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THE ULTIMATE GUIDE TO GAINING CONTROL OF THE WAN

Today's businesses rely on wide area networks more than ever before, placing unprecedented demands on geographically dispersed networks that must function 24x7. This ebook explains the drivers leading to the WAN's critical role and examines the strategies and technologies you can employ to manage traffic, increase performance and get costs under control, whether you do it yourself or use a service provider.

TechTarget
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CHAPTER 1

WAN investments that save money

Many of today's cost-saving IT projects are placing excessive pressure on the WAN. Learn how to overcome these challenges with WAN optimization technology. **BY ROBIN LAYLAND**

→ **THE COMING YEAR** looks to be a tough one, with network managers and their budgets under extreme pressure. IT must prove its worth more than ever before and come up with ways to save money and increase productivity. This can be approached in several ways. Strategies include consolidating servers from branch offices to the data center; using the latest version of desktop virtualization; increasing multimedia and video collaboration; moving applications to the Web with service-oriented architecture (SOA); and using Software as a Service (SaaS). They are all good ideas and can save significant amounts of money. In the current economic climate, enterprises are most likely considering one or a combination of these technologies.

The wide area network (WAN) becomes even more important than usual for an enterprise because every one of the above ideas requires a robust WAN. The problem is that these technologies put pressure on the WAN when resources for it are tight. WAN managers will have to invest in their WAN in 2009 to handle these new demands, but they must do it intelligently. Throwing money at the problem in the form of bandwidth upgrades is not the answer. There is little extra money to be found, and if there were, that method is not the best solution. There are better ways to support WAN-intensive projects.

CONSOLIDATING BRANCH OFFICE SERVERS

The most common and biggest money-saving project that enterprises are embarking on is server consolidation. Moving branch office servers to a central data center saves money in many ways. The first is by reducing hardware cost. Branch office server utilization is generally below 25%, and there is little that can be done to improve that. Moving several servers to the data center and using virtualization software allows multiple branch office servers to be consolidated into one physical server. Consoli-

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dating servers saves on hardware cost and software licenses and provides a greener and lower-cost solution because it requires less power and cooling. It also makes maintenance easier because all the servers are located in one place. Disaster recovery becomes easier, as well, because the servers easily fit into the data center's disaster-recovery scheme, rather than being dispersed. Overall, consolidating branch office servers in the data center is a winner and a trend that will become even more common in a down economy.

The problem with a consolidation project is its effect on the WAN. Data that was local to the user and retrieved over a high-speed local area network (LAN) now must cross the WAN. Normally, this means that bandwidth must be increased. But even with increased bandwidth, there can be response-time problems that speed alone will not solve. The main problem is the Common Internet File System (CIFS), the protocol Microsoft uses to allow programs to make requests for files and services on remote computers. Initially, it was very inefficient over the WAN. For example, when CIFS downloaded a file, it asked for a block of data and then waited for an acknowledgment before asking for the next block of data. This inefficient protocol was not a problem over a LAN because it involved almost no latency. Over the WAN, it created a slow start-stop process, which greatly increased file download time. Recent improvements to CIFS allow it to ask for multiple blocks of data at once, increasing its efficiency. That has not completely eliminated the start-stop process over the WAN and long downloads, however.

Another problem that server consolidation introduces is the effect on some of the services that the servers provide to local users. Local servers provide Dynamic Host Configuration Protocol (DHCP), domain name system (DNS), and activity directory services and support printing to local printers. Moving these services to the data center does not enhance them or provide any significant benefit and instead can introduce problems. If the link to the data center is down, then branch office users are prevented from performing any networking functions. Even if there are still local servers or alternate routes to the Internet, users can't take advantage of them without DHCP or DNS. Having a good backup path in the WAN is an important strategy, and if problems do occur it will be necessary to have DHCP and DNS functions locally. Even if the link is up, routing a print job to the data center and then back

The problem with consolidation is its effect on the WAN. Data that was local on a high-speed LAN must now cross the WAN.

to the branch office's local printer is a waste of resources.

However, these problems and their impact on the WAN or local services are not reason enough to stop server consolidation when the total cost savings picture is considered. Instead, WAN managers must find ways around the problems.

OVERCOMING SERVER CONSOLIDATION CHALLENGES

The answer is acceleration and optimization. This is accomplished with devices commonly referred to as WAN optimization controllers (WOCs). WAN optimization is a symmetrical solution, which means a WOC must be installed in each branch office and in the data center. The WOC in the data center supports multiple branch office WOCs, with the exact ratio of branch office devices to data center devices depending on the capacity of the data center WOC.

WAN optimization solves data center problems with a combination of technologies. The need for increased bandwidth is solved by compressing data using a technique commonly referred to as dictionary compression. Dictionary compression can easily reduce the amount of data sent by a factor of five to 10 times, with reduction rates as high as 20 to 30 times. Lines running at 75% capacity can be reduced to less than 10%. Server consolidation bandwidth requirements can fit within the existing bandwidth. This is not hype; independent industry tests and user experiences have confirmed that these rates and reductions are possible.

Dictionary compression achieves its high reduction rates by learning patterns in the data and substituting

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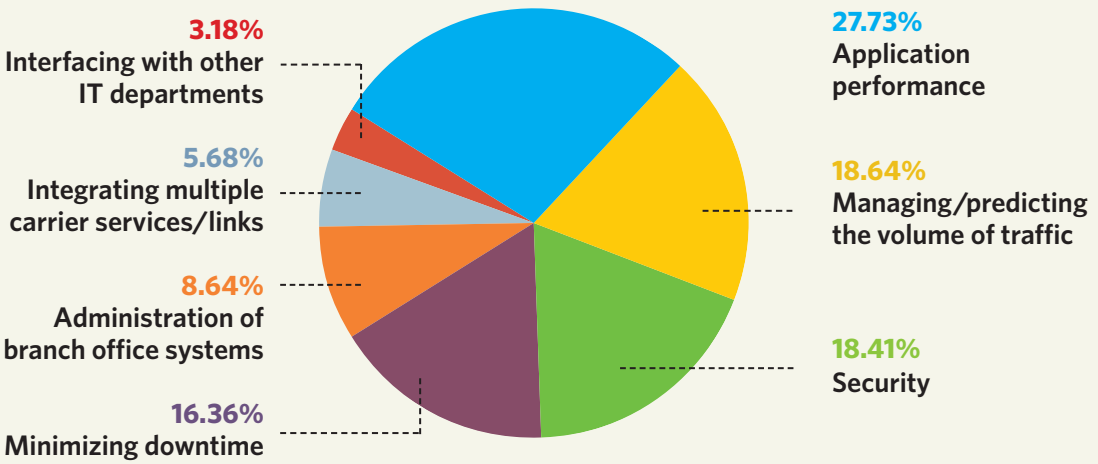
WHAT'S THE MOST CHALLENGING ASPECT OF WAN NETWORKING?



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a reference number for the patterns. As data is passing through the WOC, it breaks the data into a series of patterns and stores them, creating a dictionary of patterns. When the next message comes through, the WOC checks to see whether any of its stored patterns matches patterns in the message. If it finds them, the WOC removes the patterns and substitutes reference numbers in their place. The WOC on the receiving end removes the reference number and replaces it with its copy of the pattern from its dictionary. The patterns do not have to be exchanged between the two WOCs because they are learning and storing the exact same pattern, using the same reference number independently.

WAN managers must carefully understand how appliances handle SSL traffic to ensure it is the best fit for their environment.

For example, if a user retrieves a file from a server that he accessed the day before, then the WOC need only send a series of reference numbers. That's because the file was turned into a pattern the first time it was retrieved. If a section of the file has changed since it was last retrieved, then the WOC sends the reference numbers for the part that hasn't changed, along with the small part that has. This example uses the same file but the patterns can come from other messages as well; the WOC uses its entire dictionary of patterns to find a match. Replacing patterns with reference numbers also reduces the number of packets sent over the network because the WOC can bundle reference numbers from multiple packets into one.

Dictionary compression works only on uncompressed data or un-encrypted data. There is no reduction with video and voice since those media are already compressed. The best action for WAN optimization is not to waste time trying to compress it.

HANDLING ENCRYPTED TRAFFIC

Encrypted data, such as SSL traffic, is too random and a poor candidate for compression. Most WAN optimization appliances get around this problem by first un-encrypting the SSL traffic, compressing it and then re-encrypting it. The two endpoints never know this happens and thus require no changes. How the WOCs perform the de- and re-encryption differs from vendor to vendor. WAN managers must carefully understand how appliances handle SSL traffic to ensure it is the best fit for their environment and works with their key management system.

Reducing the size of the data generated by server consolidation solves only part of the problem created by server consolidation. Response time is still affected by the inefficiencies of

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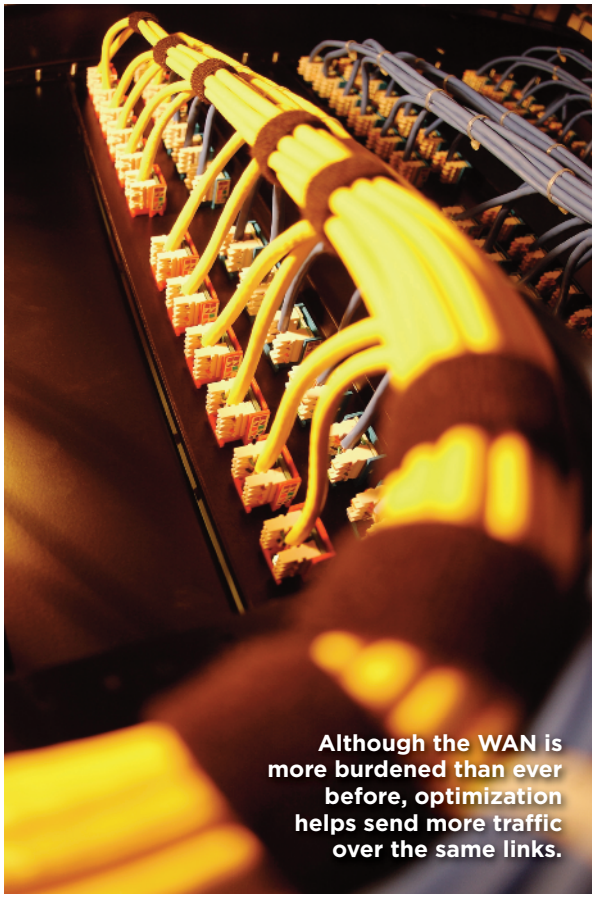
the CIFS protocol. WOCs solve this problem by optimizing CIFS. CIFS works as an end-to-end protocol between the application running on the user's PC and the Microsoft server. WOCs optimize it by first breaking the end-to-end nature. The WOC in the branch office acts like the server to the user's PC, and the WOC in the data center acts like the user to the server.

An example best demonstrates how this will improve response time. When a user requests a file, the server sends several blocks of data to the PC. After the PC has received the blocks of data, it sends an acknowledgment back to the server, which tells the server to send the next block of data. The latency of the WAN causes the file to take longer than it did over the LAN because the server has to wait a lot longer for the acknowledgment to make its way back. The WOC overcomes this problem by stepping into the middle of the process. When the PC requests the file, the WOC passes the request to the server. The server then sends the blocks to the WOC, which immediately passes them onward to the PC. But at the same time, the WOC immediately sends an acknowledgment back to the server, acting as if the PC has already received the first blocks. This causes the server to immediately send the next blocks of data.

The process continues, with the data center WOC quickly getting the entire file and sending it on to the WOC at the branch office. The WOC at the branch office sends the first block of data to the PC, which sends an acknowledgment. Instead of passing this acknowledgment back to the server in the data center, the branch office WOC sends the next block of data, acting as if it is the server. The



Although the WAN is more burdened than ever before, optimization helps send more traffic over the same links.

key is that the two WOCs are keeping the acknowledgments local and quickly receiving and sending the blocks of data. This improvement can make files appear to be local to the user, solving the response time problem of moving servers to the data center.

The final major hurdles for server consolidation are the services, including DHCP, DNS, active directory and local printing. WAN optimization ven-

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dors have either engineered their own versions of these servers or partnered with Microsoft to achieve this functionality. Most WOCs can act as if they are Microsoft servers for these functions, keeping them local. Since each vendor's implementation is unique to its product, WAN managers need to understand how they fit within their environments.

VDI AND HTTP

WAN optimization also solves the problems associated with implementing virtual desktop infrastructure (VDI) and Web-based applications. The major problem with VDI, the practice of hosting a desktop operating system within a virtual machine running on a centralized server, is that large amounts of data must be transferred quickly over the network. That problem is solved by dictionary compression.

Object caching combined with dictionary compression reduces the bandwidth impact and greatly improves response time for Web/HTTP traffic. Web pages are based on objects; each item on the page is an object. Rich media objects make Web applications appealing to users, but they generate significantly more data than the client/server applications they replace. WOCs can reduce the impact of these rich objects, because it is common for the same object to be used on multiple pages or accessed frequently by the same users.

The WOC stores a copy of the object, and when a page requests an object that the WOC already has in its cache, it sends its copy. This also addresses an HTTP protocol efficiency that has an impact on response time. The Web application may serially request the object as it builds a page. It waits until the first object is received before asking for the next object. Because the objects travel over the WAN, the WAN latency increases the page's response time. Using the objects in the WOC's cache mitigates the problem because the WAN latency is removed.

Overcoming Web and VDI challenges means enterprises can move ahead with money-saving projects and productivity-enabling applications, in many cases avoiding bandwidth upgrades. Response time problems are eliminated.

COLLABORATION AND VIDEO ON THE WAN

The current tight economic times mean businesses must be more productive. Collaboration is a proven productivity and creativity enhancer. The problem with face-to-face collaboration is that traveling for live meetings is both expensive and a time waster. The solution is more collaboration using the WAN.

Unified communications, including collaboration and conferencing tools, can provide enterprises with significant cost savings and an increase in worker productivity but create more traffic on the WAN. The effects of tools such as Web conferencing,

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social software, document sharing, whiteboarding and team workspaces can be managed using WAN optimization. Collaboration using video must be treated differently, however.

Telepresence, with its high-definition video, allows meetings over the network to have the same look and feel as being there. Even lower-resolution video conferencing is better than a traditional phone call. Collaboration puts a premium on a high-functioning WAN. There is no way to avoid upgrading WAN bandwidth to support telepresence because it requires megabits of bandwidth. Dictionary compression and protocol improvements do not help with video. Video is already compressed as much as it can be, and there are no problems with the protocol used.

WAN optimization can help if an enterprise is using video that is static rather than real-time collaboration. Some WOCs have limited content delivery networking (CDN) functions built in and can store video locally. Thus, when multiple users view it at different times, the video doesn't have to be resent over the WAN each time. This helps primarily with video such as training and corporate announcements. Another feature found on WOCs is the ability to know whether several people at a site are watching or participating in the same video stream. The data center WOC will send only one stream to the WOC at that site, and then the local WOC sends the stream to each of the viewers.

Collaboration puts a premium on a high-functioning WAN.

The reality is that WAN optimization can do little to reduce the impact of video on the WAN. If a real-time collaboration project including video is planned, WAN managers must be sure that necessary bandwidth increases are part of the proposal. The primary challenge is to support all the traffic generated by collaboration without affecting other mission-critical business traffic. ■

ABOUT THE AUTHOR

Robin Layland is President of Layland Consulting. As an industry analyst and consultant, Robin has covered all aspects of networking from both the business and technical side, and has published over 100 articles in leading trade journals including *Network World, Business Communication Review, Network Magazine* and *Data Communications*. Prior to his current role, Robin spent a combined fifteen years at American Express and Travelers Insurance in a wide range of jobs including network architect, technical support, management, programming, performance analysis and capacity planning.

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About Exinda Networks: Exinda Networks is a global supplier of WAN optimization and bandwidth shaping solutions that help organizations achieve predictable application performance. Founded in 2002, Exinda facilitates optimal and consistent application performance over the WAN. Exinda integrates traffic visibility by application, bandwidth shaping, application acceleration and application response measurement into a single appliance. Exinda has helped more than 2,000 customers worldwide to reduce network operating costs by eliminating the need for expensive bandwidth upgrades.

CHAPTER 2

Leveraging WAN resources with skillful WAN management

Discover why application awareness and comprehensive monitoring are critical to ensure your WAN is functioning optimally and to its fullest capacity. **BY ROBIN LAYLAND**

→ **BANDWIDTH NEEDS CONTINUE** to increase exponentially as enterprises add more applications to their WAN traffic. And while bandwidth is not as expensive as it once was, adding bandwidth will be a last resort when budgets are tight. In many cases, additional bandwidth will not help applications perform better, so proactive management of the WAN, and the applications traveling on it, is a much better option. Careful planning and prioritization will ensure that the WAN is functioning optimally and that its capacity is used to the fullest.

BANDWIDTH MANAGEMENT

In Chapter 1, we discussed the addition of real-time video over the WAN. Although WOCs in this case may not actively compress or accelerate video traffic, WAN optimization can play a critical role in making sure video does not adversely affect other traffic. It also can ensure that voice traffic meets latency requirements and protects critical traffic from non-business traffic. To do this, WOCs use a combination of bandwidth management and quality of service (QoS).

Few businesses want to prohibit employees outright from accessing recreational sites such as YouTube and using peer-to-peer protocols. If bandwidth utilization is low when an employee is visiting these sites, the best policy may be to allow it. Bandwidth management allows WAN managers to set this as a realistic policy. When bandwidth is tight, bandwidth management can throttle recreational traffic or block it, preventing it from adversely affecting business traffic. Combined with QoS, policies can guarantee that even when recreational traffic is allowed, it receives the lowest quality.

There are issues involved with effective bandwidth management. The first is that the WOC must be able to classify traffic at the applica-

tion level. Business and consumer Web traffic all use the same ports, and some non-business applications constantly change the port they use to hide themselves. Therefore, bandwidth management must look beyond the port to understand the application. This requires efficient deep-packet inspection (DPI) combined with the ability to process results to determine what the application is. This function must also be updated constantly. New applications are constantly being invented, especially in the consumer arena. If the WOC is not updated, it will not know how to limit or block a new bandwidth-hungry non-business application.

Classification without policies is meaningless. Knowing what the application is doesn't help if the WOC does not know how to treat the traffic. WAN managers should look for an optimization solution that provides a good set of common rules for managing traffic. The ability to easily customize these rules and policies is also important.

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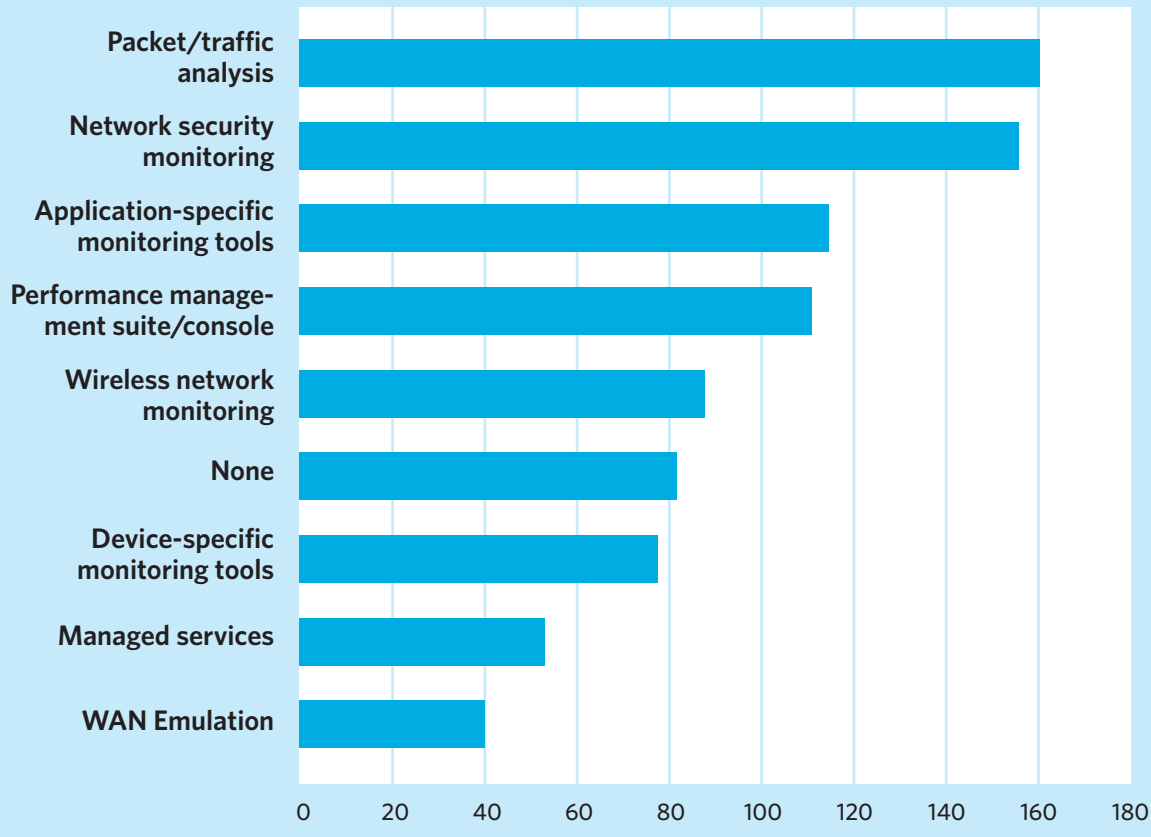
WHICH OF THE FOLLOWING TECHNOLOGIES WILL YOU INVEST IN TO MEASURE APPLICATION PERFORMANCE ON THE WAN IN THE NEXT 12 MONTHS?



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WAN VISIBILITY

Managing a WAN is always important, but with more traffic and smaller budgets it becomes even more important. It is critical that managers understand which applications are using the WAN. Not knowing means that the manager will not be able to apply the right rules for bandwidth management or QoS. WAN monitoring must evolve from simply reporting on traffic at the port level to reporting which applications are using a port. Knowing how much traffic is flowing over port 80 (HTTP) does not tell the manager very much. Is the traffic business or non-business? What are the business applications? Even knowing that it is SAP or Oracle traffic is not enough. Managers need to know the specific SAP application and, in many cases, the type of transactions within the application in order to ensure that the important ones get priority. Existing monitoring and reporting schemes must be upgraded to meet this challenge.

Application focus is not the only change WAN managers should make to their monitoring. Service-oriented architecture (SOA) and the increase in the number of gateways and security appliances are complicating the existing monitoring architecture. The change is best demonstrated by looking at response-time monitoring.

In the past, understanding response time was conceptually easy. A monitor was placed at the WAN router. When a response-time problem occurred, the WAN manager determined which side of the router it was on. If it was on the WAN side, the problem was on the WAN; if it was on the server side, it was time to call the application group. While this approach was not 100% accurate, it identified the main problem area in the majority of cases.

Today, there are complications upsetting this scheme. The first is the increasing number of appliances and gateways. The list of security services and appliances that data must pass through is growing. The security list includes a Web firewall, application firewall, XML firewall, data loss prevention appliance, antivirus device and intrusion prevention systems (IPS). Adding to the list are application gateways for XML, email and other gateways, plus the networking group's WOC. If all these devices can affect how applications perform, and many are managed by different groups than the servers and applications they protect, determining where the response-time problem is requires knowing whether one of these devices was the culprit and often requires the application, security and networking teams to communicate about performance issues to pinpoint the problem.

MANAGING SOA

Further complicating monitoring life are applications written using an SOA framework. One of the important ideas behind SOA is that a single application does not have to perform all the processes required to generate a response. An example best illus-

trates the concept. A user generates a request to the application server. This master application was written to call on three other applications that respond with information that the master application combines.

Securing the WAN is more challenging as the WAN becomes more flexible and applications and their associated threats increase.

With SOA, the master application does not have to know where the other applications are being performed, it just issues the call. The other applications can be in the same server, another server in the same data center, or a server in a data center on the other side of the world. For this example, assume that one of the applications is on the same machine, but the other two are on servers in data centers that are reached across the WAN. When the master application issues the call, SOA generates messages to the other two servers. When they respond, the master application puts together a response.

The user in the example calls Operations and complains about response time. Operations can check the WAN link and the server in the data center where the master application is running and resolve any issues that are found. If nothing shows up, the problem could be in the secondary servers or the WAN links between those servers and the master application. Because the master application could not respond to the user until it got back all the information, the slow response from either the WAN between the data centers or the servers would cause the entire transaction to be slow. The problem is that Operations is unaware of the secondary transactions. Solving this problem requires greater coordination between network operations and the application groups, plus monitoring tools that can put it all together.

SECURITY

Securing the WAN is more challenging as the WAN becomes more flexible and applications and their associated threats increase. Firewalls and IPSs are still crucial, but their focus must move up to the application layer. New application firewalls are needed to ensure that unauthorized applications are not overwhelming WAN resources. Application firewalls look beyond the port number and understand the particular application, just as monitors and WOCs do. This allows them to block applications such as BitTorrent and Limewire music-sharing programs from using valuable WAN resources.

The WAN security architecture needs to take into account that not all traffic is destined for the data center. Traditionally, users primarily accessed applications at the data center, but

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with Software as a Service (SaaS) and the Internet, users are beginning to bypass the security infrastructure in the data center and go directly to the Internet from the branch office. This means that the Internet gateway's architecture must mirror the data center's security.

For example, to prevent sensitive documents from ending up in the hands of outsiders, many companies have installed data loss prevention (DLP) appliances in their data centers. A worker requesting a sensitive document from a server has to pass through a DLP device. The problem is that an authorized user can get a document and then send it to someone on the outside, bypassing the control in the data center. This means that any time the branch office directly connects to the Internet, the entire data center security arrangement needs to be duplicated. It doesn't necessarily mean just at the corporate Internet gateway; any branch office that has a direct connection to the Internet should have full security protection.

The coming year promises to create many challenges for the WAN. Cost-saving projects, along with projects to increase productivity, will affect the WAN. This makes the WAN even more important, but that also means that it must evolve to meet the new challenges. WAN optimization, new monitoring and management and security schemes are all part of the solution. ■

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CHAPTER 3

WAN optimization: Do it yourself, or choose a service provider?

Deciding to outsource your WAN optimization or keep it in-house is a complex decision. Learn the benefits and drawbacks of both to help make your decision. **BY MICHAEL MORISY**

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→ **WITH MORE AND** more critical applications running over the WAN, organizations must embark on WAN optimization deployments carefully. One of the first choices a WAN manager must make is whether to deploy WAN optimization in-house or to outsource it to a third-party service provider.

Today, only about 10% of IT organizations outsource the complex task of WAN optimization to third parties like an Internet service provider, according to Forrester Research. But Forrester predicts that this percentage could jump to 30% over the next two years —if those offering the services do the hands-on work necessary to provide the optimization that today's networks need.

IN-HOUSE EQUALS MORE CONTROL

When Walter Weber, IT director of Charlotte, N.C.-based process automation company R.E. Mason Co., began looking into WAN optimization strategies to boost speeds for his growing network of remote offices, he found little interest from service providers. His company's branch offices use different service providers for WAN connectivity, and those providers would have had to partner with each other to deliver WAN optimization.

R.E. Mason also maintains its own DNS and Web servers. Weber was more comfortable with optimizing the WAN on his own because he could keep more control of exactly how it was done, whether that meant a custom DNS configuration or specialized security protocols.

Rob Whiteley, a principal analyst and research director at Forrester, said the desire for such network control generally determines whether a company will consider outsourcing its WAN optimization.

Whiteley said that some companies, regardless of size or industry, are

happy to pass off the tricky business of managing optimization and caching techniques to whoever can deliver it.

"You have other companies that say, 'We view our network as a core asset, and we're going to manage it whatever the size,'" he said.

Whiteley has spoken with one major national bank, for example, which had held tight to strict compliance regulations while stitching together the networks of one acquisition after another.

The bank said ripping and replacing the customizations that had been put in over the years would have been a nightmarish task, particularly at a time when banks are not eager to spend extra capital.

BENEFITS OF HOSTED SERVICES

Still, for those without specialized needs, hosted WAN optimization can bring a variety of benefits. Choosing a managed option is often the less expensive because service providers can take advantage of economies of scale, Whiteley said. But not all offerings are created equal.

The key today, he said, is the equipment. Hosted WAN optimization without equipment on-site with the customer often delivers only marginal gains.

"A service provider can do [WAN optimization] as well as an enterprise or better if they're willing to put equipment on every single customer premise," Whiteley said.

Know your priorities

FOR ANY WAN optimization deployment to be effective, WAN managers must decide exactly what they hope to get out of their optimization efforts.

At R.E. Mason, caching techniques solved file latency issues and freed up sizable bandwidth because large files weren't being unnecessarily passed around. Content filtering was another selling point of the WAN optimization vendor Weber chose, Blue Coat. The feature let him block inappropriate content—important because one of the company's frequently used Web tools was one letter away from a pornographic site—and restrict recreational traffic.

WAN optimization generally addresses lack of bandwidth and latency, but products are including more features and their beneficial effects can be far-reaching. Major offerings, whether hosted or self-maintained, boast a variety of options that allow WAN managers to define policies at granular to meet their needs. —M.M.

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The on-premise equipment is essential, he said, because other methods of optimization—tweaking either the network or trying to centrally optimize information flow remotely—just do not deliver the performance customers demand, even if some techniques, such as improved routing, do offer marginally better performance.

Outsourcing WAN optimization can also help remove management headaches because network engineers can avoid having to juggle new classes of shifting variables, including adjusting settings each time a new networked application—whether authorized or not—is added.

"WAN optimization itself is a new technology, and people are nervous about new technologies," said Steve Capozzi, manager of managed WAN optimization services product marketing for Verizon Business. "Once people get into it, they realize it's a lot more intense and involved than they realize."

Verizon's offering, which gives customers a choice between Juniper and Cisco optimization platforms, is also designed to work across networks, so even if customers use both Verizon and British Telecom WAN services, for example, they can still see WAN optimization benefits globally. ■

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Manager of managed WAN optimization services product marketing for Verizon Business

ABOUT THE AUTHOR

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