Makani CIFS Acceleration

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 with all Microsoft-based clients and servers.

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.

CIFS: The Problem

CIFS was designed back in the 1980s when 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 round-trip between client and server is 61,440 bytes (61KB). As illustrated in Figure 1, each CIFS request requires a response before the next request is sent to the CIFS server. Therefore as latency increases the performance of CIFS decreases.

In order to transfer a single 30MB file, the CIFS protocol would have to make hundreds of round-trips 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 Makani CIFS Optimization, 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 Makani Latency Buster™ architecture work together. As the bandwidth and latency of a WAN link increases, the benefit of CIFS transaction is likely to occur, it pre-fetches data (e.g., a file) and temporarily stores it in the Makani system's file cache for future reference. Once the pre-fetched data is referenced it is deleted from the cache. Transient file caching and storage facilitates improves CIFS response time.

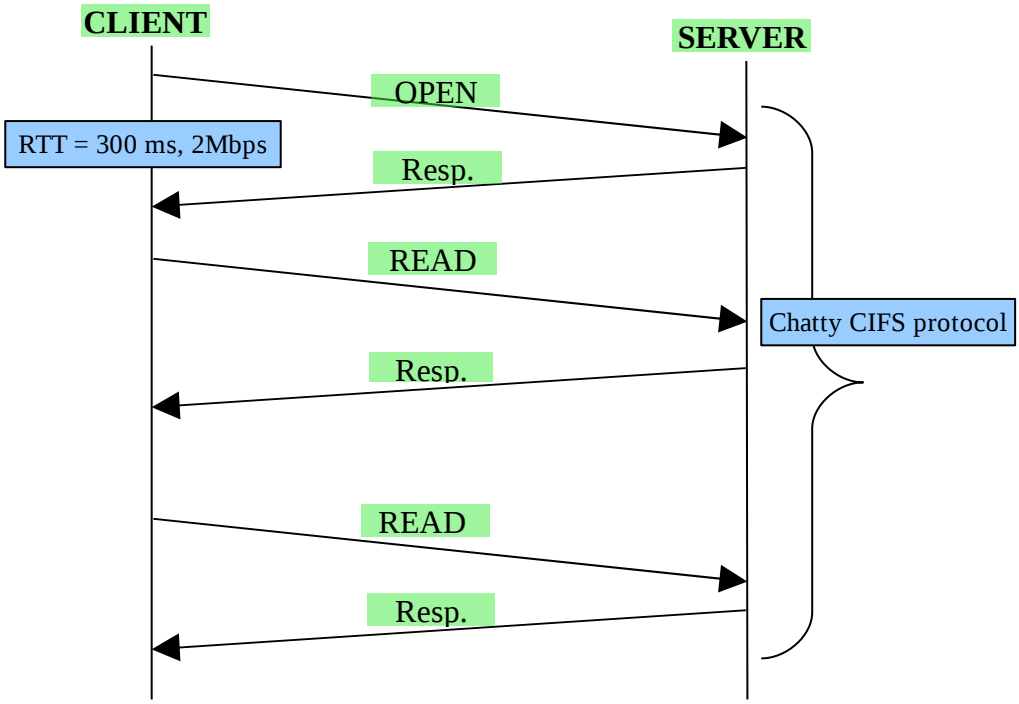

Fig. 1 Chattiness in CIFS. It takes more than 7.5 minutes to transfer a 30 MB file!

Makani CIFS Optimizations

Each Makani 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

Makani implements a CIFS proxy that it relies upon to reliably anticipate future CIFS related transactions. When Makani determines that a certain CIFS transaction is likely to occur, it pre-fetches data (e.g., a file) and temporarily stores it in the cache for future reference. Once the pre-fetched data is referenced it is deleted.

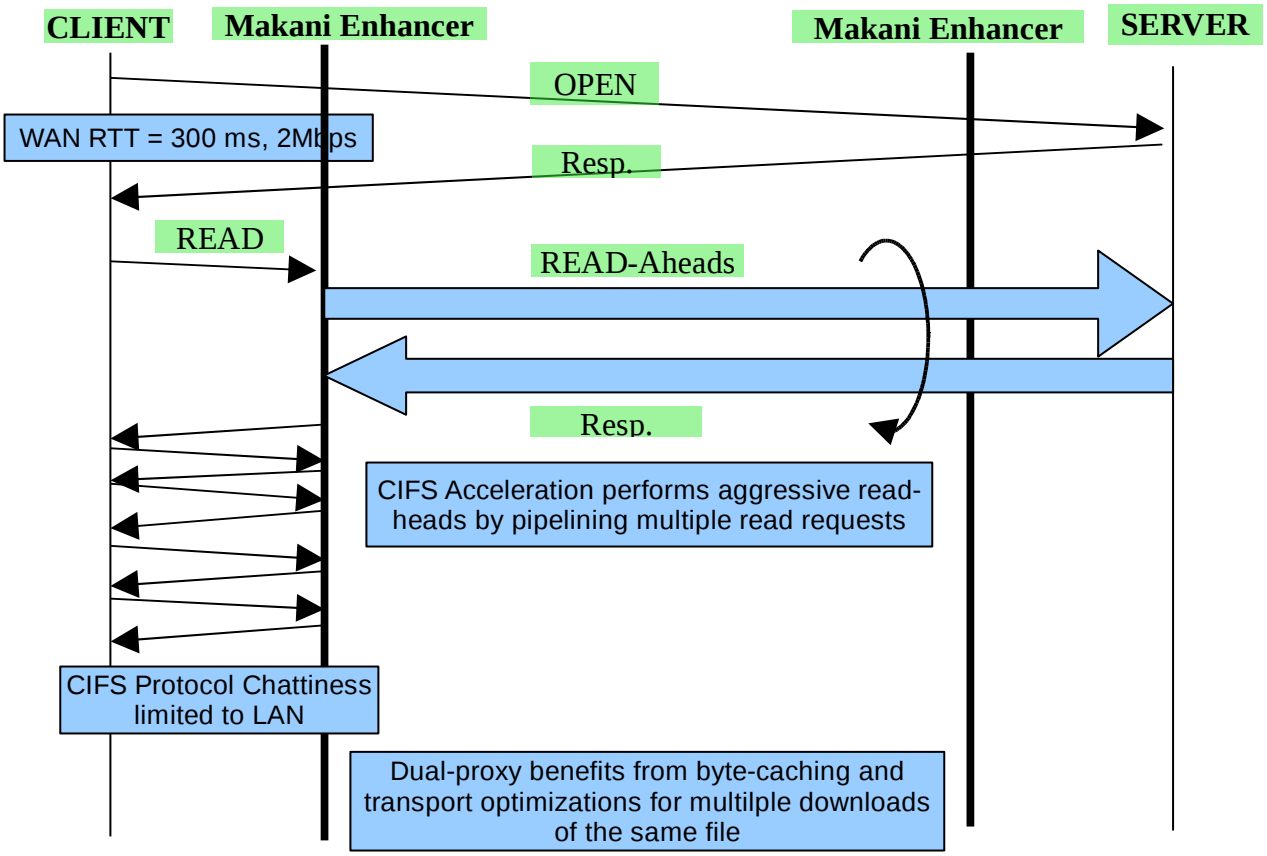

Fig. 2 CIFS Acceleration. Takes less than 2 minutes to transfer a 30 MB file!

File Download (Read)

Figure 2 illustrates the primary goal of Makani 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 when Makani 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 Makani system sees the initial transactions, it can determine that the CIFS client is attempting a file download. At this point, the client side Makani begins pre-fetching data aggressively by generating read requests to the server at a rate that will keep the WAN link full. The server side Makani appliance compresses the pre-fetched data and sends it to the client-side Makani. If this is a

repeat transfer or the file contains repeated data, then the server side Makani will get hits due to Makani's hierarchical memory technology and therefore transfer only a small amount of compressed fingerprint 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 Makani 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 Makani 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 client-side Makani and if it is not accessed it is erased. CIFS acceleration works seamlessly with Makani Latency Buster™ and will benefit from its ability to reduce data traversing the WAN just as other applications such as FTP, HTTP or email do.

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 Makani responds locally to the CIFS client's write requests and passes the data to the server side Makani 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, Makani 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 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). Makani CIFS acceleration addresses these problems by pre-fetching the file data and populating it on the client side Makani appliance. Consequently all CIFS client requests for the file data are served from the client side at LAN speeds.

Conclusion

Unlike other vendors, Makani implements a true CIFS Proxy built right into the appliance. Having an application level proxy means that Makani appliances have better control over CIFS connections, and have the ability to perform application specific optimizations not available with other generic optimizations.

Because each Makani 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 Makani CIFS acceleration also works seamlessly with Makani Latency Buster™ architecture and will benefit from its 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.

Makani offers high-performance, easy-to-use and technically innovative solutions for next-generation wide-area networked data services. Makani Enhancers™ are deployed for wide-area data acceleration and optimization. Makani Mobilizer™ appliances are deployed in the customer's network for blazing-speed data access over a wide-range of access networks. Founded in 2006, Makani is headquartered in San Francisco with regional offices all over the world.