BadMFS

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BadMFS is a covert file system which attempts to install itself in non-partitioned space. BadMFS provides an interface for a developer to interact with the covert file system, similar to typical Windows API functionality. BadMFS does not encrypt data or otherwise obscure data, it is up to the developer to protect their data, including filenames, if necessary.

BadMFS was developed as a library to support multi-process and multi-threaded environments. BadMFS has also been developed such that it can run as a kernel library to a device driver or other kernel thread.

Methods

bmfsInitialize (Constructor/Installer)

Begins the process of configuring BadMFS. bmfsInitalize will attempt to find a previous installation of BadMFS and either make use of that installation, or if none is found install BadMFS. This function must be called before the rest of the BadMFS library can be utilized.

NTSTATUS bmfsInitialize(HANDLE hDevice);

Parameters

hDevice [in]

A handle to the device that BadMFS will be located on. Examples of valid devices are, volume,

physical disk, socket, a file, or file stream. BadMFS has currently been tested using only a

physical disk.

The hDevice parameter must be created with read | write access, and buffering should be turned off. When using CreateFile this means using the flag FILE_FLAG_NO_BUFFERING, when using ZwCreateFile FILE_SYNCHRONOUS_IO_NONALERT | FILE_NON_DIRECTORY_FILE | FILE_NO_INTERMEDIATE_BUFFERING is recommended.

Return Value

STATUS_SUCCESS will be returned upon successful completion of the initialization process.

Remarks

bmfsInitialize([in] HANDLE hDevice) will attempt to install BadMFS on the first available space

on the supplied device. If a previously installed version of BadMFS is found nothing further

is required. If an appropriate location is found without a previous BadMFS installation

bmfsInitialize will attempt to install BadMFS there.

bmfsPartitionInfo

Retrieves information about the BadMFS partition. Information may only be correct for a limited time due to a multi-threaded and/or multi-process environment .

NTSTATUS bmfsPartitionInfo([out] PBadMFS_FSINF0 bmfsPartInfo);

Parameters

PBadMFS_FSINF0 bmfsPartInfo [out] Structure which will contain information about the BadMFS partition.

Return Value

STATUS_SUCCESS will be returned if bmfsPartitionInfo returns successfully, or a NTSTATUS error

code if otherwise.

Upon successful return the supplied BadMFS_FSINFO structure will contain information about the BadMFS partition.

Remarks

Information returned by bmfsPartitionInfo cannot be guaranteed to be relevant for an extended amount of time. The structure will not necessarily be up to date from moment to moment due to BadMFS being potentially multi-threaded or multi-process. Use with care.

bmfsCreateFile

Creates or opens a file within BadMFS. The method will supply a handle if no errors occur, which can be used to read or write to the file.

NTSTATUS MexCreateFile(

[in] PWCHAR pwcFileName, [in] DWORD dwAccessFlags, [in] DWORD dwCreateFlags, [out] BadMFS_HANDLE *handle);

Parameters

pwcFileName [in]

The name of the file to be created or opened.

This should be a null terminated string not longer than MAX BadMFS FILENAMESIZE-1.

Currently there is no way to extend this limit, although there may be in the future.

dwAccessFlags [in]

The requested access for the file in question. Only one process may write to a file at a time, but

many may read. If multiple instances have already opened a file for read access then an instance intending to write will have to wait until the file becomes available.

The flags used for access are BadMFS_READ , BadMFS_WRITE, or both (BadMFS READ | BadMFS WRITE). If this attribute is zero the results are undefined.

dwCreateFlags [in]

Specifies what action should be taken on the file whether it exists or does not

Value	Meaning
BadMFS_CREATE_NEW (1)	Creates a new file only if the file specified does not already exist
	If the file exists, the method will fail and the status will be STATUS_FILE_EXISTS.
BadMFS_CREATE_ALWAY S (2)	Always creates a new file.
	If the specified file already exists, and is writable, the method wipes the file and replaces it with the new one. The method then succeeds and returns STATUS_SUCCESS.
	If the file does not already exist the file is created and STATUS_SUCCESS is returned.
BadMFS_OPEN_EXISTING (3)	Opens the file only if it already exists.
	If the file is not found the method will fail return STATUS_NO_SUCH_FILE. Otherwise the handle will be set and STATUS_SUCCESS returned.
BadMFS_OPEN_ALWAYS (4)	Always opens the file.
	If the file exists, the function succeeds and returns STATUS_FILE_EXISTS.
	If the file does not exist, the file is created and STATUS_SUCCESS returned.
BadMFS_TRUNCATE_EXI STING (5)	Opens a file and truncates it so that its size is zero bytes, only if it exists.
	If the file is not found, the function fails and returns

exist.

STATUS_NO_SUCH_FILE.
The calling process must use BadMFS_WRITE as part of the dwAccessFlags.

handle [out]

A handle created to keep track of the file opened/created by bmfsCreateFile. This handle will

be used by any method which accesses the file.

Return Value

NTSTATUS will be returned to describe on success or failure.

If the method completes successfully the handle will contain a valid BadMFS_HANDLE.

Remarks

The BadMFS version of bmfsCreateFile, unlike the Windows API version of CreateFile, is specifically for the creation of files only. It cannot currently be used for different types of I/O.

When an application is finished with the handle created by bmfsCreateFile it is responsible for calling bmfsCloseHandle to clean up after itself. If this is not done the handle will remain open, potentially blocking other I/O on that file, until BadMFS is shutdown.

Directories are not currently supported, BadMFS has a flat file structure and everything is within the "root directory". This may be expanded upon at a later date.

bmfsCloseHandle

Closes a specified file handle. Assists with keeping track of how many instances have access to a handle for a unique file.

NTSTATUS bmfsCloseHandle([in] BadMFS_HANDLE *handle);

Parameters

handle [in]

A handle to the file that was opened/created by bmfsCreateFile.

Return Value

If this function succeeds the NTSTATUS code STATUS_SUCCESS will be returned.

Remarks

bmfsCloseHandle will attempt to clean up the file handle specified. This includes decrementing any read count associated with it, if there are multiple open handles to the

unique file the handle represents. This method should only be called once for each time a bmfsCreateFile is called on the file the handle represents.

Errors may occur if bmfsCloseHandle is called multiple times per creation. If this happens

unwanted writes could occur, causing the file state to become unknown.

bmfsWriteFile

Writes the supplied buffer into the file specified by the supplied handle.

NTSTATUS bmfsWriteFile(

[in] BadMFS_HANDLE fileHandle,
[in] BYTE* inBuffer,
[in] DWORD dwBufferSize,
[out] DWORD* dwBytesWritten
);

Parameters

BadMFS_HANDLE fileHandle [in]

Handle created by bmfsCreateFile which represents the unique file to be modified.

BYTE* inBuffer [in] The buffer of data which will be written to the specified file.

DWORD dwBufferSize [in]

Size of the buffer which will be written to the specified file.

DWORD* dwBytesWritten [out]

Will contain the number of bytes which were actually written upon successful completion of the

bmfsWriteFile function.

Return Value

bmfsWriteFile will return STATUS_SUCCESS upon successful completion.

Upon successful return the supplied DWORD, dwBytesWritten, will have the number of bytes

written to the file.

Remarks

bmfsWriteFile will attempt to write the supplied buffer to the file specified. If the write fails for any reason an appropriate NTSTATUS code will be returned.

bmfsListFilesW

Provides a list of all visible files in the BadMFS partition. The caller will be expected to clean up the buffer, which will be created using the pointer provided as an array of strings.

NTSTATUS bmfsListFilesW([out] WCHAR **inBuffer);

Parameters

WCHAR **inBuffer [out] Array of strings which will be created by bmfsListFiles.

Return Value

Upon successful completion the supplied double pointer will contain information about the

visible files within the BadMFS partition and STATUS_SUCCESS will be returned.

Remarks

The caller is expected to supply a double pointer, which will be populated with data in the form of an array of strings. The caller will also be expected to clean up the supplied array of pointers when finished.

If no files exist STATUS_NO_MORE_FILES will be returned and the supplied buffer will be set to NULL.

bmfsReadFile

Accepts a handle and a buffer and attempts to read data from the file specified by the handle.

DWORD MexReadFile(

[in] BadMFS_HANDLE fileHandle, [out] BYTE* outBuffer, [in] DWORD dwBufferSize, [out] DWORD* dwOutBytesRead);

Parameters

fileHandle [in]

Valid handle to a file created by bmfsCreateFile().

outBuffer [out]

Buffer supplied by the caller which will data will be put into.

dwBufferSize [in]

Size, in bytes, of the supplied buffer.

dwOutBytesRead [out]

Number of bytes written to the supplied buffer.

Return Value

Upon successful return the supplied buffer will contain data from the file and dwOutBytesRead will contain the number of bytes written to the supplied buffer. The NTSTATUS will be STATUS_SUCCESS if completion was successful.

Remarks

If a file handle has not been created before this method is called, undefined behavior could occur.

The caller is responsible for creating an appropriately sized buffer which will be filled with data upon successful completion of the method. The exact amount of bytes returned is specified by dwOutBytesRead. In the event that fewer bytes are returned than the size of the buffer it is likely that the end of the file was reached. The EOF character should be placed immediately after the last byte which was read from disk, and STATUS_EOF will be returned.

bmfsFileSize

Calculates the size of the specified file.

NTSTATUS MexFileSize(

[in] BadMFS_HANDLE fileHandle, [out] DWORD* dwFileSize,);

Parameters

fileHandle [in] Valid handle to a file created by bmfsCreateFile().

dwFileSize [out]

The address of a DWORD which will contain the size of the file upon successful completion of bmfsFileSize.

Return Value

Upon successful completion of bmfsFileSize, dwFileSize will contain the size of the specified file and NTSTATUS will be STATUS SUCCESS.

Remarks

If a file handle has not been created before this method is called, undefined behavior may occur.

bmfsDeleteFile

Attempts to delete the specified file.

NTSTATUS bmfsDeleteFile([in] BadMFS_HANDLE fileHandle);

Parameters

fileHandle [in] Valid handle to a file created by bmfsCreateFile().

Return Value

Upon successful completion STATUS_SUCCESS will be returned.

Remarks

Will attempt to delete the specified file. In the case where the proper access has not been assigned to the file handle (BadMFS_Write) bmfsDeleteFile will return STATUS_ACCESS_DENIED.

When a file is deleted it is not wiped! The data could still be there. If a wipe is desired, garbage collection should be run immediately following a delete by calling bmfsDefrag(). This means it is potentially possible to recover deleted data if it has not been overwritten already, however data recovery is not currently supported.

bmfsDefrag

Attempts to recover now unused space and move all files into contiguous blocks of memory.

DWORD bmfsDefrag(void);

Parameters

Return Value

Upon successful completion STATUS_SUCCESS will be returned.

Remarks

As bmfsDefrag() cleans up it will wipe any memory that may no longer be in use.

bmfsDefrag() requires at least 15% of the volume be free to run successfully.

bmfsUninstall

Attempts to remove the file system.

NTSTATUS bmfsUninstall(void);

Parameters

Return Value

Upon successful completion STATUS_SUCCESS will be returned.

Remarks

bmfsUninstall will wipe all data on the BadMFS volume. Currently it does one pass with zeros, which upon investigation could be a signal that something has been there. Because data written to disk with BadMFS is not encrypted in any way it is recommended that bmfsUninstall() be used to wipe the file system before removing the tool making use of BadMFS.

bmfsScramble

Attempts to scramble data in the supplied buffer using a simple xor operation.

NTSTATUS bmfsScramble([in|out] BYTE *buffer, [in] DWORD dwLen, [in] DWORD dwPos);

Parameters

buffer [in|out] Buffer to be scrambled. dwLen [in] Length of buffer to be scrambled. dwPos [in]

Position in buffer to be scrambled.

Return Value

Upon successful completion STATUS_SUCCESS will be returned.

Remarks

bmfsScramble will attempt to scramble the data in the Buffer specified. When writing large

amounts of data dwPos becomes important to help keep track of where scramble is in its

iteration through the scrambling operation.

bmfsCleanup

Attempts to clean up data structures and dynamic memory.

void bmfsCleanup(void);

Parameters

Return Value

Remarks

bmfsCleanup will attempt to delete any dynamic memory and clear our any data

structures initialized by BadMFS during operation. This function should be called

before shutting down the tool making use of BadMFS.

Data Structures

bmfsFSINFO

Structure which contains information about the BadMFS volume.

typedef struct _BadMFS_FSInfo{
 char FSName[mexfs_mfts_size];
 QWORD TotalSize;
 QWORD CurrentSize;
 DWORD NumberOfFiles;
} BadMFS_FSINF0, *PBadMFS_FSINF0;

Elements

char FSName[mexfs_mfts_size]

Contains the name of the BadMFS file system. Currently this name is restricted to being less

than 10 characters, and is not necessarily null terminated.

QWORD TotalSize

Size in bytes of the entire BadMFS volume.

QWORD CurrentSize

Size in bytes of the space currently used on the BadMFS volume.

DWORD NumberOfFiles

Number of files created by a user. This does not include the MFT which is at the beginning of any BadMFS volume.

Remarks

In the case of a multi-threaded / multi-process environment the information contained in

BadMFS_FSINFO will be highly volatile. A BadMFS_FSINFO structure appears at the start of any

BadMFS volume, immediately followed by the BadMFS MFT. This structure is used to update

any user created instance of a $\mathsf{BadMFS_FSINFO}$ structure, which may be populated by

a call to bmfsPartitionInfo().