

# **Branch Office Application Optimization Solutions**

**Internet Research Group  
September 2007**

## **About The Internet Research Group**

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The Internet Research Group (IRG) provides market research and market strategy services to product and service vendors. IRG services combine the formidable and unique experience and perspective of the two principals: John Katsaros and Peter Christy, each an experienced industry veteran. The overarching mission of IRG is to help clients make faster and better decisions about product strategy, market entry, and market development. Katsaros and Christy recently published a book on high tech business strategy *Getting It Right the First Time* – Praeger, 2005 [www.gettingitrightthefirsttime.com](http://www.gettingitrightthefirsttime.com).

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# 1. **Introduction**

The world-wide connectivity provided by modern networks has had a profound impact on how we do business already, and the impact is still growing. Use of the network has enabled direct-access applications where all participants (employees without regard to location, business partners, even customers) in a business process can access and use the same shared application rather than having a small number of expert users and everyone else interacting with the process indirectly via those expert users. This simple but profound change in application design makes important differences in the effectiveness and scope of a business that can't be ignored, but it has also changed the branch office from an IT backwater to a critical location for application success because most employees today work from branch offices, not from the enterprise headquarters. Yesterday's expert application users were typically located at the headquarters, but these new direct users are mostly located outside of central locations.

Modern networks also enable important collaboration tools (unified communications solutions that integrate messaging and real-time media, sophisticated video conferencing, and portal tools such as SharePoint) with high potential benefits in business efficiency and effectiveness.

Providing excellent application performance for all of the users of these applications regardless of their location is a substantial challenge by itself given the complexities of long distance network communications, but the challenges in the modern branch office are compounded by the equally strong desire to reduce the cost of IT. This paper goes into these issues in more detail as the basis for explaining modern application delivery requirements and product architectures.

# 2. **IT Cost Effectiveness & Consolidation**

For years IT expenditures increased as a percentage of revenues, and this spending increase accelerated during the dot com period as companies seriously feared they would be overcome by high-tech newcomers. When the dot com bubble burst, IT managers were left with relatively few results, a splitting hangover, bloated budgets and lots of excess and unused hardware and software. CEO's quickly decided that the time had come to reduce IT spending. We entered into what has been called the "nuclear winter of IT spending." Quite suddenly much greater focus was placed on IT expenditures and assets, and the hard dollar return on IT projects. One of the quick realizations was the high costs that come if IT assets are distributed to many locations because of the resulting complexity and administrative costs and as a result many consolidation initiatives were begun, moving as many assets as possible into a few large data

centers. Recently increased concerns about regulatory compliance and data privacy have added more incentives to consolidate IT assets.

To solve the branch office application delivery problem, we necessarily have to address IT cost effectiveness as well as application performance and this is a challenge from the beginning. Computer technology itself is so cheap that we can put as much processing power and storage at branch locations as proved useful for application performance if we only considered the cost of the hardware. The cost of distributed hardware is in the administration and support. For example, data in branch offices has to be backed up, a much more complex task than backing up data in a data center given the limited bandwidth to the branch office that is available. Complex systems in branch offices require some level of local expertise and support, and this rapidly increases the overall administrative and staffing costs of IT. Simple performance would dictate lots of hardware in branch offices; simple cost efficiency would dictate less. To deliver applications effectively we can't ignore either issue.

### 3. **Application Acceleration**

In 1981 IBM published seminal research suggesting a strong relationship between application performance and user productivity. For the next 20 years interactive application design was conditioned by that thinking. But in the early days of the Internet all that got confused because a 20 second page fetch time (horrible by the standards of interactive program design) was clearly better than getting something by postal mail days later – who was to say 20 seconds was “bad?” Worse still, “research” was published suggesting first “11 second” and then “8 second” “rules,” confusing what technology of the moment enabled with what humans really needed. But as more and more network-accessed applications are put in use we realize that faster really is better within the bounds of what technology cost-effectively enables. The IBM research was and is right. Faster is really better as long as the improvements are affordable until application performance is indistinguishable from use of a local application.

Performance of applications across a WAN can be problematic for many reasons:

- Limited bandwidth and lack of prioritization on the communication link to a remote office
- Packet loss and latency across the internet
- Poorly designed protocols or applications

The goal then of branch office application delivery optimization is to work around these problems (limited edge bandwidth, network latency and packet loss) and to optimize the performance of the applications and services served by

these links consistent with business priorities. This means assuring that application service level requirements are met (recognizing that these requirements vary widely between applications for both technical and prioritization reasons) and that limited communications resources are used only as needed to satisfy service requirements, and are allocated consistently with the business value of the applications if at times there isn't enough to go around.

Improvements and acceleration at many different levels in the "stack" are needed to truly optimize branch office application performance:

- Network and protocol optimization: There are many ways in which data communications can be optimized with resulting improvement to application performance. The binary data on the communications link can be compressed improving the performance of all applications. Few modern protocols were designed adequately for WAN use. For example, TCP/IP has fundamental limitations when it encounters links with latency and packet loss. Higher level protocols require additional knowledge of the details and semantics of the protocol in order to make best use of the communications link.
- Operating system optimization: Operating system functionality such as IP assignment (DHCP) and user authentication can intrude significantly into distributed application performance unless addressed in these solutions.
- File system optimization: File access over WAN links is problematic because the protocols were designed for use on the LAN where bandwidth is plentiful, latencies are short and packet loss is minimal. Remote file access over a WAN link will never be comparable to accessing a copy of the same on a disk drive at the remote location, but intelligent and network-aware optimization can make the difference between application viability and failure. File system optimization for branch office applications necessarily includes both protocol improvement and operation, and higher level architectural improvements such as the automatic replication of read-only files to remote locations where they are needed and very efficient mechanisms for updating a file copy as the original changes although issues like security, privacy and regulatory compliance motivates fewer data copies, not more.
- Application Optimization: Finally, application design can have a large impact on WAN performance and on the ability of application acceleration systems to be effective. For example, the use of cacheable content (whether it be cacheable parts of Web pages fetched by HTTP or the careful use of read-only, safely cacheable file data) can have a profound impact on application performance, as can the use of programming tools and subsystems that have been designed with network issues in mind (e.g., tools that produce minimal HTTP rather than verbose HTTP).

Finally, all this must be done consistent with the economic goals and constraints of modern IT. What makes this particularly complex are the facts that (a) computer system technology is remarkably inexpensive (the cost of systems and

storage is rarely a key issue) while (b) the cost of system administration and operation is increasingly the critical factor. Computer technology is so inexpensive putting lots of processing power and storage at each branch office is economically reasonable, but managing those remote resources is terribly expensive compared to a solution where the technology is all consolidated into a few large data centers. The art in branch office application acceleration is to use distributed technology in a way that minimizes the operational costs (e.g., using disks only to cache data so that the benefits of local storage are received without the obligation to backup the data).

In contrast to computer technology, communication links remain problematic in the sense that there are parts of the world where communication links are limited by the basic infrastructure of the region and getting better bandwidth may be impossible or unaffordable. Today's global businesses can't choose where to do business based on communications infrastructure, and we'll continue to face the unavoidable impact that the worst-served users have on the application as a whole.

These economic challenges are balanced by the increasing value that better application brings. At its worst poor application performance makes the application unavailable and impedes or suspends business progress until the problem is remedied. But even if the application is "available" and just sluggish, there is an increasing understanding that poor performance damages productivity and overall business performance, probably to a larger degree than we generally suspect.

## 4. Branch Applications

Branch applications come in a number of very distinct categories, each with its own intrinsic priority and network issues:

Application Group	Performance Needs & Challenges
<b>Unified Communications</b> (e.g., IP Telephony, VOIP, Audio & Video Conferencing)	<ul style="list-style-type: none"> <li>• Packet transmission jitter &amp; loss caused by congestion degrade application performance.</li> </ul>
<b>Transactional Applications</b> (e.g., ERP, CRM, SAP, Oracle, Citrix, Financial Trades)	<ul style="list-style-type: none"> <li>• Congestion causes TCP to clamp down on bandwidth, stalling transactions.</li> <li>• File transfers and recreational traffic can crowd out transactional data with much higher business value.</li> <li>• TCP design (e.g., slow start) can impede transaction performance.</li> </ul>
<b>File Access, Email &amp; Collaboration</b> (e.g., Microsoft CIFS, MS SharePoint, Exchange)	<ul style="list-style-type: none"> <li>• Many key protocols were designed for LAN use and are problematic over WAN connections.</li> <li>• Large file accesses and email data transport (large attachments) can compete with more important interactive activities unless suitably prioritized.</li> </ul>
<b>Recreational Traffic</b> (e.g., iTunes, YouTube P2P, personal browsing)	<ul style="list-style-type: none"> <li>• Use of recreational applications can cause bandwidth and latency problems for other applications unless suitably prioritized and controlled.</li> </ul>

A WAN optimization solution clearly must be application aware in order to understand the different transmission needs and intrinsic business priorities of the different applications. An ideal solution assures that each class of application receives network optimization so that its service level is achieved while leaving as much of the network capacity and prioritization to other applications as possible.

## 5. **The Importance of Visibility**

Visibility – knowing what is actually happening – is typically one of the largest and often least expected benefits of adding a branch application optimization solution. Branch office application optimization is the joint responsibility of the network team, the server team and the application team, and often none of these groups has a clear understanding of the complete picture or of the other components. Adding an optimization solution is often the first time that there is any joint visibility on what the problems and issues are, and the means by which the intergroup communication toward joint solutions begins.

Being able to see the traffic on a branch line in the context of the applications that engender the traffic and their respective service needs and business priorities is enormously valuable. Often the most glaring problem is competing traffic on a remote link that has little or no business value (e.g., an employee in a branch office running a Web server for a personal business or doing P2P file exchange via a corporate Internet link that is reached over the branch link). Eliminating that traffic or prioritizing it below business-relevant traffic can be the most important single optimization. Visibility also makes it clear to the application team where application design issues are causing excessive demands on limited bandwidth resources and accelerates application improvement activities with a high return. Finally, having good visibility into bandwidth usage and trends on an ongoing basis creates input and feedback to ongoing application performance improvement processes.

## 6. **The History and Future of WAN optimization**

WAN optimization is hardly a new topic. The first communication links soon gave rise to the first content compression schemes. WAN optimization techniques have changed very significantly over time as the power of inexpensive CPU's has increased and the cost of RAM and disk storage decreased. The first schemes were based on fixed dictionary compression (for example, replacing repeated strings of one character with a much smaller code signifying it). In the last ten years more complicated compression systems were developed that built dynamic dictionaries based on the content used on that specific link, and then evolved further so that even relatively large files could be dictionary elements (e.g., the ability to recognize an entire PowerPoint file that was sent previously and use a compression token instead).

Also in the last ten years WAN optimization has become protocol specific rather than just optimizing the binary data on the link. This was necessary to recognize and compress data objects larger than one packet most efficiently and also necessary to take full advantage of the semantics of a specific protocol. For

example, there is great value in understanding and optimizing the specifics of file access protocols such as SMB/CIFS and core email protocols such as MAPI – data from a read-only file can be cached and the next requester served from the cache with huge performance benefit, but this only works if the semantics of the file access protocol are understood – it can't be done at the link level. File system optimization has become an important WAN subspecialty because of the high value of optimizing remote file use.

The following table summarizes the specific needs in branch office optimization from the network perspective:

	Problem(s)
Performance Monitoring & Troubleshooting	<ul style="list-style-type: none"> <li>Identifying applications, determining issues and getting ongoing usage trends.</li> </ul>
Quality of service	<ul style="list-style-type: none"> <li>Limited bandwidth and lack of prioritization on the communication link to a remote office.</li> </ul>
Protocol acceleration	<ul style="list-style-type: none"> <li>Poorly designed application protocols produce slow performance over WAN due to latency (especially affects large file transfers over CIFS, NFS, FTP, ...).</li> </ul>
Caching and compression	<ul style="list-style-type: none"> <li>Redundant or uncompressed data being sent over links and limited bandwidth on the link.</li> </ul>
Remote IT services	<ul style="list-style-type: none"> <li>Providing key services at remote locations with minimal IT staff, expenditure and administration.</li> <li>Maintaining business continuity during WAN disruptions and recovering from disasters as quickly as possible.</li> </ul>
Security	<ul style="list-style-type: none"> <li>Securing corporate data connections over Internet.</li> <li>Difficult to secure a remote site Internet access (thus many companies continue to backhaul centralized Internet access across a private WAN).</li> <li>Difficult to secure branch office; limited security to contain any internally sourced DDOS attacks.</li> </ul>

The network aspects are a necessary but not complete part of the solution. Effective branch office solutions require traditional WAN optimization, optimization of the evolving platform specific protocols (see next section) as well as some form of support for other key IT infrastructure elements (e.g., authentication and printing).

## 7. **Microsoft Branch Office Compatibility**

For most businesses, Microsoft solutions are an important part of their branch office strategies implying that seamless integration with Microsoft platforms and acceleration solutions is equally important. Working well with Microsoft platforms is complex because Microsoft continues to improve the WAN performance of the platform (e.g., CIFS and TCP/IP stack improvements) and because many customers are implementing solutions with both distributed aspects (what Microsoft emphasizes) and centralized aspects (e.g., data consolidation) and effective optimization solutions can't trade off one at the cost of the other.

Optimization solutions should be able to adapt to evolving environments (in both the platform and customer practices), optimize Microsoft protocols as they evolve, while continuing to contribute at the network level (visibility, prioritization and QoS). Use of Windows as a platform for these solutions offers significant benefits in terms of integration with Microsoft management and functional systems and for the specific optimization of Microsoft protocols.

## 8. **On the Horizon**

The use of IT in branch offices is hardly static. Over the next few years we expect these major initiatives to have a significant impact on the need for and a value of effective branch office application optimization:

- Businesses continue to create and evolve important business process support applications and these applications form an ever growing part of the day-to-day operation of the business. Since the majority of the employees work in branch offices rather than at corporate headquarters, effective support of these applications in the branch office is critical to their success.
- In parallel with the development of these applications, larger companies are working to integrate with the applications of their key business partner bringing still more business critical applications to the branch office.
- New collaboration applications are being developed and put in use. Microsoft SharePoint is experiencing explosive growth as an enterprise tool. Both Microsoft and Cisco have strategies and product plans for Unified Communications offerings that place increasing demands on the network for communications and leverage the expanse of the network to facilitate collaboration around the world.

The branch office is a key IT venue and will only grow in importance over time as more business critical applications are created and used by an ever widening

set of employees. Efforts to centralize data are bound to place increasing demands on network links, some of which are already stressed, and create application performance problems just as performance requirements increase. Quality and availability requirements will increase for applications ranging from voice to ERP and push against cost-reduction initiatives. Simultaneous meeting cost, performance and availability objectives clearly require products and technology that work well in concert, ideally by design, including necessarily server, WAN and communications optimization and the ability to monitor the traffic as well.

## 9. **Guidance**

Here is how we net out all of this:

- 1) Branch office application optimization is important today and the importance will grow over time as more business applications, partner business applications and network-based collaboration tools are used in branch offices.
- 2) Application performance will increase in importance as an employee spends more time using critical applications and as the impact of less than optimal performance is better understood.
- 3) There are no simple or one-dimensional optimization solutions. Effective solutions necessarily must address issues at the network level, the platform level and in specific applications. There are important applications at each level. Those solutions must be designed to work effectively and synergistically with one another.
- 4) Branch office application optimization solutions must be designed to scale and to operate cost effectively at scale in terms of both the technology used and the management and administration solutions provided.
- 5) Ongoing visibility is a key part of the solution, both in terms of making clear the performance achieved and the effectiveness of various solution methods, but as importantly to provide a platform that enables cooperation and collaboration among the diverse teams involved in branch office application delivery.
- 6) For most businesses, integration with Microsoft platforms and solutions is a critical aspect of these solutions because of the widespread use of the platforms and applications, and the ongoing and potentially synergistic work that Microsoft is doing to provide optimization and acceleration within these products.