New technologies meet the growing demand for network performance by optimizing the use of existing bandwidth.

Executive Summary
The increasing reliance of modern enterprises on high-bandwidth applications and cloud services creates a new challenge for operators of wide area networks (WANs). These networks, which are used to interconnect branch offices and data centers around the world, must bear the burden of carrying high-volume traffic with low latency. Similarly, local area networks (LANs) that carry traffic over smaller areas, such as an office building, also face bandwidth demands from advanced applications.

Simply increasing bandwidth to meet an enterprise’s needs often requires a significant financial investment. Network optimization technologies allow entities to avoid these costly investments by making better use of existing bandwidth and allowing organizations to deliver applications and cloud services more efficiently.

WAN optimization technology uses data deduplication, traffic prioritization and other techniques to facilitate the efficient transmission of high-priority data. Application optimization methods attempt to reduce the amount of data generated by applications in the first place by implementing server and application improvements. These technologies allow the enterprise to better leverage network links and postpone bandwidth upgrades.
The Situation
Around the world, networks are undergoing significant changes due to the evolution of both business processes and usage patterns. This evolution often results in network growth that greatly exceeds past performance requirements. Organizations are required to take action to meet modern networking needs.

As enterprises adopt cloud computing, enterprise video, mobility and desktop virtualization tools, individual employees require more network bandwidth to get their jobs done.

Server virtualization has transformed enterprise data centers by consolidating hardware and paving the way for outsourced solutions (such as Infrastructure as a Service, or IaaS). Virtualized servers now regularly move from enterprise data centers to cloud providers.

The networks that will support the next generation of computing must dramatically differ in design and implementation if they are to efficiently meet enterprise requirements. WAN optimization provides network architects with an important tool in the battle to regain control of the network. In fact, according to research conducted by CDW, organizations will seek more outside help from third parties when it comes to implementing WAN or application optimization solutions compared with other networking elements.

The Trend Toward Cloud Computing
The increasing use of cloud computing is a significant contributor to the changing nature of network communications. Network traffic shifts from internal to external connections as users interact with applications either hosted remotely by Software as a Service vendors or maintained on IaaS solutions by internal IT staff. Branch sites connected to a central office by WAN links discover that an increasing volume of network traffic is destined for locations other than the home office. As patterns of use change, wide area networks are becoming wider every day.

From a routing perspective, the networks supporting cloud computing must be able to respond to a dynamically changing network environment. The network must adapt as conditions and applications change to provide high-bandwidth, low-latency connections to cloud providers. Achieving this goal requires making informed, intelligent routing decisions that may change from minute to minute.

Technology consumers now expect intelligent, robust networks that are available whenever and wherever they are needed. In order to meet these expectations, network providers must retool networks so that they implement WAN optimization technology in a manner that is transparent to the application. Indeed, as cloud tenants place increasing demands on their hosts, providers must also ensure that their networks can handle the traffic. Many are employing application delivery controllers to optimize this flow. This practical approach simply extends the capability of currently deployed IP routing technology to better support the widening WAN.

Optimization Solutions
A variety of solutions are available to use existing bandwidth more efficiently by optimizing the WAN, applications or both.

WAN Optimization
WAN optimization relies on a group of related technologies dedicated to improving the efficiency and speed of data transfer across WAN links. These technologies boost performance, eliminate redundancy and optimize network configurations to meet the prioritized needs of the enterprise:

- **Data deduplication** is a core WAN optimization technique. Systems implementing this technology remove redundant copies of the same data from storage or network transmission. This reduces network bandwidth requirements by eliminating the need to transmit the same data multiple times. Data deduplication may occur at either the file or block level, depending on the vendor implementation. Consider, for example, a large email attachment sent to multiple people across all branch offices. When using data deduplication technology, the file transmits once to each branch office, rather than once to each user.

- **Traffic prioritization** adjusts the precedence that network equipment gives to traffic based on a set of business rules. These rules may specify traffic priorities based upon the application in use, the user, office location, time of day and other criteria.

THE BENEFIT OF MODIFYING TRAFFIC FLOWS
Networking professionals have the ability to leverage Big Data about network operations in order to tune performance.

Network flow solutions capture network connection information at a granular level of detail, answering the following questions:

- Which systems communicated with each other?
- When did the communication take place and for how long?
- What protocols and applications generated the traffic?
- How much information did the systems exchange?

With the use of application recognition technology, such as Cisco’s Network Based Application Recognition (NBAR) and NetFlow flow technologies, IT professionals gain insight into network flow information.

Cisco’s Performance Routing technology then uses this information to actually modify future network flows based upon current network performance and the organization’s network priority policy. For example, NBAR users may automatically classify streaming video, music and gaming services as low-priority applications and restrict them to “best effort” delivery or block them entirely.
**The Intelligent WAN**

The Intelligent WAN (IWAN) combines WAN and application optimization techniques to deliver quality branch–office connections over any transport medium. Using IWAN technology allows an organization to replace costly site–to–site connections with less expensive and easily provisioned Internet links. IWAN technology ensures the secure, efficient use of all circuit types, automatically routing application traffic over the most appropriate connection.

IWANs provide IT departments with unprecedented insight into network traffic as well as policy–based control over the user experience. Organizations adopting IWANs not only know more about their network traffic, they are able to shape the end–user experience to match the organization’s business priorities.

To learn more about the capabilities that an IWAN can deliver along with WAN evolution, read “Evolving Technology and Network Choices” by CDW solution architect and blogger Aaron Pilcher and “The Evolution of WAN Optimization” by solution architect and blogger Nacho Vega.

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**Application Optimization**

While WAN optimization technology improves the efficiency of WAN data transport, network administrators have an additional opportunity to exploit efficiency at the application layer. Application optimization techniques reduce the amount of information transferred by applications. As a result of reducing application data output, these techniques also reduce the burden on the WAN and allow WAN optimizers to transfer the remaining data more efficiently. Simultaneously, application optimization reduces the load on application servers and improves end–user response time.

These optimization technologies work at both the server level and the presentation layer, providing application–specific performance improvements designed to increase application efficiency:

- **Cache control** technology stores copies of frequently requested data on an application optimization solution, reducing the burden on the server by eliminating redundant requests.

- **Compression** may take place at the application layer; for example, through HTTP’s SPDY (“speedy”) protocol. Application optimization solutions may assess the quality of a connection and apply compression when it will have the most benefit, such as over a low–speed connection, but avoid using this compute–intensive process when the benefits would be negligible.

- **Content minification** strips content down to its bare minimum. For example, a JavaScript minification process removes programmer comments, white space and other irrelevant data from web content prior to transmission, reducing the burden on the WAN.

Application optimization technology provides IT professionals an opportunity to enhance the end–to–end user experience, accelerate performance, improve security and facilitate application management. It consists of a set of tools and techniques that work together to provide these benefits to end users, improving the delivery of virtualized and traditional enterprise applications over WAN links.

**Vendor Implementation**

Several types of vendor solutions implement these WAN optimization techniques. Vendors will often combine WAN and application optimization technology into a single product:

- **WAN accelerators** perform data deduplication along with compression and data caching to reduce the number of bits that traverse expensive WAN circuits. These devices may be found in both physical and virtual appliance implementations.
WAN AND APPLICATION OPTIMIZATION

- **WAN optimization controllers (WOCs)** sit at both ends of a WAN circuit and work to improve performance. Unlike WAN accelerators, WOCs do not try to improve the configuration of the WAN itself. Instead, they optimize the performance of specific protocols. For example, a WOC might perform HTTP caching to improve the performance of WAN-based web applications.

- **Application delivery controllers** reside on the data center side of a WAN connection and encapsulate services commonly requested over the WAN. They primarily serve as load balancers, moderating access to a set of application servers. They go beyond typical load balancers by adding business intelligence to load balancing decisions. For example, the F5 Application Acceleration Manager adds compression, minification and other optimization techniques to its core load balancing function.

Enterprise IT teams may apply one or more of these products to improve the performance of WAN links without investing in additional bandwidth.

CDW: A WAN Optimization Partner That Gets IT

CDW solution providers offer WAN and application optimization products and services designed for every unique enterprise-computing environment. A dedicated team of CDW account managers, solution architects and advanced technology engineers stand ready to assist customers at every phase as they select and implement the technology needed to prepare their networks for the next generation of computing. The team also offers data-center evaluations that provide customers with insight into increasing operational efficiency.

To learn how CDW’s WAN optimization solutions can help deliver the perfect mix of network speed, scale and simplicity, contact a CDW account manager, call 800.800.4239 or visit cdw.com/wanappopt.

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Citrix® NetScaler® is an all-in-one web application delivery controller that makes applications run five times better, reduces web application ownership costs and makes sure that applications are always available. It is deployed in thousands of networks around the globe to optimize, secure and control the delivery of all enterprise and cloud services and maximize the end-user experience for all users, including mobile clients.

The performance of your website and applications sets the pace at which your organization operates. Improve performance and you can increase worker productivity. F5® Application Delivery Optimization solutions help you achieve top performance by making your network and applications work faster, use fewer resources and operate more cost-effectively. With F5, you can improve web application performance, speed replication between sites, keep mobile users happy, scale your data center and secure access to applications and data from anywhere.

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