2018

Cornerstone MFT Server
Scaling Best Practices

Instructions for monitoring or configuring Cornerstone MFT Server in a scalable environment.

QuickStart Guide

Cornerstone Scaling and Best Practices

Cornerstone MFT Server is a multi-threaded, multi-protocol server designed to support a large number of distributed clients via a standard browser interface or a client interface.

Cornerstone clustered environments—multiple servers sharing information in one SQL database to save storage and distribute client connections, memory useage, and I/O throughput—service large installations with many concurrent transactions. Cornerstone uses a thread pool model to service requests from clients and uses Windows NT I/O completion port technology, which is more efficient than typical asynchronous Winsock implementations.

You can fine-tune your Cornerstone's performance and memory consumption based on typical usage scenarios, which vary among installations. For small numbers of users, larger I/O buffers will improve useability by allowing active connections to remain open longer. For larger installations, smaller I/O buffers and timeout values for sessions and idle connections will reduce memory consumption.

The two points to consider when scaling a Cornerstone server for a large user base are **Memory Consumption** and **Transaction Throughput** - A more complicated measurement, thanks to factors including the type of transaction requested, the size of the request/response, whether a socket connection was already active, what information was cached either by Cornerstone or SQL Server or the file system, and network latency.

Memory Consumption

The amount of memory you choose to dedicate to a scaled environment requires a fairly straightforward extrapolation based on the number of users and active connections to the server.

Cornerstone MFT Server 32-bit edition allocates a maximum of 2GB or 3GB of memory, depending on the Windows configuration. Cornerstone 64-bit edition allocates a maximum of 8 TB of memory. We recommend the installing 64-bit Cornerstone on a 64-bit version of Windows for maximum performance.

As clients connect to Cornerstone, data structures are allocated to track **sessions, connections, user parameters, I/O buffers, ACL/Permission** for a path requests, and **performance analyses.** Depending on timeout parameters, the data structures remain allocated for varying time periods.

The table below lists memory consumption for some of these data structures. In SFTP and FTP, the session information is embedded in the connection and therefore not quantified.

Data Structure	HTTP/WebDAV	SFTP	FTP
Active Connection	41 KB	8.2 KB	7.8 KB
Session	2 KB	N/A	N/A
User Parameters	94 KB	94 KB	94 KB
I/O Buffers	1–64 KB (variable)		

ACL/Permission for a path	Variable length (264 bytes per entry)

Active Connections

An active connection is an open socket connection from a client. When the connection is closed (either at the request of the server or client) the memory allocated to it will be released. For performance reasons, clients using some protocols such as HTTP, WebDAV, and FTP can and often do request that a connection remain open (Keep-alive) after sending a command to the server. Cornerstone has several settings to control when a connection is allowed to remain open after a command has completed. Cornerstone can be configured to allow only a specific number of connections to be left open at a time, useful for servicing many clients at once.

Sessions

After a client connects to the Cornerstone server, the server will create a session to store user-specific information. While in an active session, Cornerstone won't need to authenticate users for subsequent transactions, which saves time and memory. However, the administrator can configure Cornerstone to clear idle sessions to save memory.

For **HTTP** and **WebDAV** connections, Cornerstone will pass a cookie back to the client for use in further communications with the server. Virtually all browsers and DAV clients are able to support cookies. The session will remain active even after an HTTP connection is closed to enable subsequent connections to make use of the same session. A client can maintain a single persistent connection to the server and open any number of new sessions to conduct transfers.

For **FTP** and **SFTP** connections, the session is attached to the connection and will remain active only as long as the connection persists and is open. FTP must create a new connection for each new data transfer. Consequently, session information is not applicable to SFTP or FTP connections/clients.

User Parameters

Configurable parameters control how individual users interact with the server, including home folder, permissions, and groups. These settings are stored with the session for each logged-on user. So, for each authenticated session object, the memory used would be the session object plus the user parameters memory.

I/O Buffers

Data Buffers are used to process requests from a client as well as data sent back to the client. There is an I/O buffer for every active connection, stored in a read-wait state for the next command from the client. The I/O buffer size can range from 1KB to 64KB. To support many active connections, a reasonable buffer size should be used (for example, 4KB). Larger buffer sizes may improve upload/download performance on larger files at the expense of memory consumption.

ACL/Permissions for a path

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Cornerstone checks the user permissions of every request sent to the server before users are allowed to access data. This information is cached so subsequent access to the same folder or file can bypass the database lookup for the permissions and save time. This cache is periodically flushed from memory.

The table below provides sample memory consumption based on the number of active users logged into the server with an allocated session object (the combination of session and user parameter allocation for authenticated users). The number of active connections to service a specific number of clients is highly variable and depends not only on how Cornerstone is configured with respect to keeping connections open, idle timeouts, keep-alive settings, and concurrent connection limit settings but also on how the client application communicates with the server. The table gives memory usage for each active connection to the Cornerstone server, assuming an I/O buffer size of 8 KB. This does not include active connections.

Logged in Users / Sessions	Memory Usage
1	96 KB
100	9.6 MB
500	48 MB
1000	96 MB
3000	288 MB
5000	480 MB

The number of active connections need not and often don't match the number of currently logged on users. There may be 500 users actively logged in to the server, each with an active session, but 300 of the users may be idle at the time. Only 200 of those clients would have an active connection to the server.

Active Connections	HTTP/WebDAV	SFTP	FTP
1	49 KB	16.2 KB	15.8 KB
100	4.9 MB	1.62 MB	1.58 MB
1000	49 MB	16.2 MB	15.2 MB
3000	147 MB	48.6 MB	47.7 MB
5000	245 MB	81 MB	79 MB

An active but idle connection will consume memory. However, it has little effect on performance, as no polling happens on active socket connections. Cornerstone uses the Windows NT I/O completion port model, which uses thread pools to service socket communications, for all socket I/O.

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System Requirements

Supported Operating Systems

- Windows Server 2012, all editions, 32-bit and 64-bit

- Windows Server 2008-R2, all editions, 32-bit and 64-bit

- Windows Server 2008, all editions, 32-bit and 64-bit

- Windows Server 2016, all editions, 32-bit and 64-bit

Minimum Hardware Requirements

- 2 GHz Pentium® class processor

- 4GB of RAM is required; 8GB of RAM is recommended

- Minimum 100MB of free disk space for the application

- Minimum SVGA (800x600) resolution display is required to run the Administration console program.

Minimum Software Requirements

- Microsoft .NET Framework v4.0 is required

- Microsoft SQL Server 2005 or later is required

- Microsoft SQL Server Management Studio Express is recommended

Limitations

- Cornerstone MFT server is a multi-threaded, dynamic server solution for the Microsoft Windows operating system. While designed to handle an unlimited number of user connections and servers, like all software, Cornerstone is limited by the resources of the computer; most notably, those limitations imposed by the Windows Sockets (WINSOCK) Library.