# F5 WANJet CIFS Acceleration

## *Overview* What is CIFS?

Common Internet File System (CIFS) is a remote file access protocol that forms the basis for Windows file sharing. It is a de facto standard and comes pre-bundled with all Microsoft-based client (e.g. XP) and server (e.g. Server 2003) platforms. Various CIFS implementations (e.g. Samba) are also available for other operating systems such as Linux.

CIFS defines both a client and server: the CIFS client is used to access files on a CIFS server. For example, each time you browse or access files on a Windows server using Windows Explorer, the CIFS protocol is used to transport information (files or directory information) back and forth between your computer and the server you are accessing.

Anyone who has ever copied a file from a mapped drive and seen the dialog box in Figure 1 has used the CIFS protocol, perhaps without actually knowing it.

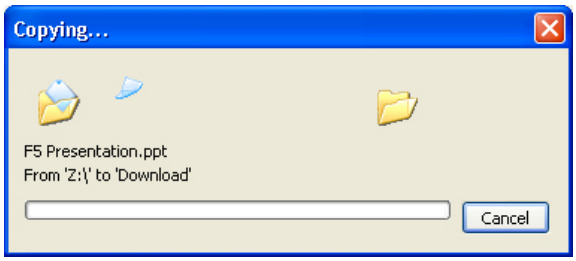


**Figure 1: Windows File Sharing (CIFS transfer)**

In addition to file sharing, CIFS is also used as a transport protocol for various higher level Microsoft communications protocols, as well as for network printing, resource location services, remote management/administration, network authentication (secure establishment services) and RPC (Remote Procedure Calls).

## *Challenge* What is the problem with CIFS?

CIFS was designed back in the 1980s* when the networking paradigm was quite different from today. At that time, no consideration was made for how CIFS would operate over a high latency WAN link. As many network managers have discovered, CIFS operates very poorly over such a link. The fundamental reason is because by design CIFS is a very “chatty” protocol, meaning a large number of back and forth transactions are required to complete a request. For example, the largest chunk of data that CIFS can transfer in a single roundtrip between client and server is 61,440 bytes (61KB). As illustrated in Figure 2, each CIFS request requires a response before the next request is sent to the CIFS server. Therefore CIFS is a latency-bound protocol meaning that as latency increases the performance of CIFS decreases.

To put this in perspective, in order to transfer a single 30MB file, the CIFS protocol would have to make hundreds of roundtrips between client and server. On a typical LAN this would take a few seconds but on a 2 Mbps WAN link with 300msec latency it would take around 7.5 minutes! Clearly this level of performance degradation has a severe negative impact on productivity. With F5’s WANJet product, this same transaction can be reduced to less than 2.5 minutes for a greater than 3x improvement. On subsequent transfers of this same 30MB file the transfer time reduces to less than 30 seconds as CIFS acceleration and the WANJet Transparent Data Reduction (TDR) work together. As the bandwidth and latency of a WAN link increases, the benefit of WANJet CIFS

acceleration increases as well.

*The precursor to CIFS called Server Message Block (SMB) protocol was designed in the 1980s and CIFS is implemented on top of SMB.

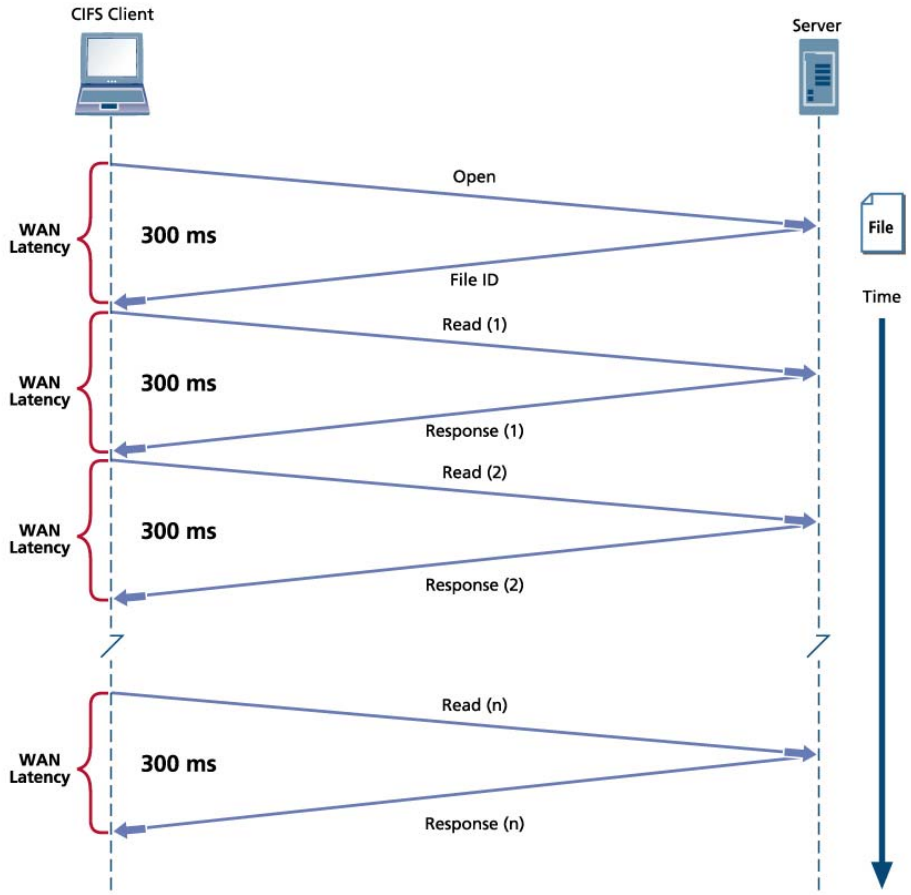


**Figure 2: CIFS inefficiency over a high latency WAN link**

## *Solution* How does WANJet improve CIFS performance?

Each WANJet appliance has a deep understanding of the CIFS protocol and can therefore act on behalf of a CIFS client (e.g. Microsoft XP computer) and server (e.g. Windows Server 2003 computer) to make the interaction between the two much more efficient. The result is dramatic improvement in two main CIFS related interactions:

- File Access – file download (read), upload (write) and remote access (e.g. launch Powerpoint file on a remote CIFS share)
- Directory Browsing - Moving around (clicking on folders and subfolders) in a directory (using Windows Explorer) on a remote server

WANJet maintains a state machine and database of CIFS behaviors that it relies upon to reliably anticipate future CIFS related transactions. When WANJet determines that a certain CIFS

transaction is likely to occur, it pre-fetches data (e.g. a file) and temporarily stores it in the remote (client) WANJet system's memory for future reference. Once the pre-fetched data is referenced (transaction successfully predicted) it is deleted from the memory. No file caching is involved; just transient storage of data to facilitate improved CIFS response time.

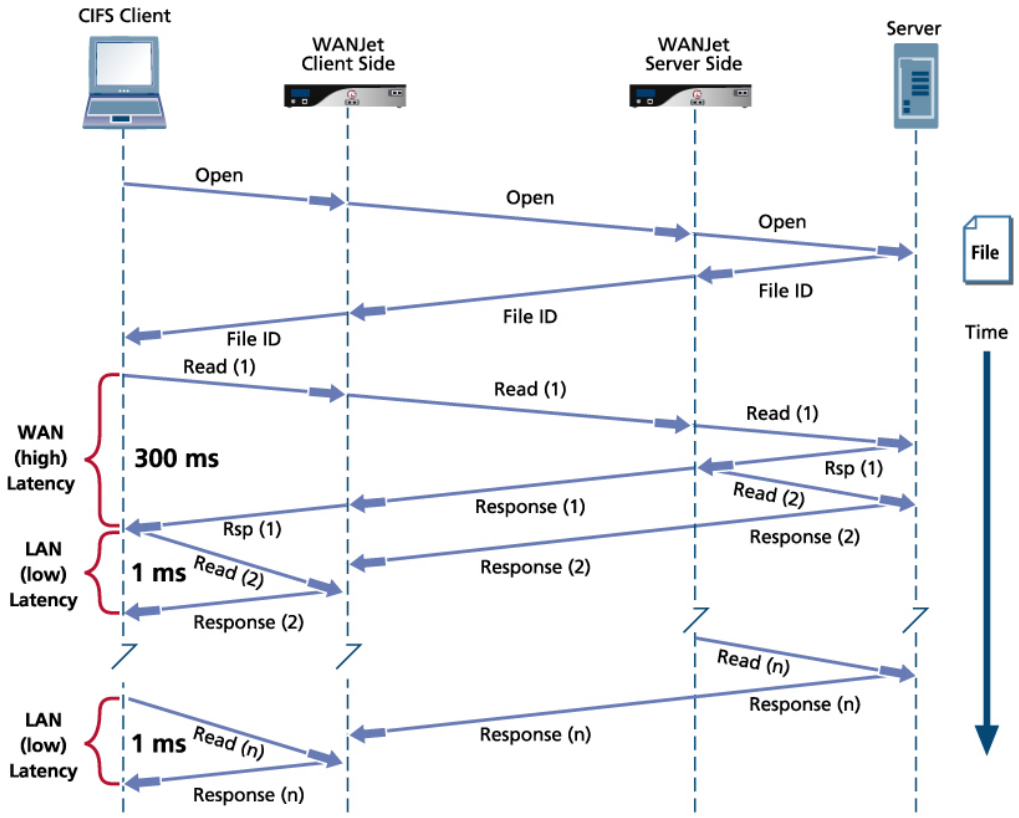


**Figure 3: CIFS File Download (Read) Example**

Figure 3 illustrates the primary goal of WANJet CIFS acceleration: reduce the latency experienced by the CIFS client (e.g. Microsoft XP computer) from WAN latency (i.e. high) to LAN (i.e. low) latency.

The sequence of events that transpire when WANJet accelerates a CIFS file download (read) request is as follows:

- CIFS client opens a file for reading
- CIFS server responds with a file ID
- CIFS client issues the first read request and CIFS server responds with data. This first transaction takes a relatively long time because the read request and response are bound by the WAN latency (e.g. 300ms)
- Once the WANJet systems see the initial transactions, they can determine that the CIFS client is attempting a file download. At this point, the server side WANJet begins pre-fetching data by generating read requests locally to the server at a rate that will keep the WAN link full. If this is a repeat transfer or the file contains repeated data, then the server side WANJet will get TDR hits and therefore transfer only a small amount of data across the WAN link. This will in turn further speed up the CIFS transfer.

- The pre-fetched data is sent to the client side WANJet and stored temporarily in anticipation of requests from the CIFS client. As the CIFS client requests the file data, instead of getting each 61k bytes from the server (and hence going across a high latency WAN) it now gets the replies locally from the client side WANJet at LAN speeds (e.g. 1 ms or less). This will in turn vastly improve CIFS download performance.

One point to note is that all pre-fetched data is only stored temporarily in WANJet memory and if it is not accessed it is erased. An entire file is never stored in the WANJet (there is no file system) and hence there is no security concern.

CIFS acceleration works seamlessly with Transparent Data Reduction (TDR) and will benefit from TDR's ability to reduce data traversing the WAN just as other applications such as FTP, HTTP or email do.

**Other Common CIFS Use Cases**

A file download was used to illustrate how WANJet performs CIFS acceleration. However, CIFS acceleration uses similar mechanisms to achieve greatly improved performance for many other scenarios. Below are a few examples:

*File Upload (Write)*

This is conceptually very similar to a file download with the obvious difference being that a CIFS client is writing a file to a CIFS server instead of reading it. In this case, the client side WANJet responds locally to the CIFS client's write requests and passes the data to the server side WANJet at WAN link speed to complete the write operation.

*Directory Browsing*

Due to CIFS inherent inefficiencies, refreshing a remote directory list across a high latency link takes a long time leaving the user to stare at an hourglass as time slowly passes by. Using a combination of directory pre-fetching and caching, WANJet can greatly improve the response time of directory browsing. Suddenly instead of waiting 10s of seconds to display a directory tree, it now appears in near real time.

*Remote Access of Microsoft Office Files*

Microsoft office files (e.g. MS Word, Powerpoint, Excel etc.) which reside on a remote CIFS server are often accessed (double-clicked) from a CIFS client. This action suffers from all of the CIFS related problems that are described in this paper because the file data is retrieved serially, 61k bytes at a time. The result is a long wait time to open the file, browse or perform any type of action (e.g. save). WANJet CIFS acceleration addresses these problems by pre-fetching the file data and populating it on the client side WANJet. Consequently all CIFS client requests for the file data are served from the client side WANJet at LAN speeds.

## *Conclusion*

Common Internet File System (CIFS) is a remote file access protocol that forms the basis for Windows file sharing. Because each F5 WANJet product has a deep understanding of the CIFS protocol, it can therefore act on behalf of a CIFS client (e.g. Microsoft XP computer) and server (e.g. Windows Server 2003 computer) to make the interaction between the two much more efficient. This results primarily in a dramatic improvement in File Access and Directory Browsing functionality while accelerating remote access to MS Office Files at LAN-like speeds. The WANJet CIFS acceleration also works seamlessly with TDR (Transparent Data Reduction) and will benefit from TDR's ability to reduce data traversing the WAN just as other applications such as FTP, HTTP or email do. All of this ultimately results in a solution that delivers LAN-like application

performance over the WAN, accelerating file transfer, email, client server applications, data replication, and others while delivering predictable, fast performance for all WAN users.

***About F5***

F5 Networks is the global leader in Application Delivery Networking. F5 provides solutions that make applications secure, fast, and available for everyone, helping organizations get the most out of their investment. By adding intelligence and manageability into the network to offload applications, F5 optimizes applications and allows them to work faster and consume fewer resources. F5's extensible architecture intelligently integrates application optimization, protects the application and the network, and delivers application reliability - all on one universal platform. Over 10,000 organizations and service providers worldwide trust F5 to keep their applications running. The company is headquartered in Seattle, Washington with offices worldwide. For more information, go to www.f5.com.