White paper

Building a better branch office

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Introduction

The majority of workers today are in branch offices, not in a headquarters facility. In many instances, all of the applications used by branch office employees are hosted on servers in the branch offices. This approach is optimal for the user because it maximizes both the availability and performance of these applications. Unfortunately, for the IT organization, this approach is sub-optimal because it maximizes cost and complexity, and limits IT's ability to enforce effective security and ensure data integrity.

Consolidating branch offices servers into one or more centralized datacenters reduces both cost and complexity and, as this paper demonstrates, implementing virtualized servers in the datacenter can significantly enhance those cost savings. Consolidating servers also positions the IT organization to better enforce effective security and ensure data integrity. Unfortunately, in many cases, the availability and performance of the applications degrade significantly in the branch office when they are run on servers centralized in the datacenter. What is needed is an approach that balances the needs of the branch office IT users with the needs of the IT organization (Figure 1).

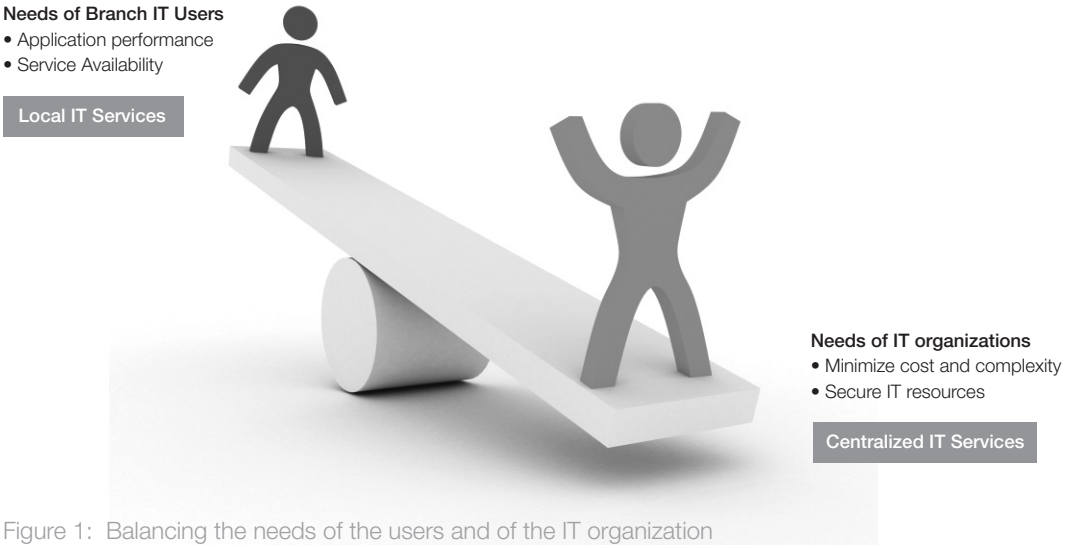

Figure 1: Balancing the needs of the users and of the IT organization

This paper discusses branch simplification and optimization through the consolidation of IT services in a central datacenter and ensuring the performance of those services. This paper also identifies branch optimization solutions from Citrix Systems, Inc. that enable IT organizations to achieve branch simplification and optimization.

The branch office dynamic

The traditional approach to branch office computing is to deliver almost all applications and services directly from servers located at the branch office. This form of distributed computing provides good performance and local autonomy, but it has a number of drawbacks, including:

- High cost for the replicated server hardware and software due to low levels of utilization.
- IT space and infrastructure is required in all branch offices.
- Management inefficiencies due to either the lack of on-site administrative staff or the extra cost associated with having this staff on-site in a branch.
- Single points of failure due to the lack of server redundancy.
- Difficulties in managing security and ensuring data integrity and privacy.

As a result of these drawbacks, many IT organizations have initiated server consolidation projects. One of the primary goals of these initiatives is to move application servers from branch offices to the company's centralized datacenters. In addition, many IT organizations also seek to reduce the number of datacenters that they support.

By consolidating branch office servers in a small number of datacenters, computing resources can be used more efficiently due to higher server utilization, reduced replication of data, lower application license fees and higher productivity for IT administrators. Centralization can also reduce exposure to security threats because it is easier to control data that is not replicated in many different physical locations. Additional advantages of server centralization include the improved ability to implement and document security measures for regulatory compliance, implement simplified disaster recovery and backup procedures, and provide low cost fault tolerance through load sharing across server clusters.

Some of the potential economic benefits of server consolidation and virtualization can be demonstrated by the following case study of a hypothetical enterprise, the Jasa Corporation. The case study is not intended to be a complete total cost of ownership (TCO) analysis. Rather, it is designed to demonstrate some of the primary areas of costs savings relative to server consolidation and virtualization.

Jasa has 100 branch offices in the United States and Europe with an average of 50 employees per branch. They currently run local instances of Microsoft® SharePoint®, Citrix XenApp™ (formerly Citrix Presentation Server™) and SAP® in each branch office. Each branch office is connected by a T-1 WAN circuit. Before server consolidation was implemented, each branch office had four servers. The consolidation initiative shifted most of the application processing to a centralized datacenter, enabling a single remaining server to meet the needs for local services at each branch office. As part of a three-year TCO analysis, Jasa's IT staff developed the comparison of server annual costs shown in Table 1.

In this financial model, the costs of the server hardware, software, maintenance, storage and networking are amortized over a three-year life cycle to allow annual costs to be calculated. For simplicity, Jasa chose to standardize on a single model of a dual core server with performance levels appropriate for branch office workloads. The table shows that the annual cost of server administration in the branch office is somewhat higher than for a datacenter server due to the inefficiencies of remote management and the occasional need for on-site visits from central IT staff. Due to the inherent economies of scale that exist in the datacenter, the cost of storage and networking is less in the datacenter than it is in a branch office. The power, cooling and space costs are slightly higher at the datacenter due to higher server density and a more specialized computer room environment.

Cost component	Branch server	Datacenter server
Server platform and maintenance contracts	$4,000	$4,000
Storage and networking	$1,300	$1,100
Server administration	$3,000	$2,700
Power and cooling	$500	$600
Space	$200	$300
Total annual cost	$9,000	$8,700

Table 1: Jasa Corporation server TCO analysis

Scenario 1: Consolidating 100 percent of the branch office servers

Jasa's IT staff determined that 300 branch office servers could be decommissioned and their workloads shifted to 40 of the newer servers moved to the datacenters and running server virtualization technology such as Citrix XenServer™ or Microsoft Hyper-V™. This level of consolidation was possible because most of the servers in Jasa's branch offices were lightly utilized and because Jasa's branch offices are geographically distributed across a number of time zones, which levels the load on the central servers over the course of the day.

	Each server annual basis	300 Servers annual basis	300 Servers over three years
OPEX savings – Relocating servers out of a branch office	$3.500	$1,050,000	$3,150,000
OPEX cost – Placing servers in the datacenter	$3,600	$144,000	$432,000
Savings		$906,000 (86%)	$2,718,000 (86%)
ROI			630%

Table 1: TCO summary

Scenario 2: Consolidating 50 percent of the branch office servers

If Jasa were to move only half of the servers out of the branch office and replace them with 20 virtualized servers in the datacenter, the OPEX cost savings would still be significant as shown in Table 3.

	Each server annual basis	150 Servers annual basis	150 Servers over three years
OPEX savings – Relocating servers out of a branch office	$3.500	$525,000	$1,575,000
OPEX cost – Placing servers in the datacenter	$3,600	$72,000	$216,000
Savings		$453,000 (44%)	$1,359,000 (44%)
ROI			630%

Table 3: TCO summary

Jasa could potentially derive further economic benefit from repurposing some or all of the retired servers to provide increased redundancy, provision new applications or accommodate growth in the use of existing applications. Each server that Jasa repurposes results in an average annual savings of $4,700[1], which is the annualized cost of the already-purchased server platform and maintenance contracts, and the already-purchased storage and networking hardware.

Obstacles to branch server consolidation

As shown above, consolidating branch office servers into centralized datacenters improves IT efficiency and reduces the cost of delivering enterprise applications to remote users. However, server consolidation involves complications that can potentially offset some of these advantages. These include:

- Vulnerability to WAN outages
- Higher WAN bandwidth consumption
- Longer application response time

Vulnerability to WAN outages

Whenever the branch office loses WAN connectivity, access to central computing resources is interrupted. This reduces employee productivity and potentially disrupts business operations. When there is a WAN failure, it is critical to preserve the LAN and Internet operations of the branch office to maintain branch user productivity. Therefore, even where an aggressive server centralization strategy is being pursued, local branch office server resources are still needed to perform print, file, Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP) services.

Higher WAN bandwidth consumption

Server and application centralization can greatly increase the amount of WAN traffic between the branch office and the central datacenter.

- It would cost Jasa an additional $12,000[2] per branch annually to upgrade the T-1 (1.5 Mbps) WAN circuit to a bonded T-1 (3 X 1.5 Mbps) circuit to support the additional demand for bandwidth.
- The cost of upgrading 100 branches is $1,200,000 annually.

As more applications are centralized, the demand for bandwidth is expected to double every year.

Longer application response time

Even with additional bandwidth, application response times may be excessive due to high WAN latency combined with inefficient protocols. For example, most client-server applications were designed for a LAN environment where ample bandwidth and near-zero latency can mask the inefficiencies of chatty client-server communications that require a large number of application turns to complete a single transaction. Each application turn adds to the user response time by an amount equal to the round trip time (RTT) over the WAN, which is typically tens of milliseconds. For example, if two hundred round trips are required to complete a transaction and if each round trip takes sixty milliseconds, then the transaction takes at least twelve seconds. The response times of SharePoint, XenApp and SAP applications are all expected to increase significantly as these applications are now moved from the branch office and deployed over the WAN from a central location.

[1] Theoretically, the savings should be $5,300 per server. However, Jasa's IT organization determined that in most instances they will need to keep some of the networking equipment in the branch office and hence the potential savings is less than the theoretical maximum.

[2] Sample Tier1 Service Provider WAN pricing. T-1 (1.5 Mbps) – $600/month, Bonded T-1 (3 X 1.5 Mbps) – $1,600/month.

The simple and optimized branch office

While branch office environments vary widely, the example of the Jasa Corporation shows that there are tangible economic benefits that result from the consolidation and centralization of server resources. As noted above, there are also a number of somewhat less tangible benefits that come with centralization, for example, the ability to implement simplified disaster recovery and backup procedures.

IT organizations implementing server consolidation initiatives must mitigate the obstacles to centralization. For example, many IT organizations will choose to keep at least one server in each branch office to support essential local services, such as file, print, DNS and DHCP, even during a WAN outage. Each branch office will also need some form of WAN optimization capability to help minimize the need for additional WAN bandwidth and to mitigate the effects of WAN latency for remote access to applications and services. The WAN optimization solution needs to provide a comprehensive suite of application acceleration functionality, including:

- Reduction of packet payloads with techniques such as data compression and de-duplication.
- Quality of Service (QoS) to prioritize critical business applications and guarantee bandwidth availability.
- Network protocol and application protocol acceleration (TCP, HTTP, CIFS, NFS, etc.) to maximize transport efficiency and to minimize the number of application turns per transaction.
- Application acceleration with techniques such as request prediction and pre-positioning of application objects.

The WAN optimization functionality can be deployed as a stand-alone appliance. An additional packaging option that can further simplify the branch office infrastructure is a branch office box that integrates the functionality of a branch office server with WAN optimization. The advantage of the branch office box is that it can consolidate several functions (e.g., WAN optimization, print server, file server, domain controller, etc.) into a single physical device and manage these capabilities through a single system management interface. Integrated management of all branch office server resources can significantly simplify central management of the end-to-end infrastructure that delivers application services to remote clients.

Citrix Branch Repeater with Windows Server

Citrix Branch Repeater™ with Windows Server® is a branch office box that has been jointly developed by Citrix and Microsoft to support both server consolidation and the consolidation of the branch office infrastructure. Citrix Branch Repeater with Windows Server combines the functionality of a WAN acceleration appliance and a Microsoft Windows Server in a single compact 1 RU (rack unit) device. Citrix Branch Repeater with Windows Server supports the following functions:

- WAN optimization and application acceleration
- Consolidated Windows services
- Consolidated management

WAN optimization and application acceleration

Citrix Branch Repeater with Windows Server accelerates all enterprise traffic while simultaneously reducing bandwidth requirements. Citrix Branch Repeater with Windows Server supports a full suite of WAN optimization technologies including multi-level data compression, adaptive TCP flow control, and protocol accelerators for CIFS, NFS, FTP, and HTTP. Citrix Branch Repeater with Windows Server accelerates, prioritizes and stages applications delivered with XenApp. Citrix Branch Repeater also improves response times to deliver LAN-like application performance for all applications, including SharePoint, XenApp and SAP. For companies like Jasa, this avoids costly WAN upgrades resulting in annual cost savings. Even as bandwidth needs double every year, Jasa can continue to get more out of their WAN without spending money on upgrades.

	300 Servers annual basis	300 Servers over three years
Cost of WAN optimization solution[3]	$11,500	$1,170,000
Monthly WAN upgrade costs	$1,000	$100,000
Payback time		11 months

Table 3: ROI

Consolidated Windows services

Citrix Branch Repeater with Windows Server is built on Windows Server. This allows the branch office to continue some operations during WAN outages by locally hosting native Windows services such as file, print, Active Directory, DNS and DHCP, as well as Microsoft's Internet Security and Acceleration (ISA) Server 2006 Web caching. The existence of native Windows services in the branch has a number of benefits including interoperability with Windows desktops and reduced training and support costs. This approach also provides additional CAPEX cost savings for companies that are planning a hardware refresh for their branch servers hosting Windows services. Citrix Branch Repeater eliminates the need for purchasing new servers by consolidating and hosting native Windows services in one device.

Consolidated management

Citrix Branch Repeater with Windows Server supports native Windows management tools, such as Microsoft System Center Operations Manager and Windows Management Interface (WMI). This support includes extensions to cover Citrix Branch Repeater with Windows Server WAN optimization functionality in addition to the Windows operating system. This means that the entire branch office infrastructure can be centrally managed with a single set of familiar Windows-based tools.

[3] Cost includes Citrix Branch Repeater with Windows Server device ($11,500) and WanScaler 8540 datacenter device ($20,000). Total cost $1,170,000 = 100 branches X $11,500 + $20,000.

Conclusion

The need for server consolidation and centralization is almost universally accepted by the IT organizations of both medium and large enterprises. This need driven by compelling economics, and by less tangible benefits such as improved control of the infrastructure and better continuity of business operations.

There are several aspects to consolidating IT resources, including reducing the number of datacenters, reducing the number of servers per datacenter with server virtualization and shifting server resources from the branch office to the central datacenter. The most effective consolidation initiatives are evolving to incorporate all three of these approaches.

The next logical step in this ongoing process is to apply the principles of consolidation to the branch office itself by consolidating its remaining server and appliance infrastructure to the greatest degree possible and by optimizing the remote manageability of the branch office with a consolidated set of management tools. The Citrix Branch Repeater with Windows Server is a device that can be used to implement branch office consolidation by virtue of its tight integration of application acceleration, WAN optimization, Windows Server and Windows management functions.

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About Citrix

Citrix Systems, Inc. (Nasdaq:CTXS) is the global leader and the most trusted name in application delivery. More than 215,000 organizations worldwide rely on Citrix to deliver any application to users anywhere with the best performance, highest security and lowest cost. Citrix customers include 100 percent of the *Fortune* 100 companies and 99 percent of the *Fortune* Global 500, as well as hundreds of thousands of small businesses and prosumers. Citrix has approximately 8,000 partners in more than 100 countries. Annual revenue in 2007 was $1.4 billion.

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