# EaseFilter Filter Driver SDK Manual

## Introduction

### File system filter driver

A file system filter driver intercepts requests targeted at a file system or another file system filter driver. By intercepting the request before it reaches its intended target, the filter driver can extend or replace functionality provided by the original target of the request. It is developed primarily to allow the addition of new functionality beyond what is currently available.

#### File system monitor filter

File system monitor filter can monitor the file system activities on the fly. With file system monitor filter, you can monitor the file activities on file system level, capture file open/create/replace, read/write, query/set file attribute/size/time security information, rename/delete, directory browsing and file close request by which user and process name. You can develop the software for the following purposes:

- Continuous data protection (CDP).
- Auditing.
- Access log.
- Journaling.

#### File system control filter

File system control filter can control the file activities, which you can intercept the file system call, modify its content before or after the request goes down to the file system, allow/deny/cancel its execution based on the filter rule. You can fully control file open/create/replace, read/write, query/set file attribute/size/time security information, rename/delete, directory browsing these Io requests. With file system control filter, you can developer these kinds of software:

- Data protection.
- File Screening
- Access Control.
- File Security.

#### The rules to use of file system control filter

To use the file system control filter, you need to follow the following rules, or might cause the system deadlock.

1. *Avoid the re-entrance issue, don't generate any new I/O request which will cause the request comes to the control filter handler again.*
2. *Avoid using any file operations in buffered mode, open any file in the control filter handler with FILE_FLAG_NO_BUFFERING flag set.*

3. *Avoid asynchronous procedure calls.*
4. *Avoid any GUI (user interface) operations.*

### File system encryption filter

File system encryption filter provides a comprehensive solution for transparent file level encryption. It allows developers to create transparent, on-access, per-file encryption products which it can encrypt or decrypt file on-the-fly. Our encryption engine uses a strong cryptographic algorithm called Rijndael (256-bit key), it is a high security algorithm created by Joan Daemen and Vincent Rijmen (Belgium). Rijndael is the new Advanced Encryption Standard (AES) chosen by the National Institute of Standards and Technology (NIST).

### Process filter driver

Process filter driver is a kernel-mode driver that tracks and controls the process and thread operations, it provides you an easy way to develop Windows application for the Windows process monitoring and protection. Prevent the untrusted executable binaries (malwares) from being launched, protect your data being damaged by the untrusted processes.

### Registry filter driver

Registry filter driver is a kernel-mode driver that tracks and controls the registry access, it provides you an easy way to develop Windows application for registry monitoring and protection, it enables your application to prevent the Windows core registry keys and values from being damaged.

## Supported Platforms

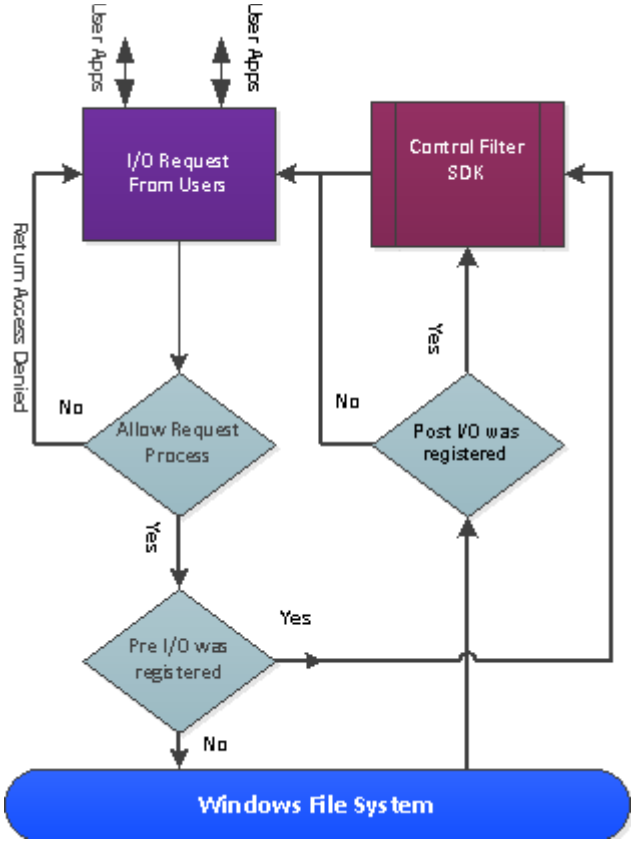
- Windows 2016/Windows 2019
- Windows 10 (32bit, 64bit)
- Windows 8 (32bit, 64bit)
- Windows 2012 Server R2
- Windows 2008 Server R2 (32bit, 64bit)
- Windows 7 (32bit,64bit)
- Windows 2008 Server (32bit, 64bit)
- Windows Vista (32bit,64bit)
- Windows 2003 Server(32bit,64bit)
- Windows XP(32bit,64bit)

# EaseFilter Filter Driver SDK Manual

## Overview and Basic Concepts

### The EaseFilter file system filter driver

EaseFilter file system filter driver is a kernel component module which is sitting on the layer between the I/O manager and the file system. When a user application invokes a win32 API to a file, the filter driver can intercept this I/O, based on the policies was set with the filter rule, the I/O information can be sent to the user, or be modified/blocked the access based on the setting as below figure.




### Filter Rule

A filter rule is the policy for the filter driver, it tells the filter driver how to manage the files. To manage the files by filter driver, you need to create at least one filter rule, you can have multiple filter rules with different policies to manage different files to meet your requirement.

A filter rule has only one unique include file mask, when a new filter rule was added to the filter driver, if a filter rule with the same include file filter mask exists, the new filter rule will replace the older one.

A filter rule has a AccessFlags to control if the file access can be proceeded, for Monitor filter driver, it always should be set with the maximum rights. If it is 0, it means this is a exclude filter rule, all the files match the include filter mask will be skipped by this filter rule. Exclude filter rules always are sitting on the top of the other filter rules.

A filter rule can register the file events (reference FileEventType), when it the file I/O events were triggered, the filter driver will send the file events message back to the user mode service.

A filter rule can have multiple exclude file filter masks, it is optional. When a file was opened, if the file name matches the exclude filter mask, the filter driver will skip this file I/O.

A filter rule can have multiple include process names, process Ids, exclude process names, process Ids, include user names and exclude user names. These are optional setting.

If a filter rule has the flag ENCRYPTION_FILTER_RULE enabled, the encrypted data can be decrypted transparently in memory by filter driver when it was read, and the new data will be encrypted and be written to the disk when the encrypted file was written. If the flag ALLOW_NEW_FILE_ENCRYPTION is enabled, the new created file will be encrypted automatically.

If a filter rule has the flag HIDE_FILES_IN_DIRECTORY_BROWSING enabled, the filter rule can add multiple hidden file filter mask, when user browses the folder, if the file names match the hidden filter mask, they will be hidden from the user.

A filter rule only can have one unique include file mask, when a new filter rule was added to the filter driver, if a filter rule with the same include file mask already exists, then the new filter rule will replace the older one. A filter rule can have multiple exclude file masks, multiple include process names and exclude process names, multiple include process Ids and exclude process Ids, multiple include user names and exclude user names.

### How to manage the file I/O with the filter rule

When an file I/O occurs, the filter driver will check the filter rule policies with the below order to decide if it should manage this file I/O or not:

a. If the exclude filter rules (AccessFlags is 0) exist, the filter driver will look for all the exclude filter rules first, if the files match the include file filter mask of the exclude filter rule, the filter driver will skip this file I/O, or go to next step.
b. Check the next filter rule, If the file name matches the include file filter mask, then go to next step, or continue step b, till no more filter rules.

c. Check if the exclude file filter mask list is empty, if it is not empty, then it will check if the file name matches the exclude file mask, if it matches, then go to step b, or go to next step.
d. Check if the include process name and include process Id list are empty, if they are not empty, then check if the current process name or process Id is in the include list, if not then go to step b, or go to next step.
e. Check if the exclude process name and exclude process Id list are empty, if they are not empty, then check if the current process name or process Id is in the list, if yes then go to step b, or go to next step.
f. Check if the include user names list is empty, if it is not empty, then check if the current user name is in the list, if not then go to the step b, or go to next step.
g. Check if the exclude user names list is empty, if it is not empty, then check if the current user name is in the list, if yes then go to the step b, or the filter driver will manage this file I/O with this filter rule.

If the files match multiple filter rules, the filter driver will choose the deepest one.

For example:

There are filter rule1 with include file mask c:\test*;
filter rule2 with include file mask c:\test\test2*;
filter rule3 with include file mask c:\test\test2\test3*

the checking order will be rule3, rule2, then rule1.If you have a file with name c:\test\test2\test.txt, the filter driver will choose filter rule 2.

### Control filter driver filter rule

For control filter driver, you not only have the same filter rule setting as the monitor filter, but also have the following extra settings:

a. Access control of the filter rule.
b. Access control for specific processes.
c. Access control for specific users.
d. Reparse file open filter rule.
e. Hidden file filter rule.

### Process filter driver filter rule

If the control filter driver and process filter driver were enabled, you can add process filter rule to control file access based on the process name or process Id. You can authorize the specific file access to the specific process.

### How to manage the file I/O with the IO registration

*Pre-IO and Post IO*

A file IO has two steps, pre-IO and post IO. A pre-IO is the I/O process in the filter driver layer, it didn't go down to the file system, a post IO is the I/O process in the filter driver, it already went down to the file system and came back to the filter driver.

You can register the I/O message types (reference MessageType ) you are interested, it is a global setting. When a file I/O occurs, if a file name matches a filter rule, and the file I/O was registered, the filter driver will send the I/O message to the user.

A monitor filter driver only can register the post IOs, it means it only can monitor the file I/O result, if a post IO was triggered, the filter driver will send the I/O message to the user and return back right away and won't block and wait.

A control filter driver can register all the IOs, it has the ability to control the file I/O behaviour, it can modify, allow, deny or cancel the file IO and data. When a file IO was triggered, the filter driver will send the I/O message to the user, it will block and wait for the result from the user, the filter driver will go to modify the file I/O and data or not based on the return result.

*An I/O message*

A typical I/O message includes the file I/O type, file name, file information (file size, file attribute, file time), user name, process name and the I/O result for the post I/O.

## Symbol Reference

### Structures, Enums

#### *Typedef enum FilterType*

```
{
    FILE_SYSTEM_CONTROL                 = 1,
    FILE_SYSTEM_ENCRYPTION              = 2,
    FILE_SYSTEM_MONITOR                 = 4,
    FILE_SYSTEM_REGISTRY                = 8,
    FILE_SYSTEM_PROCESS                 = 16,
};
```

**Comments**

FILE_SYSTEM_CONTROL filter type is the file system filter driver which can control the file I/O request's behaviour before it goes down to the file system or after it is completed by the file system.

FILE_SYSTEM_ENCRYPTION filter type is the file system filter driver which can encrypt and decrypt the files on-the-fly.

FILE_SYSTEM_MONITOR filter type is the file system filter driver which only intercept the file I/O notification after it was completed.

FILE_SYSTEM_REGISTRY filter type is the filter driver which can track and control the registry access.

FILE_SYSTEM_PROCESS filter type is the filter driver which can track and control the process and thread operations.

***typedef enum*** ***MessageType***

```
{
      PRE_CREATE                                = 0x00000001,
      POST_CREATE                               = 0x00000002,
      PRE_FASTIO_READ                           = 0x00000004,
      POST_FASTIO_READ                          = 0x00000008,
      PRE_CACHE_READ                            = 0x00000010,
      POST_CACHE_READ                           = 0x00000020,
      PRE_NOCACHE_READ                          = 0x00000040,
      POST_NOCACHE_READ                         = 0x00000080,
      PRE_PAGING_IO_READ                        = 0x00000100,
      POST_PAGING_IO_READ                       = 0x00000200,
      PRE_FASTIO_WRITE                          = 0x00000400,
      POST_FASTIO_WRITE                         = 0x00000800,
      PRE_CACHE_WRITE                           = 0x00001000,
      POST_CACHE_WRITE                          = 0x00002000,
      PRE_NOCACHE_WRITE                         = 0x00004000,
      POST_NOCACHE_WRITE                        = 0x00008000,
      PRE_PAGING_IO_WRITE                       = 0x00010000,
      POST_PAGING_IO_WRITE                      = 0x00020000,
      PRE_QUERY_INFORMATION                     = 0x00040000,
      POST_QUERY_INFORMATION                    = 0x00080000,
      PRE_SET_INFORMATION                       = 0x00100000,
      POST_SET_INFORMATION                      = 0x00200000,
      PRE_DIRECTORY                             = 0x00400000,
      POST_DIRECTORY                            = 0x00800000,
      PRE_QUERY_SECURITY                        = 0x01000000,
      POST_QUERY_SECURITY                       = 0x02000000,
      PRE_SET_SECURITY                          = 0x04000000,
      POST_SET_SECURITY                         = 0x08000000,
      PRE_CLEANUP                               = 0x10000000,
```

```
    POST_CLEANUP                                = 0x20000000,
    PRE_CLOSE                                   = 0x40000000,
    POST_CLOSE                                  = 0x80000000,

};
```

**Members**

**PRE_CREATE**

PRE_CREATE request is the create I/O request before it goes down to the file system.

**POST_CREATE**

POST_CREATE request is the create I/O request after it is completed by file system.

**PRE_FASTIO_READ**

PRE_FASTIO_READ is the read I/O request before it goes to the Cache Manager.

**POST_FASTIO_READ**

POST_FASTIO_READ is the read I/O request after it comes back from the Cache Manager.If the data is not in the Cache Manager,it will return false,and the I/O Manager will reissue a new request to the file system.

**PRE_CACHE_READ**

PRE_CACHE_READ is the read I/O request with data cache before it goes to the Cache Manager.

**POST_CACHE_READ**

POST_CACHE_READ is the read I/O request after it come back from Cache Manager.If the data is not in the Cache Manager, it will trigger a paging I/O read request and load the data from the storage to the Cache Manager.Normally you will see the paging I/O read request follows the cache read request.

**PRE_NONCACHE_READ**

PRE_NONCACHE_READ is the read I/O request without data cache before it goes to the file system.

**POST_NONCACHE_READ**

POST_NONCACHE_READ is the read I/O request after it comes back from the file system.The data won't cache in the Cache Manager. You will see the noncache read request if you open a file and specify FILE_NO_INTERMEDIATE_BUFFERING.

**PRE_PAGING_IO_READ**

PRE_PAGING_IO_READ is the read I/O request before it goes to the file system.It is initiated by the virtual memory system in order to satisfy the needs of the demand paging system.

**POST_PAGING_IO_READ**

POST_PAGING_IO_READ is the read I/O request after it come back from file system.For memory mapping file open you will see this request without the cache read request, for example open file with notepad application.

**PRE_FASTIO_WRITE**

PRE_FASTIO_WRITE is the write I/O request before it writes to the Cache Manager.

**POST_FASTIO_WRITE**

POST_FASTIO_WRITE is the write I/O request after it wrote to the Cache Manager. Normally you will see the paging I/O write request follows the fast I/O write request.

**PRE_CACHE_WRITE**

PRE_CACHE_WRITE is the write I/O request with data cache before it writes to the Cache Manager.

**POST_CACHE_WRITE**

POST_CACHE_WRITE is the write I/O request after it wrote to the Cache Manager. Normally you will see the paging I/O write request follows the cache write request.

**PRE_NONCACHE_WRITE**

PRE_NONCACHE_WRITE is the write I/O request without data cache before it wrote to the storage by the file system.

**POST_NONCACHE_WRITE**

POST_NONCACHE_WRITE is the write I/O request after it comes back from the file system.The data won't cache in the Cache Manager. You will see the noncache write request if you open a file and specify FILE_NO_INTERMEDIATE_BUFFERING.

**PRE_PAGING_IO_WRITE**

PRE_PAGING_IO_WRITE is the write I/O request on behalf of the Virtual Manager system before it writes to the storage by the file system.

**POST_PAGING_IO_WRITE**

POST_PAGING_IO_WRITE is the write I/O request after it come back from file system.

**PRE_QUERY_INFORMATION**

PRE_QUERY_INFORMATION is the I/O request which retrives information for a given file before it goese down to the file system. The file information class tells the type of the information will be returned.

**POST_QUERY_INFORMATION**

POST_QUERY_INFORMATION is the I/O request which retrives information for a given file after it comes back from the file system. The file information class tells the type of the information will be returned.

**PRE_SET_INFORMATION**

PRE_SET_INFORMATION is the I/O request which set information for a given file before it goese down to the file system. The file information class tells the type of the information will be set.

**POST_SET_INFORMATION**

POST_SET_INFORMATION is the I/O request which set information for a given file after it comes back from the file system. The file information class tells the type of the information will be set.

**PRE_DIRECTORY**

PRE_DIRECTORY is the folder browsing I/O request before it goese down to the file system. It retrive various kinds of information about files in the given directory. The information class tells the type of information will be returned.

**POST_DIRECTORY**

POST_DIRECTORY is the folder browsing I/O request after it comes back from the file system. It retrive various kinds of information about files in the given directory. The information class tells the type of information will be returned.

**PRE_QUERY_SECURITY**

PRE_QUERY_SECURITY is the query security request before it goes down to the file system. It will retrive the security descriptor for a given file. The security information tells the the type of the security descriptor.

**POST_QUERY_SECURITY**

POST_QUERY_SECURITY is the query security request after it comes back from the file system. It will retrive the security descriptor for a given file. The security information tells the the type of the security descriptor.

**PRE_SET_SECURITY**

PRE_SET_SECURITY is the set security request before it goes down to the file system. It will set the security state for a given file. The security information tells the the type of the security descriptor.

**POST_SET_SECURITY**

POST_SET_SECURITY is the set security request after it comes back from the file system. It will set the security state for a given file. The security information tells the the type of the security descriptor.

**PRE_CLEANUP**

PRE_CLEANUP is the cleanup request before it goes down to the file system. It indicates that the handle reference count on a file object has reached zero. In other words,

all handles to the file object have been closed. Often it is sent when a user-mode application has called the Microsoft Win32 CloseHandle function on the last outstanding handle to a file object.

**POST_CLEANUP**

POST_QUERY_SECURITY is the cleanup request after it comes back from the file system.

**PRE_CLOSE**

PRE_CLOSE is the close request before it goese down to the file system. It indicates that the reference count on a file object has reached zero, usually because a file system driver or other kernel-mode component has called ObDereferenceObject on the file object. This request normally follows a cleanup request. However, this does not necessarily mean that the close request will be received immediately after the cleanup request.

**POST_CLOSE**

POST_CLOSE is the close request after it comes back from the file system.

**Comments**

Register the I/O request with the combination of the request type you want to monitor. For file system monitor filter, only post requests are affected.

### *typedef enum FilterCommand*

```
{
  FILTER_SEND_FILE_CHANGED_EVENT              = 0X00010001,
  FILTER_REQUEST_USER_PERMIT                  = 0X00010002,
  FILTER_REQUEST_ENCRYPTION_KEY               = 0X00010003,
  FILTER_REQUEST_ENCRYPTION_IV_AND_KEY        = 0X00010004,
FILTER_REQUEST_ENCRYPTION_IV_AND_KEY_ACCESSFLAG=0X00010005,
  FILTER_REQUEST_ENCRYPTION_IV_AND_KEY_TAGDATA=0X00010006,
  FILTER_SEND_REG_CALLBACK_INFO               = 0X00010007,
  FILTER_SEND_PROCESS_CREATION_INFO           = 0X00010008,
  FILTER_SEND_PROCESS_TERMINATION_INFO        = 0X00010009,
  FILTER_SEND_THREAD_CREATION_INFO            = 0X0001000A,
  FILTER_SEND_THREAD_TERMINATION_INFO         = 0X0001000B,
  FILTER_SEND_PROCESS_HANDLE_INFO             = 0X0001000C,
  FILTER_SEND_THREAD_HANDLE_INFO              = 0X0001000D
```

```
}
```

**FILTER_SEND_FILE_CHANGED_EVENT**

If the monitor filter driver register the event type with API 'RegisterEventTypeToFilterRule',the notification will be sent when the file was changed.

**FILTER_REQUEST_USER_PERMIT**

If the file has this control flag, the filter driver will request the permission to open this file.

**FILTER_REQUEST_ENCRYPTION_KEY**

For encryption filter driver, if this control flag was enable for this file, the filter driver will request the encryption key for this file.

**FILTER_REQUEST_ENCRYPTION_IV_AND_KEY**

For encryption filter driver, if this control flag was enable for this file, the filter driver will request the encryption key and IV for this file.

**FILTER_REQUEST_ENCRYPTION_IV_AND_KEY_AND_ACCCESSFLAG**

For encryption filter driver, if this control flag was enable for this file, the filter driver will request the encryption key, IV and access flag for this file.

**FILTER_REQUEST_ENCRYPTION_IV_AND_KEY_AND_TAGDATA**

For encryption filter driver, if this control flag was enable for this file, the filter driver will request the encryption key, IV and tag data for this file.

**FILTER_SEND_REG_CALLBACK_INFO**

For registry filter driver, if the registry callback class was registered, the registry access notification will be sent whent the registry was accessed.

**FILTER_SEND_PROCESS_CREATION_INFO**

For process filter driver, if the PROCESS_CREATION_NOTIFICATION

was registered, the process infomation will be sent when the new process was created.

**FILTER_SEND_PROCESS_TERMINATION_INFO**

For process filter driver, if the PROCESS_TERMINATION_NOTIFICATION was registered, the process infomation will be sent when the process was terminated.

**FILTER_SEND_THREAD_CREATION_INFO**

For process filter driver, if the THREAD_CREATION_NOTIFICATION was registered, the process infomation will be sent when the new thread was created.

**FILTER_SEND_THREAD_TERMINATION_INFO**

For process filter driver, if the THREAD_TERMINATION_NOTIFICATION was registered, the process infomation will be sent when the thread was terminated.

**FILTER_SEND_PROCESS_HANDLE_INFO**

For process filter driver, if the PROCESS_HANDLE_OP_NOTIFICATION was registered, the process infomation will be sent when a handle for a process was created or duplicated.

**FILTER_SEND_THREAD_HANDLE_INFO**

For process filter driver, if the THREAD_ HANDLE_OP_NOTIFICATION was registered, the process infomation will be sent when a handle for a thread was created or duplicated.

**Comments**

This is the command which was sent from the filter driver with the information associated to the specfic command, the filter command is the field 'MessageType' in structure 'MESSAGE_SEND_DATA'.

### *typedef enum ProcessControlFlag*

```
{
  DENY_NEW_PROCESS_CREATION                    = 0X00000001,
  PROCESS_CREATION_NOTIFICATION                = 0X00000100,
  PROCESS_TERMINATION_NOTIFICATION             = 0X00000200,
  PROCESS_HANDLE_OP_NOTIFICATION               = 0X00000400,
```

```
  THREAD_CREATION_NOTIFICATION                = 0X00000800,
  THREAD_TERMINATION_NOTIFICATION             = 0X00001000,
  THREAD_HANDLE_OP_NOTIFICATION               = 0X00002000,
}
```

**DENY_NEW_PROCESS_CREATION**

If this flag is enabled, it will block the new process creation when the process name matchs the process name filter mask. It is especially good to prevent the untrusted process from being launched.

**PROCESS_CREATION_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the process creation notification will be sent when the creating new process name matchs the process name filter mask.

**PROCESS_TERMINATION_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the process termination notification will be sent when the terminating process name matchs the process name filter mask.

**PROCESS_HANDLE_OP_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the process operation information notification will be sent when a handle for a process is being created or duplicated.

**THREAD_CREATION_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the thread creation notification will be sent when the creating new thread's process name matchs the process name filter mask.

**THREAD_TERMINATION_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the thread termination notification will be sent when the terminating thread's process name matchs the process name filter mask.

**THREAD_HANDLE_OP_NOTIFICATION**

If this flag is enabled and was registered to the process filter rule, the thread operation information notification will be sent when a handle for a thread is being created or duplicated.

**Comments**

This is the control flag for process filter rule, to prevent untrusted process from being launched or track the process operations.

### *typedef enum RegCallbackClass*

```
{
  Reg_Pre_Delete_Key = 0x00000001,
  Reg_Pre_Set_Value_Key = 0x00000002,
  Reg_Pre_Delete_Value_Key = 0x00000004,
  Reg_Pre_SetInformation_Key = 0x00000008,
  Reg_Pre_Rename_Key = 0x00000010,
  Reg_Pre_Enumerate_Key = 0x00000020,
  Reg_Pre_Enumerate_Value_Key = 0x00000040,
  Reg_Pre_Query_Key = 0x00000080,
  Reg_Pre_Query_Value_Key = 0x00000100,
  Reg_Pre_Query_Multiple_Value_Key = 0x00000200,
  Reg_Pre_Create_Key = 0x00000400,
  Reg_Post_Create_Key = 0x00000800,
  Reg_Pre_Open_Key = 0x00001000,
  Reg_Post_Open_Key = 0x00002000,
  Reg_Pre_Key_Handle_Close = 0x00004000,
  //
  // .Net only
  //
  Reg_Post_Delete_Key = 0x00008000,
  Reg_Post_Set_Value_Key = 0x00010000,
  Reg_Post_Delete_Value_Key = 0x00020000,
  Reg_Post_SetInformation_Key = 0x00040000,
  Reg_Post_Rename_Key = 0x00080000,
  Reg_Post_Enumerate_Key = 0x00100000,
  Reg_Post_Enumerate_Value_Key = 0x00200000,
  Reg_Post_Query_Key = 0x00400000,
  Reg_Post_Query_Value_Key = 0x00800000,
  Reg_Post_Query_Multiple_Value_Key = 0x01000000,
  Reg_Post_Key_Handle_Close = 0x02000000,
  Reg_Pre_Create_KeyEx = 0x04000000,
  Reg_Post_Create_KeyEx = 0x08000000,
```

```
    Reg_Pre_Open_KeyEx = 0x10000000,
    Reg_Post_Open_KeyEx = 0x20000000,
    //
    // new to Windows Vista
    //
    Reg_Pre_Flush_Key = 0x40000000,
    Reg_Post_Flush_Key = 0x80000000,
    Reg_Pre_Load_Key = 0x100000000,
    Reg_Post_Load_Key = 0x200000000,
    Reg_Pre_UnLoad_Key = 0x400000000,
    Reg_Post_UnLoad_Key = 0x800000000,
    Reg_Pre_Query_Key_Security = 0x1000000000,
    Reg_Post_Query_Key_Security = 0x2000000000,
    Reg_Pre_Set_Key_Security = 0x4000000000,
    Reg_Post_Set_Key_Security = 0x8000000000,
    //
    // per-object context cleanup
    //
    Reg_Callback_Object_Context_Cleanup = 0x10000000000,
    //
    // new in Vista SP2
    //
    Reg_Pre_Restore_Key = 0x20000000000,
    Reg_Post_Restore_Key = 0x40000000000,
    Reg_Pre_Save_Key = 0x80000000000,
    Reg_Post_Save_Key = 0x100000000000,
    Reg_Pre_Replace_Key = 0x200000000000,
    Reg_Post_Replace_Key = 0x400000000000,
    //
    // new in Windows 10
    //
    Reg_Pre_Query_KeyName = 0x800000000000,
    Reg_Post_Query_KeyName = 0x1000000000000,
    MAX_REG_CALLBACK_CLASE = 0xffffffffffffffff,
}
```

**REG_PRE_DELETE_KEY**

Specifies that a thread is attempting to delete a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_SET_VALUE_KEY**

Specifies that a thread is attempting to set a value entry for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_DELETE_VALUE_KEY**

Specifies that a thread is attempting to delete a value entry for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_SETINFORMATION_KEY**

Specifies that a thread is attempting to set the metadata for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_RENAME_KEY**

Specifies that a thread is attempting to rename a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_ENUMERATE_KEY**

Specifies that a thread is attempting to enumerate a value entry for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_ENUMERATE_KEY**

Specifies that a thread is attempting to enumerate a value entry for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_QUERY_KEY**

Specifies that a thread is attempting to read the metadata for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_QUERY_VALUE_KEY**

Specifies that a thread is attempting to read a value entry for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_QUERY_MULTIPLE_VALUE_KEY**

Specifies that a thread is attempting to query multiple value entries for a key. This value indicates a pre-notification call to RegistryCallback.

**REG_PRE_CREATE_KEY**

Specifies that a thread is attempting to create a key. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_CREATE_KEY**

Specifies that a thread has successfully created a key. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_OPEN_KEY**

Specifies that a thread is attempting to open an existing key. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_OPEN_KEY**

Specifies that a thread has successfully opened an existing key. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_KEY_HANDLE_CLOSE**

Specifies that a thread is attempting to close a key handle. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_DELETE_KEY**

Specifies that the system has attempted to delete the key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_SET_VALUE_KEY**

Specifies that the system has attempted to set a value entry for a key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_DELETE_VALUE_KEY**

Specifies that the system has attempted to delete a value entry for a key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_SETINFORMATION_KEY**

Specifies that the system has attempted to set the key's metadata. This value indicates a post-notification call to RegistryCallback.

**REG_POST_RENAME_KEY**

Specifies that the system has attempted to rename the key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_ENUMERATE_KEY**

Specifies that the system has attempted to enumerate the subkey of a key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_ENUMERATE_VALUE_KEY**

Specifies that the system has attempted to enumerate the value entry of a key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_QUERY_KEY**

Specifies that the system has attempted to query the metadata for a key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_QUERY_VALUE_KEY**

Specifies that the system has attempted to query a value entry for the key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_QUERY_MULTIPLE_VALUE_KEY**

Specifies that the system has attempted to query multiple value entries for the key. This value indicates a post-notification call to RegistryCallback.

**REG_POST_KEY_HANDLE_CLOSE**

Specifies that the system has attempted to close a key handle. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_CREATE_KEYEX**

Specifies that a thread is attempting to create a key. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_CREATE_KEYEX**

Specifies that the system has attempted to create a key. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_OPEN_KEYEX**

Specifies that a thread is attempting to open an existing key. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_OPEN_KEYEX**

Specifies that the system has attempted to open an existing key. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_FLUSH_KEY**

Specifies that a thread is attempting to write a key to disk. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_FLUSH_KEY**

Specifies that the system has attempted to write a key to disk. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_LOAD_KEY**

Specifies that a thread is attempting to load a registry hive from a file. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_LOAD_KEY**

Specifies that the system has attempted to load a registry hive from a file. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_UNLOAD_KEY**

Specifies that a thread is attempting to unload a registry hive. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_UNLOAD_KEY**

Specifies that the system has attempted to unload a registry hive. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_QUERY_KEY_SECURITY**

Specifies that a thread is attempting to obtain a registry key's security information. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_QUERY_KEY_SECURITY**

Specifies that a thread has attempted to obtain a registry key's security information. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_SET_KEY_SECURITY**

Specifies that a thread is attempting to set a registry key's security information. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_SET_KEY_SECURITY**

Specifies that a thread has attempted to set a registry key's security information. This value indicates a post-notification call to RegistryCallback.

**REG_CALLBACK_OBJECT_CONTEXT_CLEANUP**

Specifies that the driver has called CmUnRegisterCallback or the driver's RegistryCallback routine has just finished processing a RegNtPreKeyHandleClose class value.

**REG_PRE_RESTORE_KEY**

Specifies that a thread is attempting to restore a registry key's information. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_RESTORE_KEY**

Specifies that a thread has attempted to restore a registry key's information. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_SAVE_KEY**

Specifies that a thread is attempting to save a registry key's information. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_SAVE_KEY**

Specifies that a thread has attempted to save a registry key's information. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_REPLACE_KEY**

Specifies that a thread is attempting to replace a registry key's information. This value indicates a pre-notification call to RegistryCallback.

**REG_POST_REPLACE_KEY**

Specifies that a thread has attempted to replace a registry key's information. This value indicates a post-notification call to RegistryCallback.

**REG_PRE_QUERY_KEYNAME**

Specifies that a thread is attempting to obtain the full path of a registry key. Use this value on Windows 10 and later versions of the Windows operating system.

**REG_POST_QUERY_KEYNAME**

Specifies that a thread has attempted to obtain the full path of a registry key. Use this value on Windows 10 and later versions of the Windows operating system.

**MAX_REG_CALLBACK_CLASS**

Specifies the maximum value in this enumeration type.

**Comments**

This is registry callback class, to get the notification of the registry operations.

### *typedef enum RegControlFlag*

```
{
  REG_ALLOW_OPEN_KEY                          = 0X00000001,
  REG_ALLOW_CREATE_KEY                        = 0X00000002,
  REG_ALLOW_QUERY_KEY                         = 0X00000004,
  REG_ALLOW_RENAME_KEY                        = 0X00000008
  REG_ALLOW_DELETE_KEY                        = 0X00000010,
  REG_ALLOW_SET_VALUE_KEY_INFORMATION         = 0X00000020,
  REG_ALLOW_SET_INFORMATION_KEY               = 0X00000040,
  REG_ALLOW_ENUMERATE_KEY                     = 0X00000080,
```

```
  REG_ALLOW_QUERY_VALUE_KEY                 = 0X00000100,
  REG_ALLOW_ENUMERATE_VALUE_KEY             = 0X00000200,
  REG_ALLOW_QUERY_MULTIPLE_VALUE_KEY        = 0X00000400,
  REG_ALLOW_DELETE_VALUE_KEY                = 0X00000800,
  REG_ALLOW_QUERY_KEY_SECURITY              = 0X00001000,
  REG_ALLOW_SET_KEY_SECURITY                = 0X00002000,
  REG_ALLOW_RESTORE_KEY                     = 0X00004000,
  REG_ALLOW_SAVE_KEY                        = 0X00010000,
  REG_ALLOW_FLUSH_KEY                       = 0X00020000,
  REG_ALLOW_LOAD_KEY                        = 0X00040000,
  REG_ALLOW_UNLOAD_KEY                      = 0X00080000,
  REG_ALLOW_KEY_CLOSE                       = 0X00100000,
  REG_ALLOW_KEY_RENAME                      = 0X00200000,
  REG_MAX_ACCESS_FLAG                       = 0XFFFFFFFF,

}
```

**REG_ALLOW_OPEN_KEY**

If this flag is disabled, it will block the registry key open if the process name matchs the filter rule.

**REG_ALLOW_CREATE_KEY**

If this flag is disabled, it will block the registry key being created if the process name matchs the filter rule.

**REG_ALLOW_QUERY_KEY**

If this flag is disabled, it will block the registry key being queryed if the process name matchs the filter rule.

**REG_ALLOW_RENAME_KEY**

If this flag is disabled, it will block the registry key being renamed if the process name matchs the filter rule.

**REG_ALLOW_DELETE_KEY**

If this flag is disabled, it will block the registry key being deleted if the process name matchs the filter rule.

**REG_ALLOW_SET_VALUE_KEY_INFORMATION**

If this flag is disabled, it will block the setting the value of the registry key if the process name matchs the filter rule.

**REG_ALLOW_SET_INFORMATION_KEY**

If this flag is disabled, it will block the setting the registry key if the process name matchs the filter rule.

**REG_ALLOW_ENUMERATE_KEY**

If this flag is disabled, it will block the registry key being enumerated if the process name matchs the filter rule.

**REG_ALLOW_QUERY_VALUE_KEY**

If this flag is disabled, it will block the value of the registry key being queryed if the process name matchs the filter rule.

**REG_ALLOW_ENUMERATE_VALUE_KEY**

If this flag is disabled, it will block the value of the registry key being enumerated if the process name matchs the filter rule.

**REG_ALLOW_QUERY_MULTIPLE_VALUE_KEY**

If this flag is disabled, it will block the querying of multiple values of the registry key if the process name matchs the filter rule.

**REG_ALLOW_DELETE_VALUE_KEY**

If this flag is disabled, it will block the value of the registry key being deleted if the process name matchs the filter rule.

**REG_ALLOW_QUERY_KEY_SECURITY**

If this flag is disabled, it will block the registry key security being queryed if the process name matchs the filter rule.

**REG_ALLOW_SET_KEY_SECURITY**

If this flag is disabled, it will block the registry key security being setted if the process name matchs the filter rule.

**REG_ALLOW_RESTORE_KEY**

If this flag is disabled, it will block the registry key being restored if the process name matchs the filter rule.

**REG_ALLOW_SAVE_KEY**

If this flag is disabled, it will block the registry key being saved if the process name matchs the filter rule.

**REG_ALLOW_FLUSH_KEY**

If this flag is disabled, it will block the registry key security being flushed if the process name matchs the filter rule.

**REG_ALLOW_LOAD_KEY**

If this flag is disabled, it will block the registry key being loaded if the process name matchs the filter rule.

**REG_ALLOW_UNLOAD_KEY**

If this flag is disabled, it will block the registry key being unloaded if the process name matchs the filter rule.

**REG_ALLOW_KEY_CLOSE**

If this flag is disabled, it will block the registry key being closed if the process name matchs the filter rule.

**REG_ALLOW_KEY_RENAME**

If this flag is disabled, it will block the registry key being renamed if the process name matchs the filter rule.

**REG_MAX_ACCESS_FLAG**

Enable the maximum access right for the registry access.

**Comments**

This is the control flag for registry filter rule, to track or control the registry operations.

### *typedef enum FileEventType*

```
{
    FILE_WAS_CREATED                = 0x00000020,
    FILE_WAS_WRITTEN                = 0x00000040,
    FILE_WAS_RENAMED                = 0x00000080,
```

```
    FILE_WAS_DELETED                = 0x00000100,
    FILE_SECURITY_CHANGED           = 0x00000200,
    FILE_INFO_CHANGED               = 0x00000400,
    FILE_WAS_READ                   = 0x00000800,
};
```

**Members**

**FILE_WAS_CREATED**

The new file was created event.

**FILE_WAS_WRITTEN**

The file was written with data event.

**FILE_WAS_RENAMED**

The file was renamed event.

**FILE_SECURITY_CHANGED**

The file security was changed event.

**FILE_INFO_CHANGED**

The file information was changed event.

**FILE_WAS_READ**

The file data was read event.

**Comments**

This is the registered event types of the filter rule, monitor the file events which only happens in the filter rule.

### *typedef enum AccessFlag*

```
{
  EXCLUDE_FILTER_RULE                   = 0X00000000,
  EXCLUDE_FILE_ACCESS                   = 0x00000001,
  REPARSE_FILE_OPEN                     = 0x00000002,
  HIDE_FILES_IN_DIRECTORY_BROWSING      = 0x00000004,
  FILE_ENCRYPTION_RULE                  = 0x00000008,
```

```
  ALLOW_OPEN_WTIH_ACCESS_SYSTEM_SECURITY     = 0x00000010,
  ALLOW_OPEN_WITH_READ_ACCESS                = 0x00000020,
  ALLOW_OPEN_WITH_WRITE_ACCESS               = 0x00000040,
  ALLOW_OPEN_WITH_CREATE_OR_OVERWRITE_ACCESS = 0x00000080,
  ALLOW_OPEN_WITH_DELETE_ACCESS              = 0x00000100,
  ALLOW_READ_ACCESS                          = 0x00000200,
  ALLOW_WRITE_ACCESS                         = 0x00000400,
  ALLOW_QUERY_INFORMATION_ACCESS             = 0x00000800,
  ALLOW_SET_INFORMATION                      = 0x00001000,
  ALLOW_FILE_RENAME                          = 0x00002000,
  ALLOW_FILE_DELETE                          = 0x00004000,
  ALLOW_FILE_SIZE_CHANGE                     = 0x00008000,
  ALLOW_QUERY_SECURITY_ACCESS                = 0x00010000,
  ALLOW_SET_SECURITY_ACCESS                  = 0x00020000,
  ALLOW_DIRECTORY_LIST_ACCESS                = 0x00040000,
  ALLOW_FILE_ACCESS_FROM_NETWORK             = 0x00080000,
  ALLOW_NEW_FILE_ENCRYPTION                  = 0x00100000,
  ALLOW_READ_ENCRYPTED_FILES                 = 0x00200000,
  ALLOW_ALL_SAVE_AS                          = 0x00400000,
  ALLOW_COPY_PROTECTED_FILES_OUT             = 0x00800000,
  ALLOW_FILE_MEMORY_MAPPED                   = 0x01000000,
  LEAST_ACCESS_FLAG                          = 0xf0000000,
  ALLOW_MAX_RIGHT_ACCESS                     = 0xfffffff0,

};
```

**Members**

**EXCLUDE_FILTER_RULE**

EXCLUDE_FILTER_RULE is the rule which bypass the files matched the FilterMask. It can`t combine to use with the other access flags. If a file matchs the exclude filter rule,the filter will bypass this file,you won`t get any Io request notification or control. If a file matches both the exclude filter rule and monitor rule, the exclude filter rule will be applied.

**EXCLUDE_FILE_ACCESS**

EXCLUDE_FILE_ACCESS is the flag indicates the filter will deny the access to the files which match the FilterMask.

**REPARSE_FILE_OPEN**

REPARSE_FILE_OPEN is the rule which reparses the file matched the FilterMask open to the other files which match the ReparseMask.

```
Example:

Reparse the file open in folder c:\test to another folder c:\reparseFol
der"


AddFileFilterRule(ALLOW_MAX_RIGHT_ACCESS|REPARSE_FILE_OPEN, L"c:\\test\
\*", 1);

AddReparseFileMaskToFilterRule(L"c:\\test\\*",L"c:\\reparseFolder\\*");
```

**HIDE_FILES_IN_DIRECTORY_BROWSING**

HIDE_FILES_IN_DIRECTORY_BROWSING is the flag let you hide the files in the managed folder when it matches the mask.

```
Example:

Hide the files in folder c:\test for process "explorer.exe"


AddFileFilterRule(ALLOW_MAX_RIGHT_ACCESS|HIDE_FILES_IN_DIRECTORY_BROWSI
NG, L"c:\\test\\*", 1);

AddIncludeProcessNameToFilterRule(L"c:\\test\\*",L"explorer.exe");

AddHiddenFileMaskToFilterRule(L"c:\\test\\*",L"*.*");
```

**ENCRYPTION_FILTER_RULE**

ENCRYPTION_FILTER_RULE is the flag indicates the filter will encrypt the new created files which match the FilterMask.If the other flag were set, this flag is automatically enabled.

**ALLOW_OPEN_WTIH_ACCESS_SYSTEM_SECURITY**

ALLOW_OPEN_WTIH_ACCESS_SYSTEM_SECURITY is the flag indicates if you can open the file with the desired access with the ACCESS_SYSTEM_SECURITY set.

**ALLOW_OPEN_WITH_READ_ACCESS**

ALLOW_OPEN_WITH_READ_ACCESS is the flag indicates if you can open the file with read access.

**ALLOW_OPEN_WITH_WRITE_ACCESS**

ALLOW_OPEN_WITH_WRITE_ACCESS is the flag indicates if you can open the file with write access.

**ALLOW_OPEN_WITH_CREATE_OR_OVERWRITE_ACCESS**

ALLOW_OPEN_WITH_CREATE_OR_OVERWRITE_ACCESS is the flag indicates if you can open with create a new file or overwrite the exist file.

**ALLOW_OPEN_WITH_DELETE_ACCESS**

ALLOW_OPEN_WITH_DELETE_ACCESS is the flag indicates if you can open the file for deletion or rename access.

**ALLOW_READ_ACCESS**

ALLOW_READ_ACCESS is the flag indicates if you have the permission to read the file.

**ALLOW_WRITE_ACCESS**

ALLOW_WRITE_ACCESS is the flag indicates if you have the permission to write the file.

**ALLOW_QUERY_INFORMATION_ACCESS**

ALLOW_QUERY_INFORMATION_ACCESS is the flag indicates if you have the permission to query the file information.

**ALLOW_SET_INFORMATION**

ALLOW_SET_INFORMATION is the flag indicates if you have the permission to set the file information.

**ALLOW_FILE_RENAME**

ALLOW_FILE_RENAME is the flag indicates if you have the permission to rename the file. If the flag ALLOW_SET_INFORMATION is unset, the rename is blocked automatically.

**ALLOW_FILE_DELETE**

ALLOW_FILE_DELETE is the flag indicates if you have the permission to delete the file. If the flag ALLOW_SET_INFORMATION is unset, the deletion is blocked automatically.

**ALLOW_FILE_SIZE_CHANGE**

ALLOW_FILE_SIZE_CHANGE is the flag indicates if you have the permission to change the file size. If the flag ALLOW_SET_INFORMATION is unset, the file size chage is blocked automatically.

**ALLOW_QUERY_SECURITY_ACCESS**

ALLOW_QUERY_SECURITY_ACCESS is the flag indicates if you have the permission to query the file security.

**ALLOW_SET_SECURITY_ACCESS**

ALLOW_SET_SECURITY_ACCESS is the flag indicates if you have the permission to set the file security.

**ALLOW_DIRECTORY_LIST_ACCESS**

ALLOW_DIRECTORY_LIST_ACCESS is the flag indicates if you have the permission to browse the directory.

**ALLOW_FILE_ACCESS_FROM_NETWORK**

ALLOW_FILE_ACCESS_FROM_NETWORK is the flag indicates if you have the permission to access the files from the network server.

**ALLOW_NEW_FILE_ENCRYPTION**

ALLOW_NEW_FILE_ENCRYPTION is the flag indicates if you allow to encrypt the new created files by the filter driver.

**ALLOW_READ_ENCRYPTED_FILES**

ALLOW_READ_ENCRYPTED_FILES is the flag indicates if you allow to read encrypted files, if it is disabled, the encrypted data will return to the users.

**ALLOW_ALL_SAVE_AS**

ALLOW_ALL_SAVE_AS is the flag indicates if the process has the permission to create a new file.

**ALLOW_COPY_PROTECTED_FILES_OUT**

ALLOW_COPY_PROTECTED_FILES_OUT is the flag indicates if allow the protected files being copy out of the protected folder, if allow_all_save_as is true.

**ALLOW_FILE_MEMORY_MAPPED**

ALLOW_FILE_MEMORY_MAPPED indicates if the file can be opened with memory mapped, a file excution must be opened with memory mapped.

**LEAST_ACCESS_FLAG**

LEAST_ACCESS_FLAG indicates the file has the least access right, it can't be set to 0, or it will be excluded by the filter driver.

**ALLOW_MAX_RIGHT_ACCESS**

ALLOW_MAX_RIGHT_ACCESS indicates if you have the maximum access right to the file.

**Comments**

A accessFlag is associated to a filter rule, used to control the access to the files matched the FilterMask.

### *typedef enum AESFlags*

```
{
  Flags_Enabled_Expire_Time                    = 0x00000010,
  Flags_Enabled_Check_ProcessName              = 0x00000020,
  Flags_Enabled_Check_UserName                 = 0x00000040,
  Flags_Enabled_Check_AccessFlags              = 0x00000080,
  Flags_Enabled_Check_User_Permit              = 0x00000100,
  Flags_AES_Key_Was_Embedded                   = 0x00000200,
```

```
  Flags_Enabled_Request_IV_And_Key          = 0x00000400,
  Flags_Enabled_Revoke_Access_Control       = 0x00000800,
  Flags_Enabled_Check_Computer_Id           = 0x00001000,
  Flags_Enabled_Check_User_Password         = 0x00002000,
};
```

**Members**

**Flags_Enabled_Expire_Time**

Flags_Enabled_Expire_Time is the flag which indicates that the filter driver will check if the encrypted file was expired before it can be opened.

**Flags_Enabled_Check_ProcessName**

Flags_Enabled_Check_ProcessName is the flag which indicates that the filter driver will check if the process has the permission to open the encrypted file.

**Flags_Enabled_Check_UserName**

Flags_Enabled_Check_UserName is the flag which indicates that the filter driver will check if the user has the permission to open the encrypted file.

**Flags_Enabled_Check_AccessFlags**

Flags_Enabled_Check_AccessFlags is the flag which indicates that the filter driver will check the access flags if the encrypted file can be opened.

**Flags_Enabled_Check_User_Permit**

Flags_Enabled_Check_User_Permit is the flag which indicates that the filter driver will require the user permission before the encrypted file can be opened.

**Flags_AES_KEY_WAS_EMBEDDED**

Flags_AES_KEY_WAS_EMBEDDED is the flag which indicates that the filter driver will user the embedded AES key to decrypt the file.

**Flags_Enabled_Request_IV_And_Key**

Flags_Enabled_Request_IV_And_Key is the flag which indicates that the filter driver will require encryption key and IV from user mode service to decrypt the file.

**Flags_Enabled_Revoke_Access_Control**

Flags_Enabled_Revoke_Access_Control is the flag which indicates that the filter driver will require the permission from the control server and get the encryption key and IV to decrypt the file.

**Flags_Enabled_Check_Computer_Id**

Flags_Enabled_Check_Computer_Id is the flag which indicates that the filter driver will check if the computer can access the encrypted files.

**Flags_Enabled_Check_User_Password**

Flags_Enabled_Check_User_Password is the flag which indicates that the filter driver will require the user password before the encrypted file can be opened.

**Comments**

A AESFlags is a flag inside the metadata of the encrypted file.

***typedef struct _AES_DATA***

```
{
    ULONG       VerificationKey;
    ULONG       AESFlags;
    ULONG       Version;
    UCHAR       IV[16];
    ULONG       EncryptionKeyLength;
    UCHAR       EncryptionKey[32];
    LONGLONG    FileSize;
    ULONG       CryptoType;
    ULONG       PaddingSize;
    ULONG       AESDataSize;
    LONGLONG    FileSizeOnDisk;
    ULONG       AccessFlags;
    ULONG       Reserve1;
```

```
    ULONG       Reserve2;
    ULONG       TagDataLength;
    WCHAR       TagData[1];

}
```

**Members**

**EaseTagKey**

The verification key of the AES data structure, the value is 0xccb76e80.

**AESFlags**

The Flags of the encrypted file's meta data,indicates the filter driver what action needs to do for the encrypted file opens.

**Version**

The version indicates the encryption engine OpenSSL library if it is 16, or use Micrsoft CNG library if it is 32.

**IV**

The 16 bytes initialization vector, is an arbitrary number that can be used along with an encryption key for the file encryption.

**EncryptionKeyLength**

The length of the encryption key, it should be 16,24 or 32.

**EncryptionKey**

The encryption key for the file encryption.

**FileSize**

The file size was present to the user for the encrypted file, this is file size doesn't include the padding size and the header size.

**CryptoType**

The crypto type for the encryption, default is 0 which is using AES CTR mode.

**PaddingSize**

The padding size of the last block if it needs the padding.

**AESDataSize**

The total size of this structure, this is the size which will be appended to the encrypted file.

**FileSizeOnDisk**

This is the actual physical file size of the encrytped file, includes the pading size and the header size.

**AccessFlags**

The file access control flag if the bit *Flags_Enabled_Check_AccessFlags* in the AESFlags flag was enabled.

**Reserve1**

The reserve data for future use.

**Reserve2**

The reserve data for future use.

**TagDataLength**

The length of the custom data.

**TagData**

The custom tag data which was added by the user from the encryption API.

**Comments**

*AES_DATA* structure is the metadata of the encrypted file which was appended to the end of the file.

## *Typedef enum FilterStatus*

```
{
     FILTER_MESSAGE_IS_DIRTY              = 0x00000001,
     FILTER_COMPLETE_PRE_OPERATION        = 0x00000002,
     FILTER_DATA_BUFFER_IS_UPDATED        = 0x00000004,
};
```

**Members**

**FILTER_MESSAGE_IS_DIRTY**

FILTER_MESSAGE_IS_DIRTY is the flag indicates the reply message was modified and needs to be processed in filter driver. Set this flag if you change the reply message.

**FILTER_COMPLETE_PRE_OPERATION**

FILTER_COMPLETE_PRE_OPERATION is the flag indicates the filter needs to complete this pre I/O request.Only set this flag with pre operation request when you don`t want the request goes down to the file system.

**FILTER_DATA_BUFFER_IS_UPDATED**

FILTER_DATA_BUFFER_IS_UPDATED is the flag indicates the data buffer of the reply message was updated.The filter will process this data buffer.

**Comments**

FitlerStatus is the status code which returns to the filter driver,it is for control filter driver.It instructs the filter drive what action needs to be done.

## *typedef struct _MESSAGE_SEND_DATA*

```
{
     ULONG               MessageId;
     PVOID               FileObject;
     PVOID               FsContext;
     ULONG               MessageType;
     ULONG               ProcessId;
     ULONG               ThreadId;
     LONGLONG            Offset;
     ULONG               Length;
```

```
    LONGLONG            FileSize;
    LONGLONG            TransactionTime;
    LONGLONG            CreationTime;
    LONGLONG            LastAccessTime;
    LONGLONG            LastWriteTime;
    ULONG               FileAttributes;
    ULONG               DesiredAccess;
    ULONG               Disposition;
    ULONG               ShareAccess;
    ULONG               CreateOptions;
    ULONG               CreateStatus;
    ULONG               InfoClass;
    ULONG               Status;
    ULONG               FileNameLength;
    WCHAR               FileName[MAX_FILE_NAME_LENGTH];
    ULONG               SidLength;
    UCHAR               Sid[MAX_SID_LENGTH];
    ULONG               DataBufferLength;
    UCHAR               DataBuffer[MAX_MESSAGE_SIZE];
    ULONG               VerificationNumber;

} MESSAGE_SEND_DATA, *PMESSAGE_SEND_DATA;
```

**Members**

**MessageId**
This is the sequential number of the transaction.

**FileObject**
The FileObject is the pointer to the file object,it is a unique number to every file open.

**FsContext**
The FsContext is the pointer to the file context,it is unique number to the same file.

**MessageType**
MessageType is the I/O request type for this transaction.

**ProcessId**
The ProcessId is the id of the process associated with the thread that originally requested the I/O operation.

**ThreadId**

The ThreadId is the id of thread which requested the I/O operation.

**Offset**
The Offset is the read or write offset.

**Length**
The Length is the length for read or write.

**FileSize**
The FileSize is the size of the file for this I/O request.

**TransactionTime**
The transaction time in UTC format of the request.

**CreationTime**
The creation time in UTC format of the file we are requesting.

**LastAccessTime**
The last access time in UTC format of the file we are requesting.

**LastWriteTime**
The last write time in UTC format of the file we are requesting.

**FileAttributes**
The file attributes of the file we are requesting.

**DesiredAccess**
The DesiredAccess is the request access to the file for the Create I/O request,which can be summarized as read,write,both or neither zero.For more information reference the Windows API CreateFile.

**Disposition**
The disposition is the action to take on a file that exist or does not exist. For more information reference the Windows API CreateFile.

**SharedAccess**
The SharedAccess is the requested sharing mode of the file which can be read,write,both,delete,all of

these,or none. For more information reference the Windows API CreateFile.

**CreateOptions**

The CreateOptions specifies the options to be applied when creating or opening the file. For more information reference the Windows API CreateFile.

**CreateStatus**

The CreateStatus is the status after the Create I/O request completed.It could be the one of the following values:

```
FILE_SUPERSEDED = 0x00000000,
FILE_OPENED = 0x00000001,
FILE_CREATED = 0x00000002,
FILE_OVERWRITTEN = 0x00000003,
FILE_EXISTS = 0x00000004,
FILE_DOES_NOT_EXIST = 0x00000005,
```

**InfoClass**

The infoClss is the information class for query/set information I/O request, or directory browsing request. For query/set security request, it is the security information.For more information reference the windows Filter API FltQueryInformationFile, FltQueryDirectoryFile,FltQuerySecurityObject.

**Status**

The Status is the I/O status which returns from the file system,indicates if the I/O request succeeded.It is only meaningful to the post I/O requests.

**FileNameLength**

The file name length in byte of the file we are requesting.

**FileName**

The file name we are requesting.

**SidLength**

The length of the security identifier buffer in byte.

**Sid**

The buffer of the security identifier data.

**DataBufferLength**

The data buffer length for read, write, security, information,directory I/O requests.

**DataBuffer**

The The data buffer length for read, write, security, information, directory I/O requests.

**VerificationNumber**

The verification number to verify the data structure integerity.

**Comments**

The MESSAGE_SEND_DATA structure is used to transfer the data from kernel to the user mode application. It includes all the information needed for the user.

```
typedef struct _PROCESS_INFO
{
    ULONG               MessageId;
    PVOID               Reserve1;
    PVOID               Reserve2;
    ULONG               MessageType;
    LONGLONG            TransactionTime;
    ULONG               ProcessId;
    ULONG               ThreadId;
    ULONG               ParentProcessId;
    ULONG               CreatingProcessId;
    ULONG               CreatingThreadId;
    ULONG               DesiredAccess;
    ULONG               Operation;
    BOOL                FileOpenNameAvailable;
    ULONG               SidLength;
    UCHAR               Sid[MAX_SID_LENGTH];
    ULONG               FileNameLength;
    WCHAR               FileName[MAX_FILE_NAME_LENGTH];
    ULONG               CommandLineLength;
    WCHAR               CommandLine[MAX_FILE_NAME_LENGTH];
    ULONG               Status;
    ULONG               VerificationNumber;

} MESSAGE_SEND_DATA, *PMESSAGE_SEND_DATA;
```

**Members**

**MessageId**
This is the sequential number of the transaction.

**Reserve1**
The reserve data field1.

**Reserve2**
The reserve data field2.

**MessageType**
MessageType is the process message type which is the filter command, reference filter command enumeration.

**TransactionTime**
The transaction time in UTC format of the request.

**ProcessId**
The ProcessId is the id of the current process associated with the thread that originally requested the process operation.

**ThreadId**
The thread Id of the current operation thread.

**ParentProcessId**
The process Id of the parent process for the new process. Note that the parent process is not necessarily the same process as the process that created the new process.

**CreatingProcessId**
The process Id of the process that created new process.

**CreatingThreadId**
The thread Id of the thread that created the new process.

**DesiredAccess**
An ACCESS_MASK value that specifies the access rights to grant for the handle.

**Operation**

The type of handle operation, this member might be one of the following values:OB_OPERATION_HANDLE_CREATE, OB_OPERATION_HANDLE_DUPLICATE.

**FileOperNameAvailable**

A boolean value that specifies whether the ImageFilename member contains the exact file name that is used to open the process executable file.

**SidLength**

The length of the security identifier buffer in byte.

**Sid**

The buffer of the security identifier data.

**ImageFileNameLength**

The image file name length in byte of the file name that is used to open the process executable file.

**ImageFileName**

The file name that is used to open the process executable file.

**CommandLineLength**

The length in byte of the command line.

**CommandLine**

The process executable file and command line.

**Status**

The Status is the I/O status which returns from the file system,indicates if the I/O request succeeded.

**VerificationNumber**

The verification number to verify the data structure integerity.

**Comments**

Replace MESSAGE_SEND_DATA structure with this one when process filter driver sends the process operation callback notification, is used to transfer the data from kernel to the user mode application.

***typedef struct _MESSAGE_REPLY_DATA***

```
{
      ULONG           MessageId;
      ULONG           MessageType;
      ULONG           ReturnStatus;
      ULONG           FilterStatus;
      union
      {
      Struct{
                  ULONG     DataBufferLength;
                  UCHAR     DataBuffer[MAX_MESSAGE_SIZE];
            }Data;

      Struct{
                  ULONG     AESDataLength;
                  UCHAR     IV[16];
                  ULONG     EncryptionKeyLength;
                  UCHAR     EncryptionKey[1];
            }AESData;

      Struct{
                  ULONG     UserNameLength;
                  UCHAR     UserName[1];
            }UserInfo;

      Struct{
                  ULONG     FileNameLength;
                  UCHAR     FileName[1];
            }FileInfo;

      }ReplyData

} MESSAGE_REPLY_DATA, *PMESSAGE_REPLY_DATA;
```

**Members**

**MessageId**

This is the sequential number of the transaction.

**MessageType**

MessageType is the I/O request type for this transaction. Reference MessageType enum type.

**ReturnStatus**

The ReturnStatus is the I/O status which returns to filter driver, and filter will return this status to the user application for the request.

**FilterStatus**

The FitlerStatus is the status code which returns to the filter driver,it instructs the filter what process needs to be done. For more information reference the FilterStatus enum.

**DataBufferLength**

The data buffer length which returns to the filter driver.

**DataBuffer**

The data buffer which returns to the filter driver.

**AESDataLength**

The total length of the AESData.

**IV**

The 16 bytes initialization vector returns to filter driver.

**EncryptionKeyLength**

The length of the encryption key.

**EncrytionKey**

The encrytion key returns to the filter driver.

**UserNameLength**

The length of the user name.

**UserName**

The user name buffer.

**FileNameLength**

The length of the file name.

**FileName**

The file name buffer.

**Comments**

MESSAGE_REPLY_DATA is only for control filter, when it needs to change the data or status of the I/O request. To update the reply data buffer, you must understand the format of the buffer, incorrect data could cause your system unfunctional, even crash.

## Types

### typedef BOOL (_stdcall *Proto_Message_Callback)(

```
IN     PMESSAGE_SEND_DATA  pSendMessage,
IN OUT PMESSAGE_REPLY_DATA pReplyMessage)
```

**Comments**

This is the proto type of the message callback function. The function will be called when the registed I/O requests match the filter rule. The second parameter "pReplyMessage" is always NULL for the file system monitor filter.

### typedef VOID (_stdcall *Proto_Disconnect_Callback)()

**Comments**

This is the proto type of disconnect function.The function will be called when the connection to the filter is disconnected.

## Exported API

***BOOL***

### *InstallDriver()*

**Return Value**

Return true if it succeeds, else return false.

**Comments**

Install the EaseFilter driver to the system.To install the driver you need the administrator permission.

***BOOL***

## *UnInstallDriver()*

**Return Value**

Return true if it succeeds, else return false.

**Comments**

UnInstall the EaseFilter driver from the system. To UnInstall the driver you need the administrator permission.

***BOOL***

## *SetRegistrationKey(*

*IN WCHAR* RegisterKey)*

**Parameters**

**RegisterKey**

Your register key.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

You have to set the registration key before you can start the filter.

***BOOL***

## *RegisterMessageCallback(*

*ULONG ThreadCount,*
*Proto_Message_Callback MessageCallback,*
*Proto_Disconnect_Callback DisconnectCallback )*

**Parameters**

**ThreadCount**

The number of threads used for connection to the filter.

**MessageCallback**

The message callback function for the registered I/O requests.

**DisconnectCallback**

The disconnect callback function when the connection is disconnected.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

RegisterMessageCallback is the first API you need to call, it is the API start the filter and create the connection to the filter.

***VOID***

## *Disconnect()*

**Comments**

Disconnect is the API when you want to stop filter and filter connection.

***BOOL***

## *GetLastErrorMessage(WCHAR* Buffer, PULONG BufferLength)*

**Parameters**

**Buffer**

This the pointer of the buffer to receive the last error message.

**BufferLength**

The length of the buffer.

**Return Value**

Return true if it succeeds,else return false if the buffer length is not big enough to contain the message,and the BufferLength is set with the right size needed.

**Comments**

This API is called right after if the other API is failed. It will return the error message.

***BOOL***

### *ResetConfigData();*

**Return Value**

Return true if it succeeds, else return false.

**Comments**

ResetConfigData is the API reset all the configuration of the filter, it will clear up all the setting includes the filter rules.

***BOOL***

### *SetFilterType(ULONG FilterType)*

**Parameters**

**FilterType**

The type of the filter you want to set. There are FILE_SYSTEM_MONITOR filter and FILE_SYSTEM_CONTROL filter.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

The default filter type is file system monitor filter.

***BOOL***

### *SetConnectionTimeout(ULONG TimeOutInSeconds)*

**Parameters**

**TimeOutInSeconds**

The value of the filter wait time out.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the maixmum time for the filter driver wait for the response from user mode, the user mode application should return as fast as possible, or it will block the system requests.Set it bigger if your application needs to process with more time.

***BOOL***

### *AddFileFilterRule(*

```
    IN   ULONG  AccessFlag,
    IN   WCHAR* FilterMask
)
```

**Parameters**

**AccessFlag**

The AccessFlag of this filter rule.

**FilterMask**

The FilterMask set the target folder or files.The mask is dos format,it can include wild character '*'or '?'. For example:

C:\test*txt
The filter only monitor the files end with 'txt' in the folder c:\test.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AddFileFilterRule is the API to setup the filter rule,You can set up multiple filte rules, the FilterMask must be different, if the FilterMask is the same, it will overwrite the previous one.

***BOOL***

### *RegisterEventTypeToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  EventType
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**EventType**
The event types were registered to the filter rule, were used to monitor the file events.

**Comments**

If you want to monitor the file events for the filter rule, this is the API to register the event types.

***BOOL***

### *RegisterMonitorToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  RegisterIO
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**RegisterIO**
The IOs were registered to the filter rule,only post-IOs can be registered, it was used to monitor the file IOs, when it was triggered, filter driver will send the notification to the user.

**Comments**

If you want to get the notification of the file IOs for the filter rule, this is the API to register the IOs which you are interested.

***BOOL***

### *RegisterControlToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  RegisterIO
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**RegisterIO**
The IOs were registered to the filter rule, were used to control the file IOs, when it was triggered, filter driver will send the notification to the user, block and wait for the response, it can control the IOs data and status based on the return result.

**Comments**

If you want to control the file requests, this is the API to register the IOs which you are interested.

***BOOL***

### *AddRegisterIOFilterToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  FilterByDesiredAccess,
    IN   ULONG  FilterByDisposition,
    IN   ULONG  FilterByCreateOptions
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**FilterByDesiredAccess**
Filter the register IO option with file opens DesiredAccess.

**FilterByDisposition**
Filter the register IO option with file opens Disposition.

**FilterByCreateOptions**
Filter the register IO option with file opens CreateOptions.

**Comments**

Filter the callback IOs by the file open options if the callback IOs were registered.

***BOOL***

### *AddEncryptionKeyToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  EncryptionKeyLength,
    IN   UCHAR* EncryptionKey
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**EncryptionKeyLength**
The length of the encryption key.

**EncryptionKey**
The encryption key for the filter rule.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

If the encryption was enabled in the access flag in the API AddFileFilterRule, this is the API to add the encryption key for the filter rule, every file will use an unique iv.

***BOOL***

### *AddEncryptionKeyAndIVToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  EncryptionKeyLength,
    IN   UCHAR* EncryptionKey,
    IN   ULONG  IVLength,
    IN   UCHAR* IV
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule.

**EncryptionKeyLength**
The length of the encryption key.

**EncryptionKey**
The encryption key for the filter rule.

**IVLength**
The length of the encryption iv.

**IV**
The encryption iv for the filter rule.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

If the encryption was enabled in the access flag in the API AddFileFilterRule, this is the API to add the encryption key and iv for the filter rule, all files in this filter rule will use the same key and iv.

***BOOL***

### *AddReparseFileMaskToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* ReparseFilterMask
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**ReparseFilterMask**
The reparse folder mask, it can include the wild character, but it must match the wild character in FilterMask.

For example:
FilterMask = c:\test*txt
ReparseFilterMask = d:\reparse*doc

If you open file c:\test\MyTest.txt, it will reparse to the file d:\reparse\MyTest.doc.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

If the REPARSE_FILE_OPEN was enabled in the access flag in the API AddFileFilterRule , this is the API to add the reparse filter mask for the filter rule.

***BOOL***

### *AddHiddenFileMaskToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* HiddenFileFilterMask
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**HiddenFileFilterMask**

The hidden file filter mask for the files to be hidden.

For example:
FilterMask = c:\hideFilesTest*
HiddenFileFilterMask = *.doc

If you open folder c:\hideFilesTest, all the files with extension .doc won't show up in the folder.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

If the HIDE_FILES_IN_DIRECTORY_BROWSING was enabled in the access flag in the API AddFileFilterRule , this is the API to add the hidden filter mask for the filter rule.

***BOOL***

### *AddExcludeFileMaskToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* ExcludeFileFilterMask
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**ExcludeFileFilterMask**

The file filter mask to be excluded.

For example:
FilterMask = *.txt
ExcludeFileFilterMask = c:\windows*

The filter driver target file is all the files with extension .txt except the files in folder c:\windows and its subfolders.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the API to add the exclude file filter mask for the filter rule which was set in AddFileFilterRule .

***BOOL***

### *AddIncludeProcessIdToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG IncludeProcessId
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**IncludeProcessId**

The process Id to be included by filter driver.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the API to add the include process Id for the filter rule which was set in AddFileFilterRule ,only the files opened by the processes in the included process Ids and process names will be monitored by the filter driver.

***BOOL***

### *AddExcludeProcessIdToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG ExcludeProcessId
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**ExcludeProcessId**

The process Id to be excluded by filter driver.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the API to add the exclude process Id for the filter rule which was set in AddFileFilterRule , all the files were opened by the processes in the excluded process Ids and process names won't be monitored by the filter driver.

***BOOL***

### *AddIncludeProcessNameToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* IncludeProcessName
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**IncludeProcessName**
The process name to be included by filter driver.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This is the API to add the include process name for the filter rule which was set in AddFileFilterRule , only the files opened by the processes in the included process Ids and process names will be monitored by the filter driver.

***BOOL***

### *AddExcludeProcessNameToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* ExcludeProcessName
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**ExcludeProcessName**
The process name to be excluded by filter driver.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This is the API to add the exclude process name for the filter rule which was set in AddFileFilterRule , all the files were opened by the processes in the excluded process Ids and process names won't be monitored by the filter driver.

***BOOL***

### *AddIncludeUserNameToFilterRule(*

```
     IN   WCHAR* FilterMask,
     IN   WCHAR* IncludeUserName
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**IncludeUserName**
The user name to be included by filter driver.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This is the API to add the include user name for the filter rule which was set in AddFileFilterRule ,only the files were opened by the useres in the included user names will be monitored by the filter driver.

***BOOL***

### *AddExcludeUserNameToFilterRule(*

```
     IN   WCHAR* FilterMask,
     IN   WCHAR* ExcludeUserName
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**ExcludeUserName**
The process name to be excluded by filter driver.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This is the API to add the exclude user name for the filter rule which was set in AddFileFilterRule , all the files were opened by the users in the excluded user names won't be monitored by the filter driver.

***BOOL***

### *AddProcessRightsToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* ProcessName,
    IN   ULONG  AccessFlag
)
```

**Parameters**

**FilterMask**
The FilterMask which was set in API AddFileFilterRule .

**ProcessName**
The process name to be set access rights.

**AccessFlag**
The access rights for the process.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This is the API to add the access flags to the specific process,when the process accesses the files, it needs to check permission from access flags firt to allow or deny the file access.

***BOOL***

### *AddUserRightsToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   WCHAR* UserName,
    IN   ULONG  AccessFlag
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**UserName**

The user name to be set access rights.

**AccessFlag**

The access rights for the user.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the API to add the access flags to the specific user,when the user accesses the files, it needs to check permission from access flags firt to allow or deny the file access.

***BOOL***

### *AddBooleanConfigToFilterRule(*

```
    IN   WCHAR* FilterMask,
    IN   ULONG  BooleanConfig
)
```

**Parameters**

**FilterMask**

The FilterMask which was set in API AddFileFilterRule .

**Booleanconfig**

The boolean config setting.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This is the API to add the boolean config setting for the filter rule which was set in AddFileFilterRule , please reference the BooleanConfig enumeration.

***BOOL***

### *RemoveFilterRule(WCHAR* FilterMask);*

**Parameters**

**FilterMask**
The FilterMask associated to the filter rule.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

You can remove the filter rule which was set by AddFileFilterRule API.

***BOOL***

### *AddIncludedProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to be included by filter.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This API let the filter dirver only intercept the I/O for the included processes,discard all other I/O from other processes, you can add multiple process Id.

***BOOL***

### *RemoveExcludeProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to remove which set by AddIncludedProcessId API.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This API removes the included process Id from filter.

***BOOL***

*AddExcludedProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to be excluded by filter.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This API let you can bypass the filter for specific processes, you can add multiple process Id.

***BOOL***

*RemoveExcludeProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to remove which set by AddExcludedProcessId API.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This API removes the excluded process Id from filter.

***BOOL***

*AddRegistryFilterRule(*
*IN ULONG ProcessNameLength*
*IN WCHAR* ProcessName,*
*IN ULONG ProcessId,*

```
    IN   ULONG     UserNameLength,
    IN   WCHAR*    UserNameFilterMask,
    IN   ULONG     KeyNameLength,
    IN   WCHAR*    KeyNameFilterMask,
    IN   ULONG     AccessFlag,
    IN   ULONGLONG RegCallbackClass,
    IN   BOOL      IsExcludeFilter
)
```

**Parameters**

**ProcessNameLength**
The length of the process name string in bytes.

**ProcessName**
The process name to be filtered, use '*' to include all processes.

**ProcessId**
If the process Id is not 0, then filter with the process Id instead of the process name.

**UserNameLength**
The length of the user name string in bytes.

**UserNameFilterMask**
The user name to be filtered, use '*' to include all users.

**KeyNameLength**
The length of the process name string in bytes.

**KeyNameFilterMask**
The register key name to be filtered, use '*' to include all the keys.

**AccessFlag**
The access control flag for the registry filter rule.

**RegCallbackClass**
Register the callback class for the registry filter rule.

**IsExcludeFilter**

The flag indicates if the filter rule exclude filter rule, if it is true, the filter driver will skip all the registry operation for this filter rule.

**Comments**

This is the API to add the registry filter rule, filter by process name.

***BOOL***

*AddRegistryFlterRuleByName(*

```
IN   ULONG      ProcessNameLength
IN   WCHAR*     ProcessName,
IN   ULONG      AccessFlag,
IN   ULONGLONG  RegCallbackClass,
IN   BOOL       IsExcludeFilter
)
```

**Parameters**

**ProcessNameLength**
The length of the process name string in bytes.

**ProcessName**
The process name to be filtered, use '*' to include all processes.

**AccessFlag**
The access control flag for the registry filter rule.

**RegCallbackClass**
Register the callback class for the registry filter rule.

**IsExcludeFilter**
The flag indicates if the filter rule exclude filter rule, if it is true, the filter driver will skip all the registry operation for this filter rule.

**Comments**

This is the API to add the registry filter rule, filter by process name.

***BOOL***

*AddRegistryFilterRuleByProcessId(*

```
    IN   ULONG     ProcessId
    IN   ULONG     AccessFlag,
    IN   ULONGLONG RegCallbackClass,
    IN   BOOL      IsExcludeFilter
)
```

**Parameters**

**ProcessId**

The process Id of the process which will be managed by registry filter driver.

**AccessFlag**

The access control flag for the registry filter rule.

**RegCallbackClass**

Register the callback class for the registry filter rule.

**IsExcludeFilter**

The flag indicates if the filter rule exclude filter rule, if it is true, the filter driver will skip all the registry operation for this filter rule.

**Comments**

This is the API to add the registry filter rule, filter by process Id.

***BOOL***

*RemoveRegistryFilterRuleByProcessId(*

```
    IN   ULONG     ProcessId
)
```

**Parameters**

**ProcessId**

The process Id of the process which will be managed by registry filter driver.

**Comments**

This is the API to remove the registry filter rule, filter by process Id.

***BOOL***

*RemoveRegistryFilterRuleByName(*

```
    IN   ULONG     ProcessNameLength
    IN   WCHAR*    ProcessName
)
```

**Parameters**

**ProcessNameLength**
The length of the process name string in bytes.

**ProcessName**
The process name to be filtered.

**Comments**

This is the API to remove the registry filter rule, filter by process name.

***BOOL***

*AddProceeFilterRule(*

```
    IN   ULONG     ProcessNameMaskLength,
    IN   WCHAR*    ProcessNameMask,
    IN   ULONG     ControlFlag
)
```

**Parameters**

**ProcessNameLength**
The length of the process name mask string in bytes.

**ProcessName**
The process name mask to be filtered.

**ControlFlag**
The control flag for the process, reference the ProcessControlFlag enumeration.

**Comments**

This is the API to add the process filter rule, to prevent the process from being launched, or register the callback notification of the process operation.

***BOOL***

*RemoveProceeFilterEntry(*

```
    IN   ULONG     ProcessNameMaskLength,
    IN   WCHAR*    ProcessNameMask
)
```

**Parameters**

**ProcessNameLength**
The length of the process name mask string in bytes.

**ProcessName**
The process name mask to be filtered.

**Comments**

This is the API to remove the process filter rule.

***BOOL***

*AddFileControlToProcessByName(*

```
    IN   ULONG     ProcessNameMaskLength,
    IN   WCHAR*    ProcessNameMask,
    IN   ULONG     FileNameNameMaskLength,
    IN   WCHAR*    FileNameMask,
    IN   ULONG     AccessFlag
)
```

**Parameters**

**ProcessNameLength**
The length of the process name mask string in bytes.

**ProcessName**
The process name mask to be filtered.

**FileNameMaskLength**
The length of the file name mask string in bytes.

**FileNameMask**
The file name mask to be filtered.

**AccessFlag**
The file access flag which control the process file access rights.

**MonitorIO**
Register the callback notification of the monitor IO.

**ControlIO**
Register the callback notification of the control IO.

**Comments**

This is the API to add the file access rights of the specific files to the specific processes.

***BOOL***

*AddFilterCallbackIOToProcessByName(*

```
IN   ULONG     ProcessNameMaskLength,
IN   WCHAR*    ProcessNameMask,
IN   ULONG     FileNameNameMaskLength,
IN   WCHAR*    FileNameMask,
IN   ULONG     MonitorIO,
IN   ULONG     ControlIO,
IN   ULONG     FilterByDesiredAccess,
IN   ULONG     FilterByDisposition,
IN   ULONG     FilterByCreateOptions
```

*)*

**Parameters**

**ProcessNameLength**
The length of the process name mask string in bytes.

**ProcessName**
The process name mask to be filtered.

**FileNameMaskLength**
The length of the file name mask string in bytes.

**FileNameMask**
The file name mask to be filtered.

**MonitorIO**
Register the callback notification of the monitor IO.

**ControlIO**
Register the callback notification of the control IO.

**FilterByDesiredAccess**
Filter the register IO option with file opens DesiredAccess.

**FilterByDisposition**
Filter the register IO option with file opens Disposition.

**FilterByCreateOptions**
Filter the register IO option with file opens CreateOptions.

**Comments**

Register the callback IOs for the process, filter the callback IOs by the file open options if they are not zero.

***BOOL***

*RemoveFileControlFromProcessByName(*

```
    IN   ULONG     ProcessNameMaskLength,
    IN   WCHAR*    ProcessNameMask,
    IN   ULONG     FileNameNameMaskLength,
    IN   WCHAR*    FileNameMask
)
```

**Parameters**

**ProcessNameLength**
The length of the process name mask string in bytes.

**ProcessName**
The process name mask to be filtered.

**FileNameMaskLength**
The length of the file name mask string in bytes.

**FileNameMask**
The file name mask to be filtered.

**Comments**

This is the API to remove the file access rights of the specific files to the specific processes if it was set.

***BOOL***

*AddFileControlToProcessById(*

```
    IN   ULONG     ProcessId,
    IN   ULONG     FileNameNameMaskLength,
    IN   WCHAR*    FileNameMask,
    IN   ULONG     AccessFlag
)
```

**Parameters**

**ProcessId**
The process Id of the process which will be added file access rights.

**ProcessName**
The process name mask to be filtered.

**FileNameMaskLength**
The length of the file name mask string in bytes.

**FileNameMask**
The file name mask to be filtered.

**AccessFlag**
The file access flag which control the process file access rights.

**Comments**

This is the API to add the file access rights of the specific files to the specific process.

***BOOL***

*RemoveFileControlFromProcessById(*

```
    IN   ULONG     ProcessId,
    IN   ULONG     FileNameNameMaskLength,
    IN   WCHAR*    FileNameMask
)
```

**Parameters**

**ProcessId**
The process Id of the process which will bed removed file access rights.

**FileNameMaskLength**
The length of the file name mask string in bytes.

**FileNameMask**
The file name mask to be filtered.

**Comments**

This is the API to remove the file access rights of the specific files to the specific process if it was set.

***BOOL***

### *AddProtectedProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to be protected by filter.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

This API can prevent the process being terminated, you can add multiple process Id, this API is supported in OS vista or later versions.

***BOOL***

### *RemoveProtectedProcessId(ULONG ProcessId)*

**Parameters**

**ProcessId**
The process Id you want to remove which set by *Add**Protect**edProcessId* API.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

This API removes the protected procss Id.

***BOOL***

*RegisterIoRequest(ULONG RequestRegistration)*

**Parameters**

**RequestRegistration**
The RequestRegistration is the bit combination of the request type.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

Register the I/O requests which you want to monitor. For File_SYSTEM_MONITOR filter, only post I/O requests registration are affected, since it only can get notification after the request was completed by file system.

For FILE_SYSTEM_CONTROL filter you can register both pre and post reqeusts. If you want to deny, cancel or return with your own data instead of going down to the file system, you need to register the pre request.

For some post I/O requests, you can't cancel or deny it, for example Create, Set information,Set security, Write requests.

***BOOL***

*GetFileHandleInFilter(WCHAR* FileName, ULONG DesiredAccess, Handle* FileHandle);*

**Parameters**

**FileName**
The full path of the file which you want to open.

**DesiredAccess**

The requested access to the file or device, which can be summarized as read, write, both or neither zero).

**FileHandle**

The pointer to the file handle which will receive the file handle after the file was opened.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

Use this API to open the file,it will bypass the filter, avoid reentrant issue.It also will bypass the security check.Close the handle with CloseHandle win32 API.

***BOOL***

### *AESEncryptFile(*

```
IN   WCHAR* FileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV,
IN   BOOL   AddAESData )
```

**Parameters**

**FileName**

The file name to be encrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if it is 0, the sysem will allocate an unique IV for the file.

**IV**

The initial vector,when IVLenght is 0, it sets to NULL.

**AddAESData**

If it is true,it will add the AESData structure to the encrypted file,then the encryption filter driver can recognize this encrypted file.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESEncryptFile is the API to encrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *AESEncryptFileWithTag(*

```
IN   WCHAR* FileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV,
IN   ULONG  TagDataLength,
IN   UCHAR* TagData )
```

**Parameters**

**FileName**

The file name to be encrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if it is 0, the sysem will allocate an unique IV for the file.

**IV**

The initial vector,when IVLenght is 0, it sets to NULL.

**TagDataLength**

The the length of the tag data.

**TagData**

The custom tag data which was added to the AESData structure in the encrypted file header, the user can get this custom data when the filter request the encyrption iv and key.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESEncryptFile is the API to encrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *AESEncryptFileToFile(*

```
IN   WCHAR* SourceFileName,
IN   WCHAR* DestFileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV,
IN   BOOL   AddAESData )
```

**Parameters**

**SourceFileName**

The source file name to be encrypted.

**DestFileName**

The target file name was encrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if it is 0, the sysem will allocate an unique IV for the file.

**IV**

The initial vector,when IVLenght is 0, it sets to NULL.

**AddAESData**

If it is true,it will add the AESData structure to the encrypted file,then the encryption filter driver can recognize this encrypted file.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESEncryptFileToFile is the API to encrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *AESEncryptFileToFileWithTag(*

```
IN   WCHAR* SourceFileName,
IN   WCHAR* DestFileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV,
IN   ULONG  TagDataLength,
IN   UCHAR* TagData )
```

**Parameters**

**SourceFileName**

The source file name to be encrypted.

**DestFileName**

The target file name was encrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if it is 0, the sysem will allocate an unique IV for the file.

**IV**

The initial vector,when IVLenght is 0, it sets to NULL.

**TagDataLength**

The the length of the tag data.

**TagData**

The custom tag data which was added to the AESData structure in the encrypted file header, the user can get this custom data when the filter request the encyrption iv and key.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESEncryptFileToFile is the API to encrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *AESDecryptFile(*

```
IN   WCHAR* FileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV )
```

**Parameters**

**FileName**

The file name to be decrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if the encrypted file already has IVTag,it will use the IV tag instead of the pass in IV, if the encrypted file doesn't set the IV tag,then the IVLength can't be 0, and IV can't be NULL.

**IV**

The initial vector,when the encrypted file doesn't set IV tag, the IV can't be NULL, or it can be NULL.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESDecryptFile is the API to decrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *AESDecryptFileToFile(*

```
IN   WCHAR* SourceFileName,
IN   WCHAR* DestFileName,
IN   ULONG  KeyLength,
IN   UCHAR* Key,
IN   ULONG  IVLength,
IN   UCHAR* IV )
```

**Parameters**

**SourceFileName**

The encrypted file name.

**DestFileName**

The target file name was decrypted.

**KeyLength**

The encryption key length,it has to be 16(128bits),24(192bits) or 32(256bits).

**Key**

The encryption key,it is an unsigned char array with KeyLength size.

**IVLength**

The initial vector length,if the encrypted file already has IVTag,it will use the IV tag instead of the pass in IV, if the encrypted file doesn't set the IV tag,then the IVLength can't be 0, and IV can't be NULL.

**IV**

The initial vector,when the encrypted file doesn't set IV tag, the IV can't be NULL, or it can be NULL.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

AESDecryptFileToFile is the API to decrypt file file with AES encryption cryptographic algorithm.

***BOOL***

### *GetAESHeader(*

*IN WCHAR* FileName,*
*IN PULONG HeaderSize,*
*IN UCHAR* Header )*

**Parameters**

**FileName**

The file name was encrypted.

**HeaderSize**

The pointer of the header buffer size.

**Header**

The header buffer to store the header data.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

GetAESHeader is the API to get encrypted file header, return true if it exists, or it will return false.

***BOOL***

### *GetAESTagData(*

```
IN   WCHAR*  FileName,
IN   PULONG  TagDataSize,
IN   UCHAR*  TagData )
```

**Parameters**

**FileName**
The file name was encrypted.

**TagDataSize**
The pointer of the Tag Data size.

**TagData**
The custom tag data which was added to the header of the encrypted file.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

GetTagData is the API to get the custom tag data from the encrypted file header, return true if it exists, or it will return false.

***BOOL***

### *AddIVTag(*

```
IN   WCHAR* FileName,
IN   ULONG  IVLength,
IN   UCHAR* IV )
```

**Parameters**

**FileName**
The file name was encrypted.

**IVLength**
The initial vector length.

**IV**
The initial vector.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

AddIVTag is the API to add the IV tag to the encrypted file if it doesn't have the iv tag set, or it will return false.

***BOOL***

### *GetIVTag(*

*IN WCHAR* FileName,*
*IN Out ULONG* IVLength,*
*IN out UCHAR* IV )*

**Parameters**

**FileName**
The file name was encrypted.

**IVLength**
The pointer to the initial vector length,the iv length always is 16,it has to be 16,it will return 0 if the file is not encrypted.

**IV**
The pointer to the buffer to receive the initial vector.

**Return Value**
Return true if it succeeds, else return false.

**Comments**

GetIVTag is the API to get the IV tag from the encrypted file if it has the iv tag set, or IVLength will return 0.

***BOOL***

### *DeleteIVTag(*

```
    IN          WCHAR* FileName )
```

**Parameters**

**FileName**

The file name was encrypted.

**Return Value**

Return true if it succeeds, else return false.

**Comments**

GetIVTag is the API to delete the IV tag from the encrypted file if it has the iv tag set, or it will return true.

## How to use EaseFilter SDK

### The components

The EaseFilter file system filter SDK includes two components (EaseFlt.sys and FilterAPI.dll), The EaseFlt.sys and FilterAPI.dll are different for 32bit and 64bit windows system. EaseFlt.sys is the file system filter driver which implements all the functionalities in the file system level. FilterAPI.dll is a wrapper DLL which exports the API to the user mode applications.

To check the binary is 32 bit or 64 bit you can right click file and go to the property, then go to the "Details" tag and check the "file description" section.

### Set up the filter

Install the filter driver with InstallDriver() method if the driver has not been installed yet. After filter driver was installed, the filter was loaded, if not you can load the filter with command "Fltmc load EaseFlt" in dos prompt. To remove the filter driver from the system, call UninstallDriver() method.

### Start the filter

1. Activate the filter with API SetRegistrationKey(). You can request the trial license key with the link: http://www.easefilter.com/Order.htm or email us info@easefilter.com
2. After register the callback function with API RegisterMessageCallback, filter is started.

   *BOOL ret = RegisterMessageCallback( FilterConnectionThreadsCount, MessageCallback, DisconnectCallback);*

3. Setup the filter configuration after filter was started. First select the filter type, then add filter rule and register the I/O request:

   *BOOL ret = SetFilterType(FILE_SYSTEM_MONITOR);*
   *BOOL ret = AddFileFilterRule (AccessFlags,L"C:\\MyMonitorFolder*", FilterRuleId);*
   *BOOL ret = RegisterIORequest(POST_CREATE|POST_CLEANUP);*

We provide C++ example and C# example to demonstrate how to use the EaseFilter File System Monitor and Control Filter.

## C++ Example

Copy the correct version (32bit or 64bit) EaseFlt.sys, FilterAPI.DLL,FilterAPI.h and FilterAPI.lib to your folder. FilterAPI.h file includes all the functions and structures used for connecting to the filter driver. WinDataStructures.h file is part of the structures of windows API which is used in the example, for more structures please reference Microsoft MSDN website.

For monitor filter, it will only display the file system call messages which include process Id, Thread Id, file name, user name, file system I/O type, etc.

For Control filter, the filter will block and wait for the response if that I/O was registered, so it is better handle this request as soon as possible, or it will block the system call.

## C# Example

Copy the correct version (32bit or 64bit) EaseFlt.sys, FilterAPI.DLL and FilterAPI.cs to your folder. FilterAPI.cs has the structures and APIs used for connecting to the filter driver.

For more programming detail, go to : http://www.easefilter.com/programming.htm