

WAN Optimization Integrated with Cisco Branch Office Routers Improves Application Performance and Lowers TCO

The number of branch-office work sites is increasing, so network administrators need tools to help them ensure solid application performance in remote locations. A May 2007 study by Nemertes Research, “Branch Office Best Practices”, for example, determined that the number of branch offices is likely to grow 11 percent in 2007, up 8.9 percent from 2006, and that 9 of every 10 new hires work in branch offices. The growth factors, says Nemertes, are global expansion, employee attraction and retention, mergers and acquisitions, cost savings, and environmental concerns.

In the meantime, branch-office communications requirements are evolving to embrace collaborative applications, video, and Web 2.0 technologies. These developments are also placing greater performance demands on the branch office and WAN.

The enterprise trend toward data-center consolidation also continues. The consolidation efforts move most branch-office assets into data centers, largely to comply with regulatory mandates for centralized security and stronger control over corporate data assets.

Consolidating data centers while growing the branch-office population means that increasing numbers of remote employees access LAN-based business applications across comparatively slow WANs. With these applications growing increasingly multimedia-centric and latency-sensitive, IT and networking staffs are further challenged to keep remote application response times on par with the experiences of users situated locally to the company’s application servers in the data center. These local users enjoy multimegabit LAN speeds and are not affected by any distance-induced delay, unlike their counterparts at the other end of a WAN connection.

One way to address branch-office performance requirements is by integrating specific technologies for optimizing the WAN experience alongside other required branch-office networking functions within the Cisco Integrated Services Router platform. The Integrated Services Router packs all branch-office networking necessities, including WAN optimization, into a single compact, easy-to-manage platform. Cisco WAN optimization services coupled with the Cisco Integrated Services Router lowers networking total cost of ownership (TCO) for enterprises with growing numbers of branch-office sites.

Router Integration

The Cisco Integrated Services Router has evolved into the industry’s premier branch-office routing solution. It bundles all the networking capabilities required for a remote site into a single device:

- Local Ethernet switching
- Wireless LAN switching
- WAN access routing (both terrestrial and wireless WAN/third-generation [3G] cellular)
- Voice

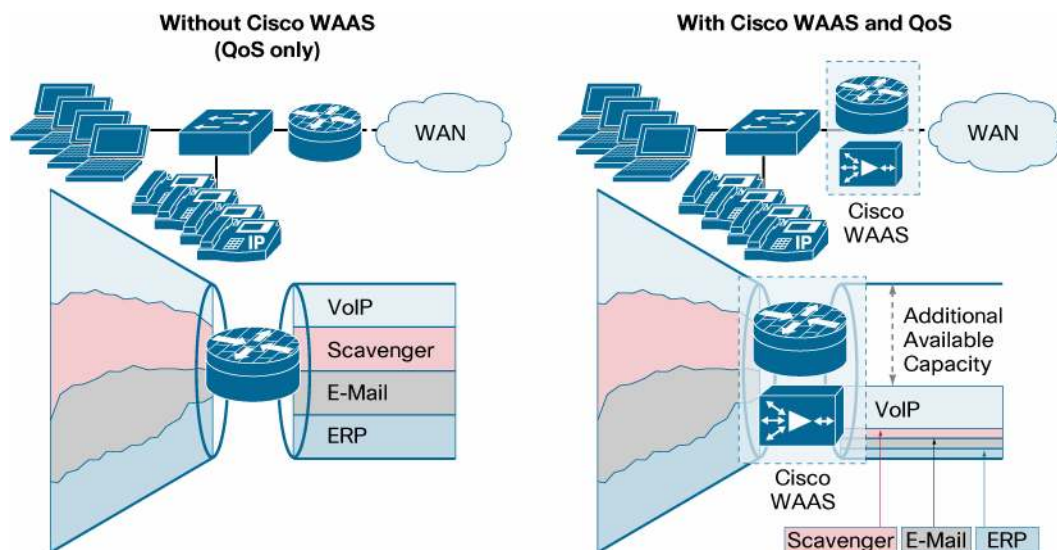
- Security
- WAN optimization

The term “WAN optimization” refers to a collection of capabilities that hone the performance of applications written for high-speed LANs when they are accessed across lower-speed and latency-prone WANs. In the Cisco portfolio, Cisco Wide-Area Application Services (WAAS) provide a rich set of WAN optimization capabilities. Among the WAAS functions are advanced data redundancy elimination (DRE), caching, application-specific protocol acceleration, and TCP flow optimization (TFO), all of which accelerate application response times by alleviating WAN traffic loads and congestion. You can implement these features using a physically integrated module in the router or an appliance colocated and logically integrated with the router. Content distribution and caching also help improve client performance by keeping the transmission of validated data within the branch office so that user response times feel “local”.

In addition, Layer 7 application-specific protocol proxies enable local processing of client-server protocol messages by the WAAS module, alleviating what would otherwise entail thousands of messaging round trips when executing such applications as the Microsoft Common Internet File System (CIFS) over the WAN, which introduces latency into the process and lowers performance.

In addition to improving performance, lightening WAN traffic loads and reducing the number of round-trip protocol messages might enable you to postpone investments in additional WAN bandwidth by freeing capacity for new business-critical application traffic, such as voice over IP (VoIP). Many Cisco customers have been able to justify implementing VoIP or have improved existing VoIP quality by deploying Cisco WAAS. Cisco WAAS reduces congestion on the WAN, and the router identifies VoIP traffic and prioritizes it as business critical even while compressing and forwarding other bulk traffic types (refer to Figure 1).

Figure 1. Cisco WAAS Facilitates Enterprise VoIP Deployments by Easing the Contention for Available Bandwidth Resources and Complying with Network-Based End-to-End QoS

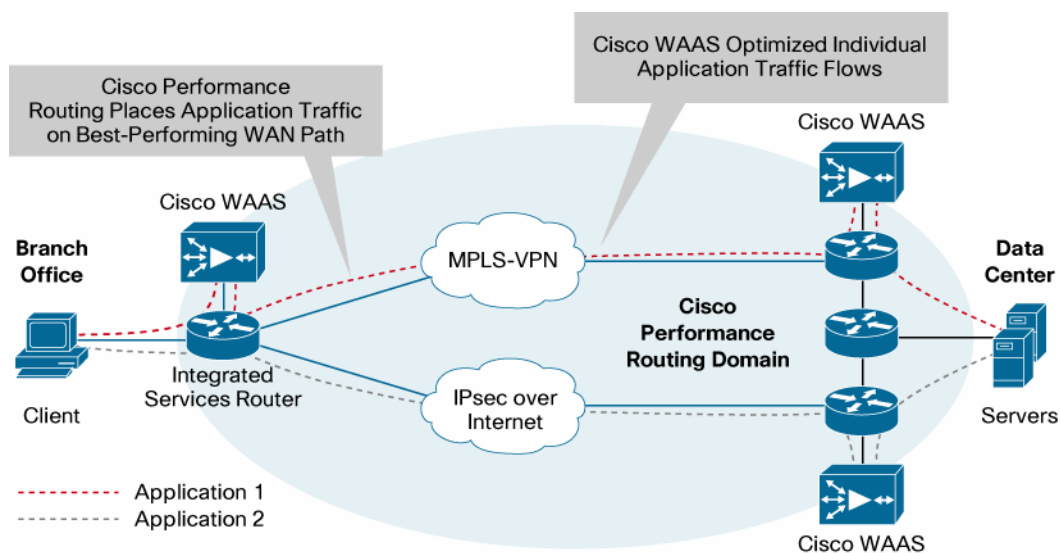


Cisco WAAS + Cisco IOS Software

The Cisco WAAS module embraces the various WAN optimization services described and works in close conjunction with Layer 3 performance optimization, monitoring, and quality-of-service (QoS) network services embedded in Cisco IOS® Software, the router operating system that runs on the Integrated Services Routers. The Cisco WAAS module has hardware, software, and processing resources dedicated to it—so as not to detract from the operation and performance of other networking capabilities bundled into the common housing.

Among the inherent Cisco IOS Software tools in the Integrated Services Router is intelligent, application-aware selection of the most desirable Internet route, a capability called Cisco Performance Routing. Rapidly changing conditions on the enterprise WAN create scenarios where it is desirable for specific applications to be routed on a link with higher security, lower cost, lower latency, or higher priority (QoS). The Cisco IOS Software-based Performance Routing engine facilitates this flexibility. Route, or path, optimization is applicable at sites configured with two or more access connections. It dynamically chooses the optimum route based on variables other than just the shortest path—the criterion used by standard routing algorithms—by correlating real-time data on latency, packet loss, link usage, reachability, throughput, and link cost (refer to Figure 2).

Figure 2. Cisco WAAS and Cisco Performance Routing Work Together with Advanced Cisco IOS Software Features to Deliver an Optimized WAN Experience for the Branch Office



With advanced performance monitoring, network accounting (NetFlow), and transparent WAN optimization capabilities, administrators have deep insight into what traffic is on the network, and the network can respond to provide optimum performance.

From there, deep-packet inspection and related traffic classification and QoS tools built into Cisco IOS Software allow network administrators to assign actions to specific traffic flows so that they behave in a certain way. For example, administrators could configure an action to guarantee a minimum amount of bandwidth for a certain class of application traffic (such as voice and Citrix sessions) or set a ceiling on the maximum volume of WAN bandwidth that any particular application or protocol (such as peer-to-peer traffic) can consume.

All these capabilities work together to make the remote user's application experience like that of the local user. A technology called Web Cache Communication Protocol Version 2 (WCCPv2)

facilitates synchronization of Cisco IOS Software features and Cisco WAAS services. WCCP redirects traffic from the router to the WAAS module and back. If the WAAS module suffers an impairment, WCCP—a stateful protocol—bypasses the module and passes traffic directly to the WAN to preserve connectivity and user sessions.

As mentioned, you can also deploy Cisco WAAS in inline mode using an external appliance to allow for full WAN optimization capabilities without changing the configuration of the router. If the appliance stops working for any reason, it defaults to “fail-to-wire” mode for continued uptime. The appliance simply continues to pass traffic to the router and the session stays live, albeit without the benefit of the WAN optimization functions.

Cost Reduction

The integration of networking functions in the Integrated Services Router allows IT organizations to install and manage a single device at each branch-office site. This setup affords numerous cost-reducing benefits and capabilities:

- Cisco Integrated Services Routers that support Cisco WAAS and the other branch-office networking technologies described can be easily preconfigured and shipped to each branch office. This approach reduces IT staff travel and installation costs for the enterprise.
- An integrated WAN optimization and routing solution reduces the need to train staff already familiar with the router management interface: you can configure and manage the WAAS module on the integrated services module from the Cisco IOS Software command-line interface (CLI), while advanced multi-site monitoring and management via the Cisco WAAS graphical management interface is also preserved.
- Integration provides service transparency, meaning that Cisco WAAS capabilities deploy without the use of tunnels. Tunnels modify the sender’s and receiver’s source and destination IP addresses and TCP port numbers to identify the WAN optimization endpoints. Transparency, then, is an important Cisco differentiator, because you can preserve existing policies for QoS and security without re-architecting your enterprise network. Transparency also helps your organization maintain visibility of individual traffic flows and measure the net benefit of WAN optimization on individual applications.
- With an integrated device, you have fewer devices to manage and fewer user interfaces to deal with. Troubleshooting faults and errors is easier with integrated technology as compared to overlay appliances.
- There is one service warranty on the whole Integrated Services Router platform. Software upgrades are included for all modules under that contract, making them easier to manage and less expensive to procure.

Conclusion

WAN optimization and application acceleration are growing requirements in today’s enterprises, which comprise increasing numbers of branch-office sites and remote users but consolidate application and data storage resources for regulatory compliance reasons and cost savings. By some estimates, 70 to 90 percent of enterprise resources are now accessed by remote users across a WAN, which is slower than the LAN platform for which most applications were designed and introduces distance-based latency into the networking experience.

WAN optimization functions, however, are now available to alleviate WAN traffic loads, reduce application protocol message round trips, and cache critical data to make branch-office

application-access experiences “LAN-like”. Integrating these WAN optimization features, known collectively as Cisco WAAS, directly into branch-office multifunction Integrated Services Routers simplifies management, troubleshooting, and support contract problems, while also decreasing capital outlay costs.

Operationally and cost-wise, blending WAN optimization into the Integrated Services Router streamlines and simplifies configuration, deployment, and ongoing maintenance.

Equally important, alleviating traffic loads on the WAN using Cisco IOS Software and WAAS services in a Cisco Integrated Services Router module frees capacity to accommodate new business-critical application traffic, such as voice.



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