How SafeVelocity™ Improves Network Transfer of Files

1. Introduction

The explosive growth of e-business and e-commerce is causing the demands of data storage and transfer management to increase exponentially. Financial, healthcare, insurance, manufacturing, high technology, telecommunications, and other industries are all conducting mission-critical operations over the Internet and within private intranets.

Unfortunately, many of the data management tools used today are yesterday's technology. IT departments everywhere are discovering that what were adequate tools just a few years ago will not scale to the massive rise in network activity and data transmissions needed today. The growing pains associated with these network infrastructure developments can include network congestion, slow response times, failed network connections, data loss and corruption, data not synchronized between systems, and compromised network security. Not only are these problems costly in time and money, but there is also a negative impact on image and reputation. With the fierce competition in today's electronic marketplace, corporations need solutions that enable them to stay ahead of the pack.

Forester Research reports that the data storage is increasing on average at a rate of about 52% per year. Other reports estimate this rate at 100% per year. The global 2,500 companies, reportedly, have an average of about 15 terabytes of data each. In addition, corporate LAN and WAN bandwidth requirements of companies are expanding at an average rate of 34 – 38% per year. Part of that bandwidth expansion is caused by movement of this ever increasing amount of stored data.

During 2000, two top corporate spending priorities for IT were 1) increased bandwidth and 2) better network security. Companies that have the most requirements for more bandwidth and security tend to be in industries that are data-intensive: telecommunications, healthcare, pharmaceutical, insurance, in addition to the newer companies like the Internet Service Providers, Application Service Providers, and Storage Service Providers. Further, many traditional companies are now moving their sales online and seeing this tremendous growth in storage and bandwidth needs.

2. Common Methods for Network File Transfer

Significant portions of this exploding data must be moved over networks and there are three primary ways to accomplish this. One of the most common and probably the most efficient is via ftp, file transfer protocol. Second, but generally for smaller files, is e-mail. Third are web browsers, which also tend to be for smaller files.

FTP: Free ftp software comes bundled with most systems. However, this free ftp software has shortcomings. First, it is slow. If you're transferring very large files (files for engineering applications, for example, are often hundreds of megabytes or even gigabytes), it's necessary to compress these files before sending to reduce the transmission time and make the files easier to handle. Unfortunately, this compression process adds considerable time (often hours for gigabyte-sized files). When you transfer large files, you need to monitor the progress, often for hours, because if the transfer is interrupted, you either have to restart the transfer or start over again. It's a manual process that must be monitored and helped along.

Probably the most serious shortcoming of the bundled ftp products is their lack of security. They send your password in the clear. If intercepted, all files in your account are at risk, not just the ones you transferred. Also, most of these free ftp applications were written before software hacking and break-ins were common and are very susceptible to security breach. They contain known security holes and don't use modern programming techniques.

Despite these shortcomings, these bundled ftp products are used daily for millions of file transfers. Today, ftp file transfers represent about 5% of all internet traffic, according to an MCI study of backbone data traffic.

E-mail: E-mail applications use SMTP, simple mail transfer protocol, which runs on top of TCP/IP. SMTP is written for ASCII files and only supports seven-bit characters. Yet, most binary files use a format of more than seven bits. When you send an e-mail with an attached binary file, the e-mail program converts the binary attachment into an ASCII file, when it does that, the file size increases by about one third. Further, many e-mail servers limit the size of attachments that can be accepted to less than 5 megabytes. Clearly, e-mail is not a practical or efficient approach for users who transfer a lot of files or large files.

Web browsers: Web browsers are convenient for downloading small files but are slow and have very limited file transfer functionality. Web browsers don't allow you to perform basic functions of an ftp application, such as adding/deleting remote directories or changing file names. Some browsers will not even allow you to upload files.

3. Need for an Improved Network Transfer Solution

It's clear that there is a need for an improved file transfer solution. Based on an extensive survey of existing ftp users, the primary areas requiring improvement include the following:

- *Security:* encoded passwords and hacker-resistant coding.
- *Reliable transfer:* ensured transfer even if the line is interrupted during transfer
- *Better performance:* faster file transfers and less bandwidth requirements
- *Manageability:* easy to use and less time to administer.
- *Scalability:* from small files to file sizes in the gigabytes
- *Open standards:* works with the other existing ftp programs, as well as with itself.

4. SafeVelocity™ — The Optimum Solution

The SafeVelocity file transfer Program offers an optimum solution. It is a reliable, secure, performance-optimized network transfer solution that meets the needs of today's enterprises. Table 1 compares the features of SafeVelocity with standard ftp:

Table 1: Feature Comparison – SafeVelocity™ vs. Standard ftp

Feature	SafeVelocity	Standard FTP
STANDARD FTP FUNCTIONS		
Upload and download files	X	X
Select and transfer multiple files during one session	X	X
Concurrent file transfers from one client	X	X
View and navigate directories on local & remote systems	X	X
Add & delete files & directories on local & remote systems	X	X
Rename files and directories on local & remote systems	X	X
SECURITY ENHANCEMENTS		
Encrypted password	X	No
Hacker-resistant coding	X	No
ENSURED TRANSFER FEATURES		
Auto-resume if communications interrupted	X	No
Checks available disk space before sending	X	No
Verifies file size after transfer	X	No
PERFORMANCE ENHANCEMENTS		
Automatic on-the-fly compression/decompression of files	X	No
Parallel threaded processing	X	No
Transfer files changes only – delta transfer function	X	No
SCALEABILITY		
Supports file transfers >2GB	X	No
EASY TO USE		
Standard command line interface	X	X
OPEN STANDARDS DESIGN		
Compatible with other ftp products	X	X

Security: Unlike standard ftp applications that transmit passwords in the clear, SafeVelocity hinders unauthorized system access by transmitting encrypted passwords. Further, SafeVelocity is hacker-resistant: Instead of invoking sub-processes, like most transfer programs; SafeVelocity is a threaded application that never invokes a sub-process. Character buffers are always cleared, and boundaries are always checked to foil hacking. These programming techniques significantly limit the possibility that malicious operators can exploit these known security holes. In addition, SafeVelocity's on-the-fly compression (discussed below under Performance) also serves as a form of encryption for additional data protection.

Ensured Transfer Features: Before transferring files, SafeVelocity checks to ensure that adequate disk space exists on the target machine. During transmission, SafeVelocity performs a checksum verification of each compressed block of data to ensure data integrity. After transmission, SafeVelocity checks the transmitted file size against the original file to ensure complete transmission. In the event of a difference in file size, a checksum error, or a broken communications line during transfer, SafeVelocity automatically resumes the link and completes the transfer from the point of error or interruption.

This feature allows the unattended transfer of a large file or group of files with full confidence that if a transmission failure occurs it will be corrected automatically without the need for operator intervention.

Performance: SafeVelocity is the first intelligent file transfer solution. It determines the fastest way to transfer a file over the network. Before transmitting, SafeVelocity determines the speed of the network between the sending system and the receiving system. Based on the speed of the network, SafeVelocity determines if it is faster to automatically compress and decompress the file during transmission or to send it uncompressed. SafeVelocity also has the intelligence to turn compression on and off dynamically based on the compressibility of the data. If a file has mixed data where some portions are easy to compress and some portions are not compressible, SafeVelocity will only compress the portions that are easy to compress. By compressing the file to a smaller size, transmission time is reduced dramatically and less bandwidth is used.

In most cases where the end to end throughput rate is less than about 1.5MBits/sec (about the speed of a T1 line), it is significantly faster to automatically compress and decompress the file than it is to send it uncompressed. Note that even though a user may have a T1 connection to the internet, the throughput rate to any given location is only as fast as the slowest link. File transfers over the internet rarely achieve T1 throughput rates even with a T1 connection at one or both ends. Even with high-speed connections between two locations, heavy network congestion can significantly slow the transfer rate.

The figure below shows typical savings achieved using SafeVelocity during test transfers. The Word file was transferred a little more than three times faster using SafeVelocity than using standard FTP. An Excel file was about two and a half times faster. An ASCII text file took 7 minutes and 24 seconds using normal FTP. SafeVelocity transferred it in 15 seconds, about 30 times faster. Most impressive of all, an Oracle file took 2 hours and 14 minutes to transfer using standard ftp. SafeVelocity transmitted it in 67 seconds: Actual savings will vary depending upon the file transmitted, the speed of the system processors, and network congestion at the time of transfer.

TIME & BANDWIDTH USAGE
SAFEVELOCITY vs. STANDARD ftp
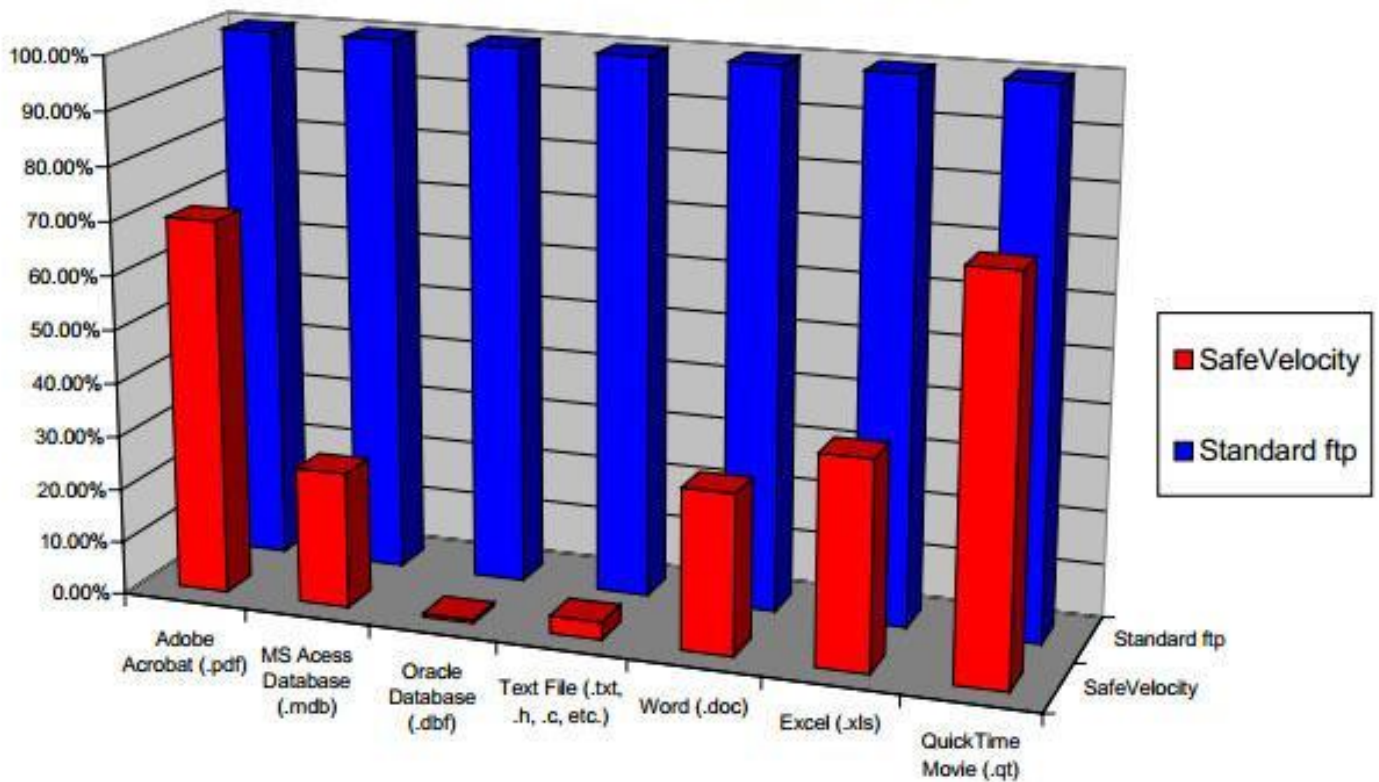
If SafeVelocity determines it is faster to use compression, the compression and decompression of the file are performed automatically and are completely transparent to the user. SafeVelocity uses parallel threaded processing, which means that while one thread reads the file from the Input/Out buffer, another thread performs block by block compression, while a third thread writes the file out onto the network. All three threads work in parallel. In the meantime, the reverse parallel threaded process is taking place at the receive site. This parallel processing provides significant performance advantages: Rather than manually compressing the whole file (Time T1), transferring it (Time T2), and manually decompressing the whole file (Time T3), which takes T1 + T2 + T3, SafeVelocity takes slightly more than T2, as the read, compress, decompress, and write processes all occur concurrently.

If the file being transmitted is already compressed, SafeVelocity will attempt to compress it further, which it frequently can. If, however, SafeVelocity determines that it cannot compress the file further, it will send the file in its existing compressed state. Files are always delivered in exactly the same state as they were sent.

In order to transmit a compressed file using standard ftp, the user must first compress the file using a compression utility, then transmit the file using standard ftp. The recipient of the file must then decompress the file using the same compression utility. This manual, sequential process is significantly more time consuming and far less convenient for the user than the completely automated SafeVelocity process. More importantly, the time required to compress, transfer and then decompress may actually take longer than sending the uncompressed file. Factors affecting this decision include the compressibility of the file, the throughput rate of the network at the time of transmission and the processor speed of the sending and receiving machines. Manually making this decision is pure guesswork. SafeVelocity takes the guesswork and hassle out of the management of file transfers by providing an automated, highly efficient process.

Another advanced and unique feature of SafeVelocity is its ability to stream (pipe) file generation with file transfer (put). This pipeput capability enables file generation and transfer to be done concurrently on the fly. It is common to have pre-processing before transferring large files, such as compression, encryption, or tar. As a result, the work flow is in sequence: Ftp cannot transfer the first byte of the file until the last byte of the file is generated. With pipeput, the transfer starts as soon as the first byte is generated. This speeds up the whole transfer process. For large file transfers, many hours or days can be easily saved.

The combination of automatic compression/decompression, threaded processing, and parallel transfer with file generation provides a file transfer solution that is unmatched in overall performance.

Scalability: The SafeVelocity Solution provides even greater savings in time and bandwidth with larger files. It's a completely scalable product even for files in excess of 2 gigabytes, which is the limit for most standard ftp products. Because of their large size, the time and bandwidth savings provided by SafeVelocity are multiplied many times over for these very large files.

Ease of Use: Minimal training and administration are required for SafeVelocity because of the user-friendly interface. SafeVelocity provides a simple, command-line interface that will be familiar to users of standard ftp. Because SafeVelocity is backward compatible with standard ftp, switching to SafeVelocity requires very little training: Users immediately reap the benefits of added reliability, security and improved performance.

Open Standards Design: Due to its standards-based design, SafeVelocity is compatible with existing ftp products. Implementation follows Request for Comment standards including RFC 959, RFC 2389, and RFC 2640. As a result, standard ftp client software and standard web browsers (e.g. Internet Explorer and Netscape Navigator) can upload and download files to a SafeVelocity server. Similarly, SafeVelocity Client software can upload and download files to standard ftp servers. SafeVelocity automatically determines if standard ftp or SafeVelocity software is on the other end of the transfer and formats files accordingly. However, only with SafeVelocity on both ends of the transfer can you take advantage of SafeVelocity's advanced features such as the encrypted password, automatic compression and decompression and delta transfers.

5. Summary

SafeVelocity is the only intelligent file transfer solution available. It optimizes ftp performance, enhances security and reliability, saves time and bandwidth and scales with tomorrow's growth. Overall, it provides tremendous value to its users.