The AcceleNet Advantage:

Application Acceleration for Mobile & Small-Office Workers

An AcceleNet White Paper

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The New Corporate Mandate – Software Acceleration Client

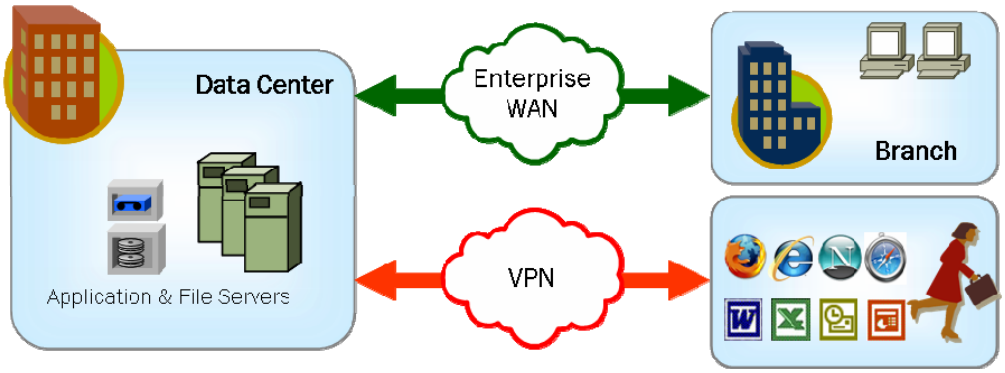
The market paradigm for consolidating enterprise applications and data resources at the corporate data center is becoming well established. Regulatory compliance and rising support costs have driven remote servers to the data center, requiring network connectivity for many employees' everyday use of shared files and applications.

At the same time, employees are dispersing, connected by an ever-expanding extended network – but that extended network is not just a "bigger LAN" connected by high-speed links. For many, employees, bandwidth is much less, latency is much greater and error rates can be significant.

The challenge in extending the corporate network is to deliver LAN-like behavior over the wide area network to *everyone* – regardless of location.

With many enterprises already employing office-to-office acceleration appliances, the demand is shifting again. The new mandate is for a software client solution for the growing percentage of small branch offices as well as workers who are not permanently connected to the enterprise LAN:

- retail and restaurant chains
- investment brokers and insurance adjusters
- small branch offices
- remote field sales forces, service technicians and road warriors
- teleworkers, corporate travelers, and even those who work from home evenings and weekends



The Unique Requirements of Mobile and Small-Office Workers

AcceleNet is designed expressly for small branch and home offices (SOHO) and mobile workers. This is important because these users' requirements are significantly different and often more challenging than those of larger branch office workers. This paper explores the challenges facing mobile and small office workers and describes the technologies that have been developed and optimized to meet these challenges.

The unique challenges facing the small office and home office workers include:

- *Lower quality networks*. These workers typically have consumer-grade broadband connectivity over DSL or cable.
  - High packet loss. Unlike business-grade service that is installed in branch offices, commercial connections often exhibit significant packet loss (0.5 – 1%), with worst case packet loss of up to 2-5% during peak periods (7 pm – 10 pm).
  - Higher latency. The round trip latency of consumer grade cable connectivity is both highly variable and much larger than business grade connections. During daytime hours, expect round trip latency to be 60 ms higher, and even higher during peak evening hours.
- *High-cost networks*. Small branch offices that cannot withstand the loss and latency of public infrastructure are overpaying for T1 lines and receiving less bandwidth than lower-cost, less reliable networks. Opportunities now exist for lowering network cost and gaining speed, without sacrificing network reliability.
- *Different usage scenarios*. WAN optimizers for large branch offices take advantage of the commonality of data accessed by large groups of users and have optimized 2nd time access while using generic, open-source compression for 1st time access. However, SOHO users are much more likely to download a given item only once. For these workers, 1st time performance is often more important than subsequent file access.
- *No IT staff available*. Many SOHO workers lack even basic computer and network troubleshooting skills. They often have scores of programs running on PCs that are several years old with limited resource capacity. Their IT support desk is remote, understaffed, and typically unable to provide deep troubleshooting and repair support.
- *SSL VPN interoperability required*. Increasingly, SSL VPNs are being deployed by enterprises with large numbers of small offices in order to provision access on a per-resource basis instead of granting complete network access. The client acceleration software must be appropriately architected in order to provide broad interoperability for SSL VPNs.

- *Internet access must also be accelerated*. Unlike larger branch offices that have local Internet access, when remote workers are connected via VPN, their Internet access usually goes through the corporate gateway.

- *Integrated voice*. Many SOHO workers take advantage of low-cost VoIP to reduce long-distance phone bills. A variety of products are now available to enable voice calls (and videoconferencing) from the PC. But performance can be severely degraded by email and other traffic. An acceleration solution should manage the overall traffic so that real-time traffic is not degraded while background traffic continues to flow.

In a relative sense, however, SOHO workers have it good! Mobile workers face even more challenges. Specifically:

- *Much poorer networks*. Lower bandwidth, higher latency, and packet loss. Hotel wireless access is notoriously poor – very lossy and very low bandwidth. Users connecting via 2G/3G wireless can, in good coverage locations, expect 788 kbps, 200 ms, and 2% packet loss. At the edges of the coverage zones and in RF-noisy environments such as airports, packet loss is much higher (5-10%) and latency can exceed 1 second.

- *Mobility*. When mobile, users are often assigned different IP addresses. And wireless subscribers want seamless acceleration moving between coverage zones—between WiFi and 3G or between WLAN access points.

- *Security*. A much more serious concern for the mobile worker:
  - The network access afforded mobile workers is inherently insecure, and virtually anyone can intercept communications. Accordingly, secure communications protocols must be used for all access. Since many guest networks block IPsec VPNs, HTTPS support is essential.
  - Unfortunately, it is an all-too-frequent occurrence for laptops to be stolen from cars or hotel rooms. Sensitive data stored in acceleration histories must be secured to ensure it cannot be exploited.

Of course, there are a set of WAN-related challenges that are common to the branch office, and an optimum SOHO and mobile worker solution must also address these:

- *Chatty application protocols*. The SMB-based CIFS and MAPI protocols used for file shares and email are notoriously chatty and, in some cases, require thousands of round trips to transfer a file or email. Typically, whenever latency exceeds 40 ms, SMB performance is noticeably poor.

- *Chatty applications*. Dynamic web applications frequently request many small objects per page which, on first access, are fetched *sequentially* and, on subsequent access, are validated for freshness. For typical pages, each 100 ms of delay slows down page rendering by 2-4 seconds. On high latency EVDO links or international access, performance is intolerable.

The AcceleNet Solution

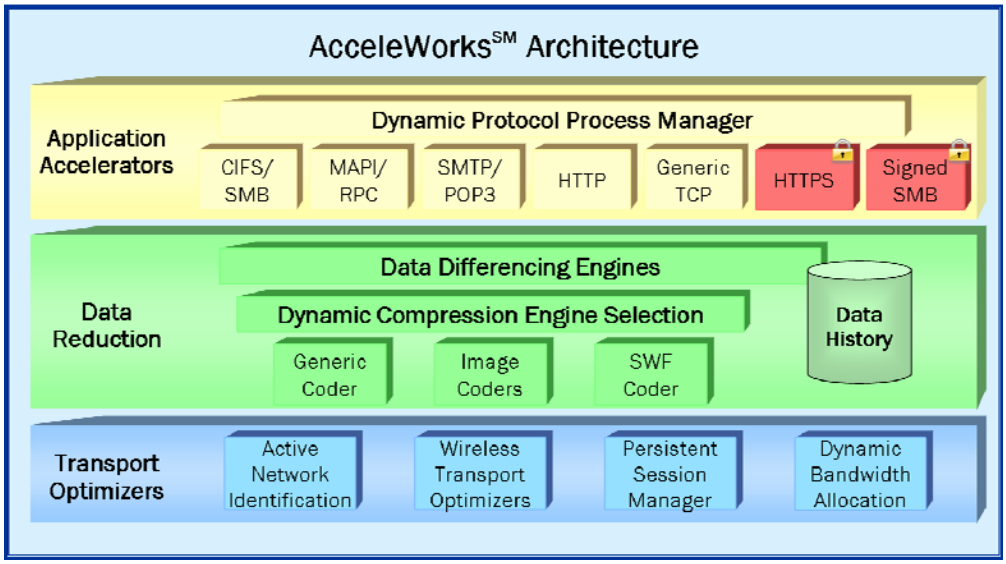
Solving the Mobile and Small/Home Office Performance Problem

AcceleNet is the only software client accelerator designed specifically to address the performance challenges of mobile and small- and home-office users. While several of these users' challenges mirror those of remote corporate office workers, many unique capabilities distinguish AcceleNet's performance.

The combination of techniques described in this document delivers superior performance for transfers of remote files, email attachments, Internet browsing, and web-based enterprise applications over narrowband and high-latency networks.

Architectural Overview

The AcceleNet "AcceleWorks[SM]" architecture provides the framework for several common and advanced acceleration technologies.



Key architectural components are:

- *Application Accelerators* reduce application protocol chattiness, intelligently pre-fetch data objects, and maintain security for signed SMB file shares and HTTPS traffic.
- *Data Reduction* reduces the amount of data transmitted on first and subsequent user requests by 80% or more; AcceleNet transfers the least amount of data possible, then applies application accelerators and transport optimizers to speed the transfer in the fewest number of round trips.

- *Transport Optimizers* improve the effective throughput over networks with one or more of the following: restricted bandwidth; high latency; high packet loss. AcceleNet uses a UDP-based transport that uniquely overcomes network problems, can allocate bandwidth dynamically to voice and other "unified communications" traffic, and can even maintain an acceleration session through temporary network disconnects, resuming in-process transfers when connectivity is re-established.

This robust set of technologies is further enhanced with a high degree of "on-the-fly decision-making" throughout the system that applies the most advantageous combination of techniques in each situation. Some examples are:

- selection of the best transport optimization techniques, based on the latency and packet-loss detected in the network – including bypassing AcceleNet when appropriate
- "application-aware" transport decisions, such as dynamic allocation of bandwidth when a new network is detected or in the presence of an IP voice call

The next several sections describe the technical capabilities of the AcceleWorks framework modules.

Application Accelerators

AcceleNet recognizes that Windows file shares, web-based applications, and Outlook/Exchange email all use "chatty" communication protocols that make many sequential requests over the network to satisfy a single user request. These round-trip transmissions multiply any latency in the network, quickly degrading response time. Application accelerators speed multiple, related transactions by continuously predicting what is likely to be requested in the future, effectively focusing on the original user request. Predicted requests and their responses are bundled together for efficiency, reducing the number of transmissions; the application being accelerated is unaware of what is going on "under the covers."

Although most application acceleration solutions may reduce round trips for a few applications, AcceleNet boasts the broadest set of application protocol optimizers in the industry, including CIFS/SMB, MAPI, and other critical business application protocols. In fact, it is the only solution that accelerates secure application protocols such as Signed SMB and HTTPS for small office and mobile users:

- SMB signing protects against session hijacking by providing an additional level of secure authentication that protects SMB traffic from a well-known man-in-the-middle vulnerability. Competitive solutions may be able to apply simple transport optimization and/or data reduction techniques (such as whole-object caching), but for them, the application proxy is blocked by the SMB signature so the application

receives no round-trip reduction. AcceleNet's specialized intellectual property (patent-pending technology) makes it the only client accelerator to actually reduce round trips of signed SMB file transfers.

- performance of secure web applications such as Outlook Web Access (OWA), SharePoint, and SAP is improved with patent-pending Secure Certificate Proxy technology that enables HTTPS to be accelerated without loading private keys onto either the server or client computers.

Data Reduction

Reduction of data volume is at the heart of any acceleration solution as it directly increases the effective throughput of a low bandwidth connection.

AcceleNet delivers the industry's highest compression for first time data access by comparing new content against a very deep data dictionary and by encoding new data based on preceding byte sequences.

On subsequent accesses of the same data, AcceleNet's patent-pending compression and differencing algorithm typically achieves 2000x–4000x data reduction. AcceleNet compression and differencing is:

- able to accelerate any size file (up to size of disk store)
- application protocol agnostic and provides cross-protocol acceleration
- bi-directional, so that data downloaded in one direction can be used for a subsequent transfer in the opposite direction
- secure, with optional encryption for vulnerable client-side history

Each time data is sent through the AcceleNet client or server, the differencing engine creates a history of file information and data blocks that is used to analyze new data. The history is stored to disk, so that data stored from previous sessions is available for extended time periods and over multiple user sessions. A single, shared server history is used by all clients. Thus, even though thousands of users may download the same file, only a single copy is stored, reducing overall system resource requirements.

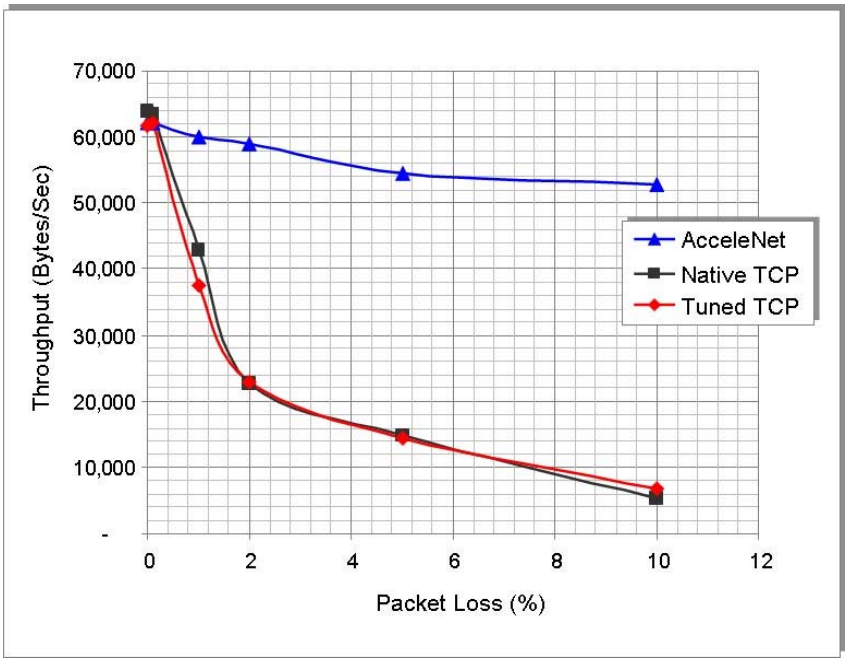
Aggressive, Secure Transport Optimizers

Even with the benefits of compression and application protocol optimization, data still needs to be sent over the network and that still presents a challenge for small office and mobile users. With the exception of AcceleNet, WAN optimization solutions rely on TCP for transport. But TCP is very inefficient on the unreliable links typical of mobile and remote users, especially when using chatty enterprise application protocols. Attempts to improve the performance of TCP in this area are hampered by the need to preserve good congestion behavior in general networks; an

aggressive transport that is aware of application behavior can deliver data as fast as is theoretically possible, even over poor-quality links.

AcceleNet uses its own transport protocol, Intelligent Transport Protocol (ITP), within the acceleration path created between the AcceleNet client and server. ITP runs over TCP/UDP port 1182 and provides better performance than TCP for transferring the highly compressed data within the tunnel—up to 15% improvement over dial-up and 35% improvement for 3G wireless and satellite networks. ITP appears as standard UDP to network routing devices but provides the 100% reliability and optimized flow control that is not found in UDP.

ITP incorporates encryption and many unique features not found in TCP-based products to improve performance. The benefits are best demonstrated in a test of throughput vs. packet loss. Several mobile and remote worker networks like 3G wireless, DSL or dial-up experience 2% or greater packet loss. The graph shows that, at 2% packet loss, the effective throughput of AcceleNet's ITP transport is 95% of the available bandwidth, whereas TCP-based solutions achieve only 35%. In fact, *ITP's benefits actually increase as network conditions degrade* – delivering 8x the throughput of TCP and significantly better application response time in very high-loss networks.



ITP Throughput Comparison with Competitive Protocols

Additional transport features are designed for special handling of network disruptions, voice traffic, and SSL-enabled applications:

- *Advanced roaming and roving:* AcceleNet can maintain the acceleration session even through disruptions such as dropped calls/connections, traversing through hybrid networks (such as cellular roaming), or moving between wireless access points on a WLAN. To understand the

benefit, imagine downloading a very large file; when it's 80% complete, the transfer is interrupted by a momentary network disconnect. With competitive solutions, the request must be re-initiated and the entire download must be repeated. In contrast, AcceleNet maintains the acceleration session; the partially downloaded data is compressed and saved until the session is re-established, and then the download resumes.

- *Dynamic bandwidth allocation:* Recognizing the growing adoption of VoIP applications such as Skype, Microsoft OCS, and unified IP communications systems in small office and mobile worker applications, AcceleNet can actually improve voice performance over a connection with significant packet loss or when transferring large files during a call. AcceleNet monitors for the presence of real-time traffic, dynamically allocates adequate bandwidth, and then reassigns the full bandwidth to data when the call is complete. All traffic is accelerated throughout, including the data, but depending on available bandwidth, the data may see a decrease in assigned bandwidth since it is being shared with the prioritized real-time data.

- *Trusted acceleration tunnel for enterprise security.* The end-to-end encryption used by SSL-enabled applications prevents optimization of the underlying data. AcceleNet creates a "trusted acceleration tunnel" to de-encrypt and optimize the data, transmit it securely and then encrypt it again at the other end. This allows applications like Outlook Web Access to be accelerated across the WAN as if they were not encrypted.

Client Data Flow

AcceleNet's data flow architecture maximizes PC-friendliness with other installed applications by using application-aware traffic interception techniques. The application-aware approach eliminates the necessity to specify ports, port ranges, and fine-grained IP address filters, and aligns to the way administrators currently manage PC-based applications.

In the client device, traffic that is to be accelerated is intercepted and redirected to the AcceleNet client, which sends it to the AcceleNet server, which in turn communicates with the application or file server.

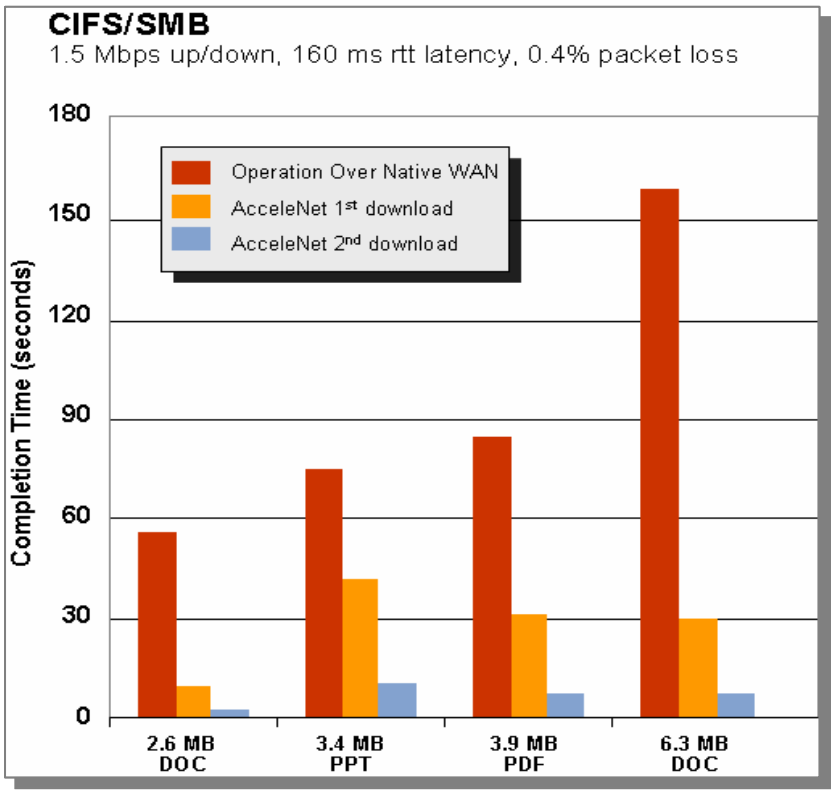
Accelerated traffic is differenced and compressed, multiplexed with other application traffic, compressed again, encrypted and transported via a single, highly optimized ITP connection to the AcceleNet server. ITP, which runs over UDP port 1182, does not create an open port on the client, so it is generally transparent to the firewall.

The AcceleNet server data flow mirrors the client data flow, similarly terminates the application and file connections on one side, and communicates via ITP on the other.

The AcceleNet Performance Advantage

AcceleNet stands alone in the market for client-based acceleration. The reason is a deep understanding of enterprise application behavior over public infrastructure, poor-quality networks, and secure VPN connections, as well as the application of several technology innovations to address them.

The AcceleWorks architecture's robust combination of application accelerators, data reducers, transport optimizers, security handlers, and real-time decision-making intelligence delivers unmatched performance. The following graph shows first and subsequent download performance of several Microsoft Office files. Performance on higher-loss networks, such as 3G, would be even greater with the benefits of ITP.



AcceleNet Download Performance

In addition to these examples, AcceleNet outperforms all competitive products over poor-quality networks and is the only solution that accelerates:

- Signed SMB traffic
- HTTPS secure web applications

Summary

In summary, AcceleNet is the only application acceleration solution designed specifically for the growing percentage of workers who are not permanently connected to the enterprise LAN – remote field forces, business travelers, teleworkers, small office workers, and even those who work from home evenings and weekends. Because single- and few-user locations are less likely to be accessing the same data repetitively, security considerations are not the same as remote corporate offices, and the networks these users depend on are less reliable, porting acceleration software from appliance-based solutions is not the answer.

The combination of AcceleNet techniques described in this document delivers superior performance for transfers of remote files, email attachments, web pages, and web-based enterprise applications over narrowband, high latency, and problematic networks.