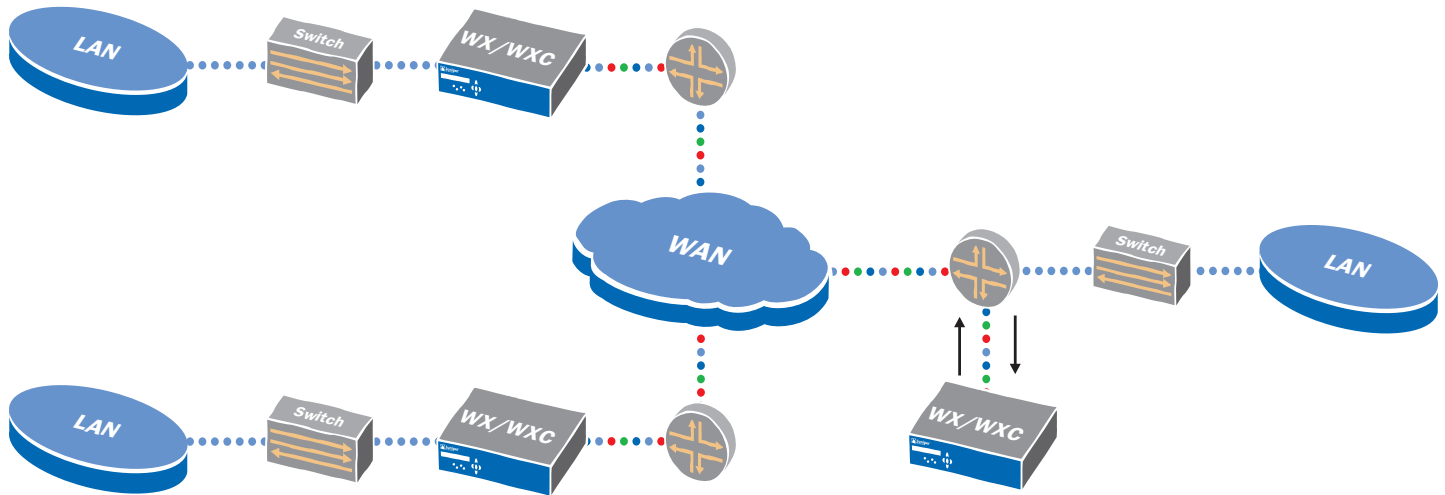
The WX application acceleration platforms also provide sophisticated yet easy-to-implement Quality of Service (QoS), bandwidth allocation, and path optimization features across dual WAN links. All these capabilities are application independent, so they apply to all IP traffic including e-mail, web traffic, VoIP, database access, and ERP applications. The application- and protocol-specific acceleration overcomes the inefficiencies of Exchange communications over the Messaging Application Programming Interface (MAPI), Windows file services using the Common Internet File System (CIFS), and web applications running over HTTP as well as optimizes secure, SSL-encrypted traffic over the WAN.

The WX products integrate seamlessly with existing LAN and WAN designs and operate fully transparently, independent of other network equipment, applications, servers, clients, and WAN topology and interfaces. WX devices are deployed at both ends of a WAN link, enhancing the WAN and application knowledge of each.

IT can place a WX platform either directly in the flow of traffic between a LAN switch and WAN router or attach it to a port on the switch or router. This off-path deployment option provides IT the flexibility required to support LANs designed with collapsed backbone switch/routers or with so many redundant connections among the LAN switch and WAN router that in-line deployments would be impractical.

The WX products provide a number of redundancy, high-availability, and load-balancing features. All data center WX products include redundant power supplies, and all WX platforms support fail-safe operation. In the event of a failure of any kind, including total loss of power, the WX interfaces automatically convert to a bypass mode in which all traffic simply passes through the device untouched.

The WX platforms operate in communities that dynamically exchange information such as topology, reachability, and path-performance metrics, providing IT with distributed stateful intelligence about local- and wide-area network conditions. IT also has the option to partition large WX deployments into separate domains, increasing operational scalability.



WX devices also support a multitude of redundant deployment modes. The WXOS software works with routers configured with redundancy protocols, and WX devices can also be deployed in tandem at a single location, with both platforms active or with one in standby mode. WX devices also work effectively alongside VPN servers or firewalls. The WX units sit on the trusted side of the security device and optimize traffic before it is encrypted, avoiding any conflict with the security devices.

In contrast to many WAN optimization platforms that involve cumbersome configuration, the WX products are fast and easy to install. Central devices can be configured within 10 minutes, and IT can use the WX CMS software to automate deployment of devices at remote locations, which typically have no local IT staff. Corporate IT simply defines centralized configuration templates and notes which locations will use them. At boot up, remote WX devices automatically obtain a network address, locate the WX CMS server through the domain name service (DNS), request their configuration from the WX CMS server, download the appropriate configuration file, and begin operation.

IT can also use the WX CMS software to monitor and manage multiple WX devices as a group, or they can use the embedded secure WebView or CLI to manage each device separately. WX products are available in a range of capacities to meet the needs of various sizes of enterprise locations.

The product family includes the WX 15, WX 20, WX 60, WX 100, and the WX Stack. Each provides the full feature set and runs the same WXOS software. They provide a range of compressed output, from 64 Kbps to 155 Mbps rates. The WX products also differ in the number of remote sites they can link to, ranging from two to 2,000. Multiple communities of WX devices can be configured to support an unlimited number of locations.

Flexible Deployment

The WX and WXC platforms integrate seamlessly into existing network designs and can operate in a number of deployment modes.



WXC Product Family

The WXC application acceleration platforms support the same core software capabilities as the WX product line with one unique addition – support for Network Sequence Caching technology. The Sequence Caching feature dramatically speeds the transfer of large files by eliminating repeated data sequences even when they are separated by hundreds of gigabytes over days or even weeks.

By operating on large patterns of data, Sequence Caching technology appears to be similar to file caching. While file caching was designed to eliminate large redundant file transmissions, it often fails to deliver because of two key limitations. First, file caching works only on a single application, and since enterprises have a heterogeneous mix of applications, the overall value that file caching provides in reducing WAN transmissions is limited. Second, file caching operates only on exactly repeated files.

The Sequence Caching technology, in contrast, works on any IP-based application. Also, it recognizes repeated data sequences and eliminates them, even when they occur within a file that has been modified. Since most large files transmitted over the WAN are simply modified versions of previously sent files, Sequence Caching technology is far more effective at reducing WAN traffic than file caching. For example, if a new slide is added to a 30-page PowerPoint file and the file is re-sent over the WAN, Sequence Caching will detect the repetition and eliminate more than 95 percent of that transmission. File caching would miss it.

In addition, Sequence Caching technology makes use of on-board hard disks that provide up to 3 terabytes of persistent storage in a stacked configuration, so even sequences seen several days earlier can be eliminated.

Working together, the Sequence Caching and MSR compression technologies recognize and eliminate different types of repeated data patterns, providing IT with maximum traffic reduction.

The WXC product family features the WXC 250, which offers a single 40 GB hard drive and provides compressed output from 128 Kbps to 2 Mbps; the WXC 500, which offers two 250 GB hard drives and compressed output from 256 Kbps to 20 Mbps; and the WXC 590, which offers dual, field-serviceable 250 GB hard drives and compressed output from 2 Mbps to 45 Mbps. In a WXC Stack configuration, the WXC 500 or WXC 590 platforms can also serve as clients of the WX 100 platform, extending support for the Sequence Caching feature to 3 TB of hard-drive capacity and 155 Mbps bandwidth levels. The WXC platforms are fully interoperable with all WX platforms and run the same WXOS software.

WX Operating System Software

The WX Operating System (WXOS) software provides the core features that allow the WX and WXC application acceleration platforms to provide LAN-like application response times over the WAN. The software tightly integrates compression, application- and protocol-specific acceleration, prioritization, path-selection, security, and deployment capabilities.

Compression and Caching

Because businesses run a variety of application types, a combination of reduction technologies provides the greatest overall benefit to improve application performance and increase WAN capacity. The WX and WXC platforms feature two techniques for reducing repetitive data over the WAN.

The patented Molecular Sequence Reduction (MSR) technology, the WX Framework's flagship compression algorithm based on DNA pattern matching, provides up to a 10-fold increase in WAN capacity by recognizing repeated data patterns and replacing them with labels. MSR technology operates in memory, and its dictionary can store hundreds of megabytes of patterns.

MSR compression benefits a broad cross-section of application types, reducing both short, chatty applications such as MS SQL and web (HTTP), as well as larger patterns such as Microsoft Office files. MSR compression dramatically reduces WAN transmissions, providing immediate congestion relief while enabling IT to improve application performance and avoid costly WAN upgrades.

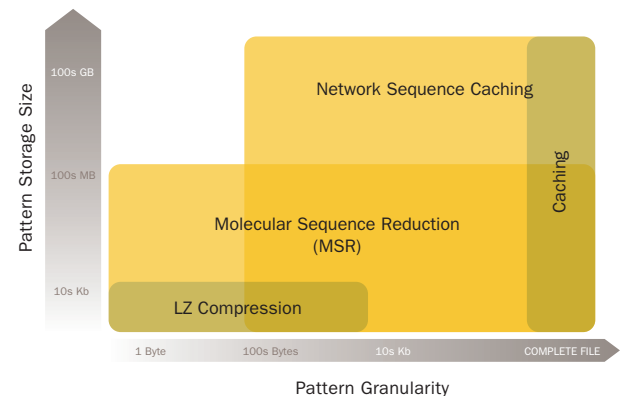
The patent-pending Network Sequence Caching technology also eliminates repetitive data patterns but uses hard drives to store longer patterns and store them for longer periods of time. The WXC application acceleration platforms automatically provide the advantages of both the Sequence Caching and MSR technologies.

Acceleration

The WX and WXC platforms improve application performance over the WAN through both protocol- and application-specific acceleration techniques.

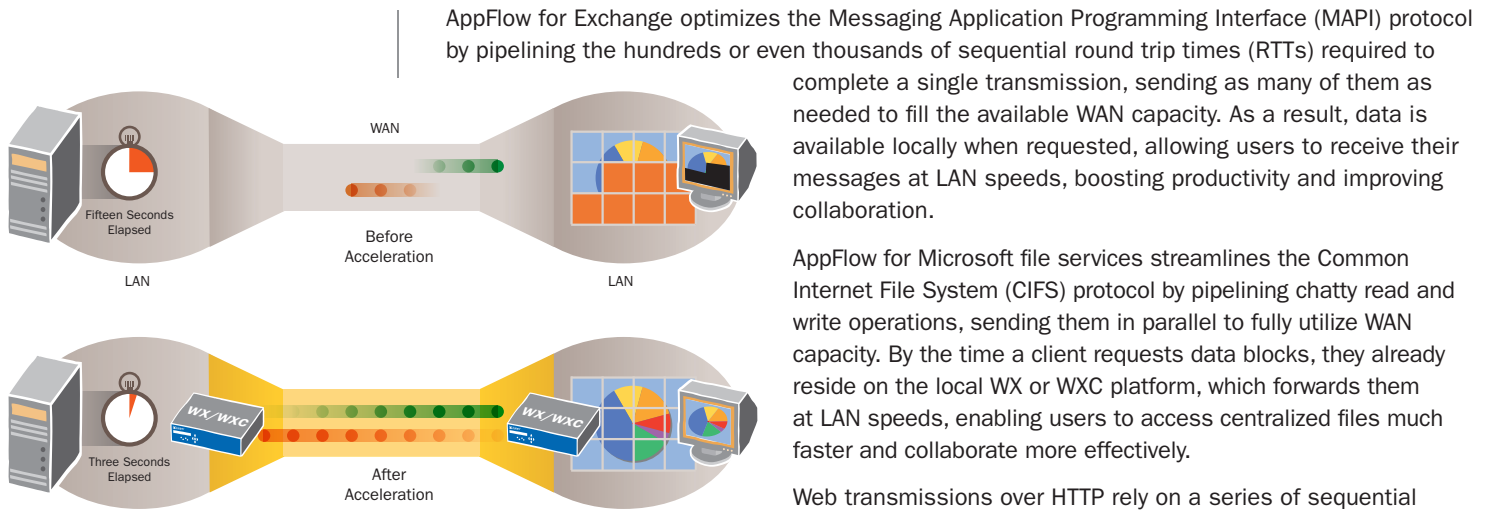
The Packet Flow Acceleration™ (PFA™) technology improves performance for TCP-based applications. An Active Flow Pipelining™ feature, a component of the PFA technology, dramatically accelerates transmissions by terminating TCP and using a more efficient transport protocol between WX or WXC devices, significantly speeding applications on high-bandwidth or high-latency connections. Forward Error Correction, combined with TCP termination, limits the need for retransmissions on lossy networks by making use of recovery packets to reconstruct lost transmissions.

When TCP acceleration isn't enough, the Application Flow Acceleration™ (AppFlow™) technology provides application-specific acceleration for several Layer 7 protocols. The AppFlow acceleration techniques – completely transparent to the existing application infrastructure – require no changes to clients, do not interrupt protocol communications between clients and servers, and fully support any WAN transport and network topology including high-availability designs.



Increased Bandwidth

The Sequence Caching and MSR technologies benefit different traffic types in their compression and caching capabilities. Both provide far broader advantages than file caching or traditional compression.



Dramatically Improve Application Response Time

TCP and application-specific acceleration technologies dramatically improve application performance over the WAN by minimizing the impact of network latency.

between the client and the server to build a page. The AppFlow for HTTP feature enables WX and WXC platforms to learn and cache objects associated with URLs and confirm their freshness or pre-fetch updated objects in advance of the client's request. The result: clients receive objects at LAN speeds and web pages load much faster.

Finally, AppFlow for SSL accelerates encrypted flows over the WAN by decrypting the traffic at the local WX/WXC device, optimizing the data, sending it across the WAN via IPSec, and then re-encrypting the data in the WX/WXC device at the far end of the link. Now, SSL-encrypted traffic enjoys the same WAN acceleration benefits as other mission-critical applications.

Application Control

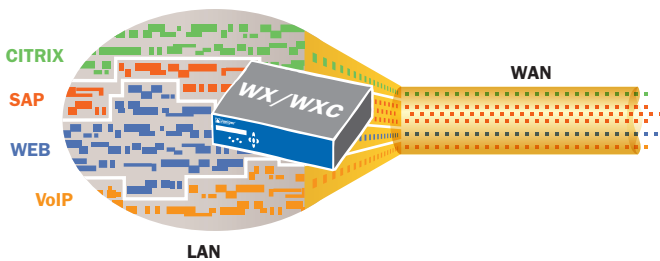
To ensure application prioritization and maintain high application availability, the WX and WXC platforms support a number of bandwidth-management and path-optimization techniques.

The Juniper Networks approach to WAN application acceleration defies the commonly held belief that effective Quality of Service (QoS) must be difficult to implement. The intuitive wizard- and template-based approach employed by the WX and WXC platforms enables IT to easily define and enforce QoS policies for critical and latency-sensitive applications.

IT can assign priority status and bandwidth-allocation metrics to applications, and the WXOS software classifies traffic by looking not just at IP header or ToS/DiffServ information but also inside the data payload to act on Layer 7 application information. Further, because the WX and WXC platforms may

not be the only QoS-aware devices in the network, they preserve and allow visibility into the QoS markings that other devices apply. For example, the WXOS software can preserve an enterprise-based QoS marking, map that QoS policy to an MPLS-based service level for transmission through a service provider's network, and then restore the enterprise-based marking at the remote location.

The WX and WXC platforms also include a congestion-control feature that further increases application throughput. As enterprises move from private, point-to-point WANs to public networks such as MPLS and VPNs, the any-to-any connectivity, shared access, and variable bandwidth on these networks increases traffic volatility. This traffic is subject to loss in the middle of the network and to contention on receiving links. The WX and WXC devices continuously monitor the instantaneous bandwidth availability anywhere along the path between them, using this knowledge to dynamically control traffic rates in accordance with business priorities and QoS settings. This congestion-control feature minimizes traffic loss and enables maximum WAN throughput.



Prioritize Mission-Critical Application

The Juniper Networks QoS technology implementation honors or sets traffic priorities as well as allocates new-found bandwidth to ensure optimal application performance.

The Policy-based Multipath™ (Multipath™) function enables companies to take even greater advantage of public WAN services by allowing IT to define which applications should traverse which path in locations served by two or more WAN links. The WXOS software monitors the performance of each path and automatically diverts applications from one path to the other if performance degrades, while ensuring key performance metrics are always met.

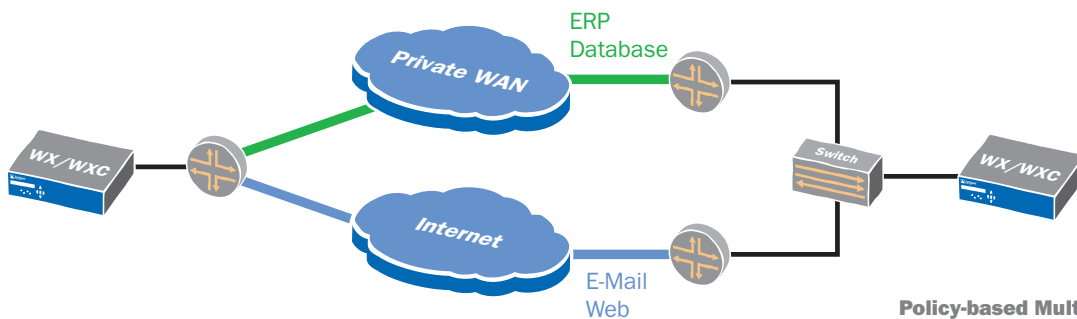
The Multipath technology demonstrates the integrated nature of the WX Framework. For example, when the Multipath function diverts traffic from one link to another, QoS policies ensure that applications already flowing over the second link are not negatively impacted by the diverted flows.

Visibility

The WXOS software's visibility features provide IT with detailed information about their distributed networks and applications. The WebView device management software is available for per-device management, while the WX Central Management System (WX CMS) software is used to manage, monitor, and configure WX and WXC platforms deployed throughout the enterprise.

The WebView and WX CMS software provide IT with the information needed to quickly identify, diagnose, and resolve problems, even in remote branch offices that lack any IT staff or management tools. For example, the Top Talker report can help IT pinpoint that a workstation is propagating a virus and consuming significant WAN capacity.

The management software, which permits administrator, read/write, and read-only access levels, provides extensive reporting capabilities, allowing IT to view and export per-application compression, Sequence Caching, and acceleration results; reports about time-of-day usage; top talker reports; and historical data.



The WXOS software supports other key security, automation, and scaling functionality. IPsec encryption between devices provides enterprises with an effective security option in branch offices that have not deployed a VPN strategy. Automated deployment uses WXOS and WX CMS software to enable remote turn-up of WX and WXC platforms with no need for IT involvement. Tunnel Switching enables any-to-any communications between sites, relying on hierarchical aggregation of tunnels to minimize the total tunnels needed.

Policy-based Multipath

IT can use the Multipath feature to define which applications should follow which path when multiple paths are available. If performance degrades on one path, the WX and WXC platforms will automatically divert traffic to the other path based on predefined business policies.

Central Management System (CMS) Software

One of the most critical issues to address in WAN optimization is visibility into an enterprise's distributed network and applications. All too often, IT does not have – and cannot get the budget to buy – the tools needed to really understand what is traversing the WAN. More than any other single feature of the WX Framework, the WX CMS software is tightly woven into every other function, providing IT with aggregated reporting of WAN and application performance and control over the parameters that affect business policies.

The WX CMS software provides easy yet extensive central configuration, management, monitoring, and reporting for distributed WX and WXC devices. The software dramatically simplifies the control and monitoring of multiple WX and WXC application acceleration platforms deployed across dispersed locations, providing IT with unprecedented visibility into WAN and application performance.

While the WX CMS software configuration and management capabilities are key, its greater value derives from its extensive monitoring and visibility tools. IT has routinely operated with very little knowledge of WAN communications; the WX CMS software provides summary and detailed information about traffic patterns and bandwidth consumption.

The software helps IT learn the mix of applications running over the WAN and how much bandwidth they're consuming, which users are consuming the greatest amount of bandwidth, and how QoS is affecting application throughput. These top talker, application mix, and other reports help IT quickly pinpoint anomalies in the network, identify whether the WAN is the cause of application performance problems, and troubleshoot problems that have historically been tough to diagnose given the lack of WAN insights.

The WX CMS software also highlights the benefits of each core technology within the WX Framework. The software allows IT to manage additional WAN capacity enabled by the MSR compression and Sequence Caching technologies, view application acceleration results of PFA TCP acceleration and AppFlow application-specific acceleration techniques, allocate bandwidth and prioritize applications through QoS, and direct applications over different WAN links with the Multipath feature. IT can customize the mix of reports they view by designing personal My WAN™ portals, and Executive Summary reports provide an at-a-glance view of key traffic, performance, and reduction results. And a comprehensive Event Management Console allows network managers to proactively identify, isolate and resolve system and application problems before they adversely affect WAN performance.

All WX CMS capabilities are available via a web-based GUI that as many as 50 users can access simultaneously. The WX CMS software manages both the WX and WXC application acceleration platform families, and IT can define which IT staff can view and manage which devices.

The WX CMS software provides the following benefits for any deployment of multiple WX and WXC devices:

- Provides visibility into WAN applications and performance, with unique customizable portal:** The WX CMS software gives IT a complete view into what is happening on their WAN links. Administrators can see the application mix, which users are consuming the most bandwidth, and the impact of bandwidth-management settings. The WX CMS software provides the only WAN optimization management and monitoring portal, “My WAN,” which lets users customize their view of key reports. IT staff can choose from a number of summary reports about the health and performance of their application acceleration deployment and use these reports to diagnose, troubleshoot, and resolve WAN problems.
- Centralizes and simplifies configuration:** The WX CMS software creates a single location from which to manage as many as 2,000 WX and WXC devices. IT can leverage configurations on devices already deployed in the network, schedule key upgrade and management tasks, and perform updates such as rolling out a new WXOS software revision to all WX and WXC devices at once.
- Provides global policies and monitoring:** The WX CMS software allows network managers to centrally manage and modify global configuration settings on all WX and WXC devices. IT can also monitor the distributed platforms, with status reports providing at-a-glance summaries of device health, configuration status, and data on compression, sequence caching, and acceleration results.
- Simplifies content distribution:** The WX CMS software allows IT to selectively pre-populate distributed WXC devices with large files, providing content delivery network (CDN)-like capabilities without actually deploying a dedicated CDN solution. Content distribution proactively warns WXC dictionaries with large files destined for company-wide distribution, making them locally available for immediate download by remote and branch-office users.
- Automates deployment and license management:** Using the WX CMS software, IT can automate configuration of remote WX and WXC devices, greatly simplifying the set up of tens or hundreds of distributed platforms. IT can also use the WX CMS software to automate license management, simplifying the administration of a large and highly distributed deployment.
- Simplifies Problem Resolution:** The WX CMS Event Management Console provides a summary of system and performance events, enabling IT to proactively find and resolve network problems. The system can be configured to send e-mail alerts when events are detected for more rapid resolution.

The WX CMS software runs on Microsoft Windows 2000 and 2003 servers and can be accessed securely from any browser connection via HTTPS.

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at www.juniper.net.



Networkwide Visibility

WX CMS software provides both custom and system-generated views into application acceleration, errors and events, WAN utilization, QoS, WAN performance events and a variety of other conditions across the distributed enterprise.

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