A Better Approach to Branch Office Application Delivery

A TECHNICAL WHITE PAPER

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Introduction

THE RISING IMPORTANCE OF THE BRANCH OFFICE

Companies have a more distributed workforce than ever before. For example, today there are over 6 million branch offices and 30 million branch office workers in the U.S.[1] On a worldwide basis, there are over 23 million branch offices and 50 million branch office workers. Virtually all companies regard their branch offices as a key touch point with their customers and hence view these offices as critical to the success of their business.

>> Chatty Protocol

Chatty protocols require several communication exchanges in order to open a connection and transfer data. Chatty protocols are less efficient due to the increase overhead of the extra communication.

CIFS, which is used by many applications such as Windows drag and drop, is an example of a chatty protocol.

Branch office workers need access to the same applications (e.g., Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), and office productivity tools) as do workers in a headquarters facility. However, in most cases one or more of the applications that branch office workers need to access are hosted in a central facility, such as a data center. Because of the distance between a company's branch offices and the central facility that houses the applications, branch office workers experience significantly more delay in accessing an application than would an employee who worked in the central facility.

It is quite common that an application that performs well when accessed locally performs badly when accessed remotely. Two of the reasons for this include the use of a chatty protocol such as CIFS (Common Internet File System) as well as the congestion that typically occurs on the WAN (Wide Area Network). Figure 1 exemplifies the use of a chatty protocol over a WAN. When using a chatty protocol such as CIFS, tens or hundreds of round trips may be required to complete a single transaction. If the user is accessing the application locally, this is rarely a problem as there is virtually no delay in the LAN (Local Area Network) within a facility. However, given the delay associated with the WAN this is often a problem when the user is accessing an application remotely.

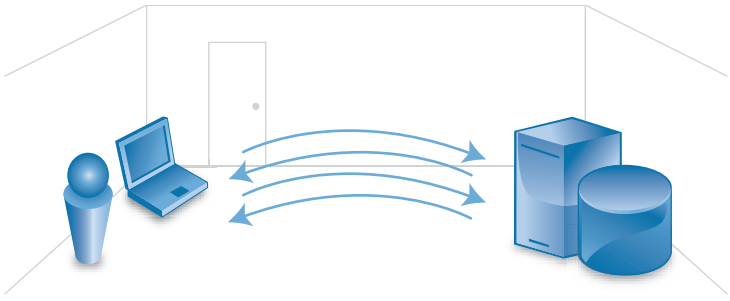

Figure 1a. Chatty Protocol
Chatty protocols are not an application performance problem when the end user needs to access an application or data from a server in the same building.

[1] Addressing Operational Efficiencies in Branch Offices, IDC, May 2006

Figure 1b. Chatty Protocol
Over great distances, the end user has to wait for all application messages to complete before proceeding. This dramatically impacts application performance and the result is slow end user experience.

>> Network Congestion

Condition where multiple traffic sources are competiting for the same share bandwidth resource creating a congested network environment. Congestion can lead to poor application performance due to dropped packets, slowed throughput, and high number of packet retransmissions.

Network congestion refers to a situation in which there is more traffic being offered to the network than the network can support. As a result of network congestion, application traffic is either dropped or significantly delayed. This situation seldom occurs when a user accesses an application locally because the typical LAN has tremendous capacity. However, because WAN capacity is a monthly recurring cost that increases with the speed of the WAN, the typical WAN has significantly less capacity than does the typical LAN. As a result, network congestion occurs frequently in the WAN.

Adding WAN bandwidth can resolve some of the performance issues that employees in a branch office face when trying to access an application. However, adding WAN bandwidth is unlikely to resolve all of the issues that are caused by network congestion. In addition, adding bandwidth cannot resolve the performance issues that are associated with using a chatty protocol over a WAN. This follows because those performance issues are a result of two factors—the speed of light and the number of information flows that are required to complete a single transaction. Neither of these factors is addressed by adding WAN bandwidth.

This white paper on branch office application delivery will:

- Describe some key factors that cause branch office applications to perform poorly over the WAN.
- Discuss why the traditional approach to resolving branch office application performance problems may not resolve the problems.
- Suggest a class of solutions that are designed to efficiently and effectively improve the delivery of applications to branch offices.

FACTORS THAT DRIVE POOR BRANCH OFFICE APPLICATION PERFORMANCE

Two of the primary factors that cause applications delivered to employees in branch offices to perform badly are the movement to distribute the organization's employees geographically and the simultaneous movement to consolidate IT resources into a small number of locations.

Globalization of resources

Over the last few years there has been an accelerating trend to distribute key business functions (e.g., R&D, marketing, manufacturing and customer service) around the country, and in some cases around the world. There are many factors driving this trend. One of these factors is the ongoing merger and acquisition activity.

Another factor driving this trend is the desire on the part of many enterprises to have a presence close to their customers, suppliers and distributors. There are several reasons why having a local presence is advantageous for an enterprise. For example, enterprises doing business internationally typically find that having a local presence is driven by a combination of logistical and economic necessity, as well as legal requirements.

Another component of the globalization of resources is the move to outsource various business functions. For example, many companies outsource software development to India in part due to the supply of highly trained software engineers.

IT Consolidation

The phrase IT consolidation refers to three trends:

I. Application and Data Storage Consolidation

A large percentage of IT organizations either already have, or are currently in the process of taking applications and data storage out of branch offices and placing them in centralized data centers. The benefits of application and data storage consolidation are described below. However, this form of consolidation can also produce some significant performance issues. In particular, the consolidation of applications can result in chatty protocols that previously ran over the LAN now running over the WAN. As discussed in the introduction, running chatty protocols over the WAN usually results in poor application performance.

II. The Reduction in the Number of Data Centers

In addition to consolidating applications and data storage out of branch offices and into centralized data centers, many companies are also reducing the number of data centers they support worldwide. Hewlett-Packard, for example, is reducing the number of corporate data centers it supports from 85 down to six.[2] The state of Texas has announced its intention to go from 31 data centers down to two.[3] Reducing the number of data centers increases the distance between remote users and the applications they need to access. This added distance results in additional application delay over the WAN, thus increasing the probability of unacceptable application performance.

III. Application Single Hosting

A large percentage of IT organizations are adopting a single-hosting model whereby users from all over the country, or perhaps all over the world, transit

[2] Hewlett-Packard picks Austin for two data centers (http://www.statesman.com/business/content/business/stories/other/05/18hp.html).
[3] IBM wins data center consolidation contract, Network World, December 4, 2006.

the WAN to access an application that the company hosts in just one of its data centers. For example, an organization may have three data centers—one each in Europe, the Americas and the Pacific Rim. However, one or more applications, for example the corporate CRM application, may be hosted only in a U.S. data center, but accessed by all users worldwide.

Moving to a single hosting model has the same impact as reducing the number of data centers—it increases the distance between remote users and the applications that they need to access. As was the case with reducing the number of data centers, this increased distance between the user and the application that they need to access increases delay and hence increases the likelihood of unacceptable application performance.

IT consolidation is driven by the following business mandates:

Cost Control
Consolidating applications and data storage into centralized data centers, reducing the number of data centers and introducing a single hosting model results in cost savings. Consolidation reduces the cost of IT support, real estate and utilities such as heating and cooling.

Security and Compliance
Consolidating IT resources also makes it easier to provide for backup and to implement physical, as well as logical security measures. As a result, consolidation makes it easier for companies to comply with regulations such as the Sarbanes-Oxley (SOX) act in the U.S. and similar regulations in other countries. Such regulatory acts require management to make a written assertion stating their accountability for establishing and maintaining an adequate control structure and procedures for financial reporting.

These regulations require companies to put a greater emphasis on assuring the accuracy, security and confidentiality of data. It is very difficult to do this when there are multiple copies of the company's data in branch offices. Thus consolidating the company's storage into a small number of centralized data centers makes these tasks notably easier to accomplish.

THE TRADITIONAL APPROACH

A traditional approach to managing application performance is to set thresholds for WAN utilization. Many IT organizations, for example, use a rule of thumb that says that they will add WAN bandwidth once network utilization exceeds a threshold—often in the range of 70 to 80 percent. IT organizations that use this approach to managing network and application performance implicitly make two assumptions:

- If the network is heavily utilized, the applications will perform poorly.
- If the network is lightly utilized, the applications will perform well.

The first assumption is often false. For example, if the network is supporting email or bulk file transfer applications, heavy network utilization is unlikely to result in the unacceptable performance of these applications.

The second assumption is also often false as it is quite possible to have situations in which the network is operating at relatively low utilization levels and yet the applications that transit the network are performing poorly. The use of a chatty protocol over the WAN, which was discussed in the introduction, is an example of such a situation. In this case, the application can perform badly because of the large number of information flows that are required to complete a single transaction.

>> Frame Relay

Widely deployed WAN connection technology used to connect branch offices to datacenters. Frame relay puts data into variable sized frames over a permanent virtual circuit (PVC), which is seen as a dedicated link by the branch office. This is often regarded as a cost effective alternative to a dedicated lease line.

While it is not clear if adding bandwidth will improve the performance of branch office applications, it is quite clear that adding bandwidth will increase cost. To put this in perspective, consider a company that has 20 branch offices that connect to a headquarters site using a frame relay network. (See figure 2a.)

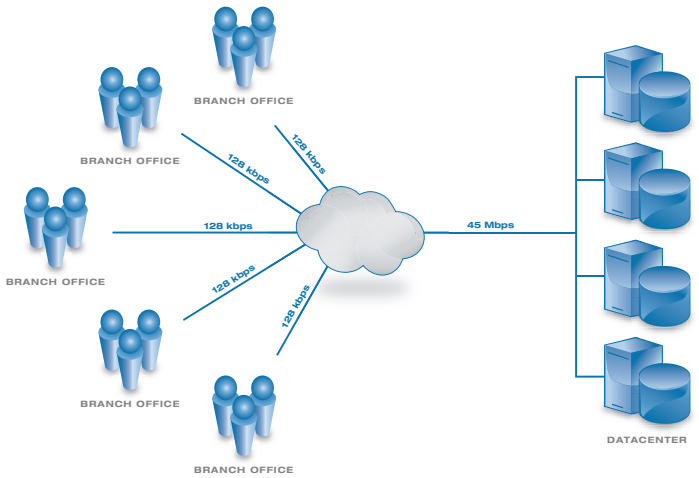

Figure 2a. *Each branch office connects to the frame relay network using a 128 Kbps PVC (permanent virtual circuit) and has a 256 Kbps frame relay port and that headquarters connects to the frame relay network using a T3 (45 Mbps) frame relay port.*

As part of this example, further assume that each branch office connects to the frame relay network using a 128 Kbps PVC (permanent virtual circuit) and has a 256 Kbps frame relay port and that headquarters connects to the frame relay network using a T3 (45 Mbps) frame relay port.

In order to improve the performance of branch office applications, the company is considering upgrading their WAN so that each branch connects to the frame relay network using a 384 Kbps PVC and a 768 Kbps frame relay port. As part of this upgrade, the company would add a second T3 connection into their headquarters site.

As mentioned, upgrading the WAN may or may not improve the performance of branch office applications, but it will increase the cost of the WAN. In particular, the incremental cost of this upgrade is roughly $13,000 USD per month. Over three years, the incremental cost of the upgrade is approximately $450,000 USD. (See Figure 2b.)

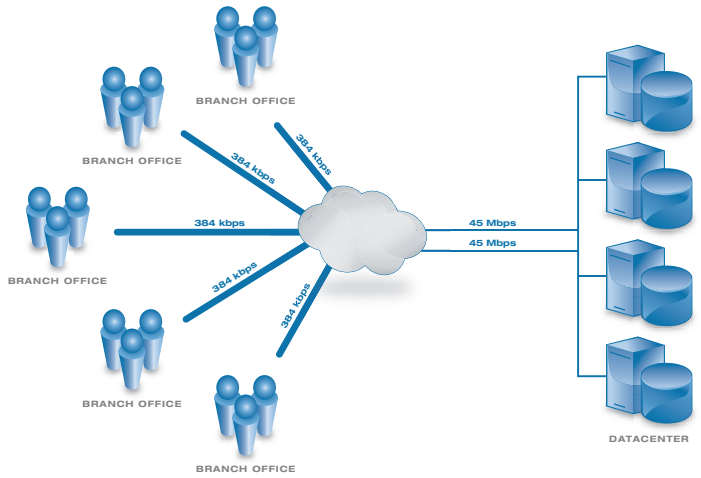

Figure 2b. *Upgrading the WAN may or may not improve the performance of branch office applications, but it will increase the cost of the WAN.*

BRANCH OFFICE APPLICATION ACCELERATION SOLUTIONS

As previously mentioned, adding WAN bandwidth adds cost without necessarily addressing the root cause of poor application performance over the WAN. An alternative to merely adding WAN bandwidth is to use a branch office application delivery solution. A branch office application delivery solution typically requires an appliance in both the data center as well as the branch office. These solutions are designed to overcome the factors that cause poor application delivery to branch office employees by providing a variety of functions, including data compression, TCP flow control and protocol-specific acceleration.

As shown in the preceding section of this white paper, it can be very expensive to add WAN bandwidth. As a result, one of the features found in most branch office application delivery solutions is compression. The role of compression is to reduce the size of a file prior to transmitting that file over a WAN. Being able to compress the size of a file or application traffic flow reduces the congestion on the shared WAN link and improves overall application performance while deferring any WAN upgrade costs.

Another important feature of a branch office application delivery solution is flow control. The purpose of flow control is to ensure that the sending device does not transmit more data than the network can accommodate. The vast majority of

data communications use TCP (Transmission Control Protocol). TCP has multiple mechanisms for managing congestion.

Another key feature of a branch office application delivery solution is protocol specific acceleration. For example, TCP and CIFS are two protocols that can cause performance issues when run over a WAN. TCP acceleration involves a range of techniques to help TCP run better. This includes simple steps such as increasing the TCP window size. The TCP window size refers to the number of packets that can be sent without receiving an acknowledgment.

One of the goals of protocol acceleration is to mitigate the impact of chatty protocols such as CIFS. Figure 3 illustrates the information flow of a chatty protocol once protocol acceleration has been implemented. In contrast to Figure 1, most of the information flow in Figure 3 is local. As a result, protocol acceleration greatly reduces the impact of the WAN on branch office application performance. CIFS acceleration includes techniques such as compressing the payload and reducing redundant application messages.

Figure 3. *Protocol Acceleration*

Some of the criteria that IT organizations should consider when choosing a branch office application delivery solution include:

Transparency
It should be possible to deploy the solution and not have the solution impact or interfere with other network functionality such as routing, security or QoS. The network should not have to be reconfigured to accommodate the solution. For example, applications and client PCs should not be required to be rerouted to the application delivery solution. In addition, after the solution has been deployed, it should be possible to continue to use the existing set of application and network management tools.

Ease of Deployment
As part of the solution, an appliance needs to be deployed in each branch office. In most cases, the branch offices will not have any IT staff. As such, it is important that any personnel can install the solution. This requires that the solution must be easy to deploy and use, and not require any special training.

Ease of Management
The greater the number of appliances deployed, the more important it is that they can be configured and managed by an IT professional without extensive product-specific training. In no situation should day-to-day management require an expert. In addition, the solution should not make troubleshooting any more difficult.

SUMMARY

Globalization of resources and IT consolidation cause applications delivered to branch office users to perform badly by physically moving the applications far away from the end user. As a result, branch office users are forced to now access applications and data over a WAN, which has higher delay and lower capacity than a LAN. Additionally, this globalization dramatically increases the amount of traffic that transits the enterprise WAN over what it was when the majority of employees worked in a headquarters facility.

The traditional approach to solving the branch office application delivery problem is to add WAN bandwidth. In many cases adding bandwidth will not improve application performance. Adding WAN bandwidth, however, will always increase cost.

A better approach to this problem is to deploy a branch office application delivery solution. Key features of such a solution include:

- Compression
- Flow control
- Protocol acceleration

When choosing a branch office application delivery solution IT organizations need to validate that implementing the solution will not break existing functionality, such as routing, security or QoS. IT organizations also need to ensure that the solution is easy to deploy and manage.

Given the breadth of performance issues that they address, implementing a branch office application delivery solution is a better approach to managing application delivery than throwing bandwidth at a problem and hoping that the performance of the application improves.

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