

FILES

- File access is one of the most basic services provided by any operating system.
- This involves
 - opening and closing files
 - reading from and writing to files
 - gathering information about files
- You can access files from a C++ program in one of two ways
 - at the API level, using Win32 systems calls
 - from a higher-level C++ library

FILES

- In many cases, the C++ library level will be sufficient when you just want to open a file, read to or write from it, and close it again.
- However, in many cases it is beneficial to drop down to the API level to access files.
- This is because many features are not exposed at the higher level, such as NT's security options.

What is a file?

- Physically, a file is a set of sectors on a disk identified under a unique file name.
- In the Win32 API, a file is treated as a collection of bytes.
- You can seek to any byte offset, and read a block of bytes of any size.
- If you want to work at a higher level, (e.g. you want to treat a file as a set of text lines), you use the high-level C++ libraries.

Opening and Reading from a file in C++

- The easiest way to open and read from a file is to use the I/O library that comes with C++.

```
#define MAXPATH 30
#include <iostream.h>
#include <fstream.h>
void main()
{
    char filename[MAXPATH];
    char ch;
    cout << "Enter filename: ";
    cin >> filename;           //get the file name
    ifstream infile(filename); //open it
    if(infile)                //read until EOF (End Of File)
        while(infile.get(ch)) //one character at a time
            cout << ch;      //echo to screen
    infile.close();           //close the file
}
```

Files in C++

- In C++, you open a file by linking it to a stream.
- The definitions are found in <fstream.h>
 - To create an input stream, create an **ifstream** object,
 - for output, create an **ofstream** object
 - for both input and output create an **fstream** object.

Files in C++

- You can either open the file in the constructor, or with the member function **open()**
- Here you must specify the filename and the mode, which may be a combination of such values as:

ios::app
ios::in
ios::out

Etc...

Files in C++

- You can move to random positions within the file using seekp() and seekg().
- For example, to start reading at the beginning of the file use:
`in.seekg(0,ios::beg);`
- to start writing at the beginning of the file use:
`out.seekp(0,ios::beg);`

Files in MFC

- **CFile** is the base class for Microsoft Foundation file classes.
- Use **CFile** and its derived classes for general-purpose disk I/O. Use iostream classes for formatted text sent to a disk file.
- Normally, a disk file is opened automatically on **CFile** construction and closed on destruction. Static member functions permit you to interrogate a file's status without opening the file.

CFile::CFile

- There are 3 forms of the CFile constructor:

```
CFile( );  
CFile( int hFile );  
CFile( LPCTSTR lpszFileName, UINT nOpenFlags );  
throw( CFileException );
```

(This is an example of the MFC error handling mechanisms
– you can examine the CFileException object to get more information
about any error that occurs)

CFile::CFile

- *hFile*: The handle of a file that is already open.
 - *lpszFileName*: A string that is the path to the desired file. The path can be relative or absolute.
 - *nOpenFlags*: Sharing and access mode. Specifies the action to take when opening the file. You can combine options listed below by using the bitwise-OR (|) operator. One access permission and one share option are required;

Typical values of nOpenFlags are :

CFile::modeCreate Directs the constructor to create a new file. If the file exists already, it is truncated to 0 length.

CFile::modeNoTruncate Combine this value with **modeCreate**. If the file being created already exists, it is not truncated to 0 length.

CFile::modeRead Opens the file for reading only.
CFile::modeReadWrite Opens the file for reading and writing.

CFile::modeNoInherit Prevents the file from being

CFile::shareDenyNone Opens the file without denying other processes read or write access to the file.
CFile::shareDenyRead Opens the file and denies other processes read access to the file.

Example 1 - opening a file

```
char* pFileName = "test.dat";
CFile f( pFileName, CFile::modeCreate |
          CFile::modeWrite );
```

Or, using the MFC exception handling facilities:

```
char* pFileName = "test.dat";
try{ CFile f( pFileName,CFile::modeCreate|
              CFile::modeWrite); }
catch(CfileException *e){
    //Alert user to the error...
}
```

Example 2 - opening a file

- In MFC, the most common way to open a file is a two-stage process.:
 1. Create the file object without specifying a path or permission flags. You usually create a file object by declaring a **CFile** variable on the stack frame.
 2. Call the **Open** member function for the file object, supplying a path and permission flags. The return value for **Open** will be nonzero if the file was opened successfully or 0 if the specified file could not be opened.

Example 2 - opening a file

- The following example shows how to create a new file with read/write permission (replacing any previous file with the same path).
- If there are problems, the **Open** call can return a **CFileException** object in its last parameter.
- The **TRACE** macro prints both the file name and a code indicating the reason for failure.
- You can call the **AfxThrowFileException** function if you require more detailed error reporting.

```
char* pszFileName = "myfile.dat";
CFile myFile;
CFileException fileException;

if ( !myFile.Open( pszFileName,
                   CFile::modeCreate | 
                   CFile::modeReadWrite),
    &fileException ){
    TRACE( "Can't open file %s,
           error = %u\n",
           pszFileName,
           fileException.m_cause );
}
```

To read from and write to the file

- Use the **Read** and **Write** member functions to read and write data in the file. -or-
- The **Seek** member function is also available for moving to a specific offset within the file.

To read from and write to the file

- **Read** takes a pointer to a buffer and the number of bytes to read and returns the actual number of bytes that were read.
- If the required number of bytes could not be read because end-of-file (EOF) is reached, the actual number of bytes read is returned.
- If any read error occurs, an exception is thrown.
- **Write** is similar to **Read**, but the number of bytes written is not returned. If a write error occurs, including not writing all the bytes specified, an exception is thrown.

If you have a valid **CFile** object,
you can read from it or write to it as follows:

```
char      szBuffer[256] = "Any String";
UINT      nActual = 0;
CFile    myFile;

myFile.Write(szBuffer, sizeof(szBuffer));
myFile.Seek(0, CFile::begin);
nActual = myFile.Read(szBuffer,
                      sizeof(szBuffer));
```

Closing Files

- Once you finish with a file, you must close it. (Otherwise, it may remain locked)
- Use the **Close** member function. This function closes the file-system file and flushes buffers if necessary.
- If you allocated the **CFile** object on the frame, the object will automatically be closed and then destroyed when it goes out of scope.
- Note that deleting the **CFile** object does not delete the physical file in the file system.
