File Handling in C

What is a File?

- A *file* is a collection of related data that a computers treats as a single unit.
- Computers store files to secondary storage so that the contents of files remain intact when a computer turns off.
- When a computer reads a file, it copies the file from the storage device to memory; when it writes to a file, it transfers data from memory to the storage device.
- C uses a structure called **`FILE`** (defined in **`stdio.h`**) to store the attributes of a file.

Steps in Processing a File

1. Create the stream via a pointer variable using the `FILE` structure:
   `FILE *p;`
2. Open the file, associating the stream name with the file name.
3. Read or write the data.
4. Close the file.

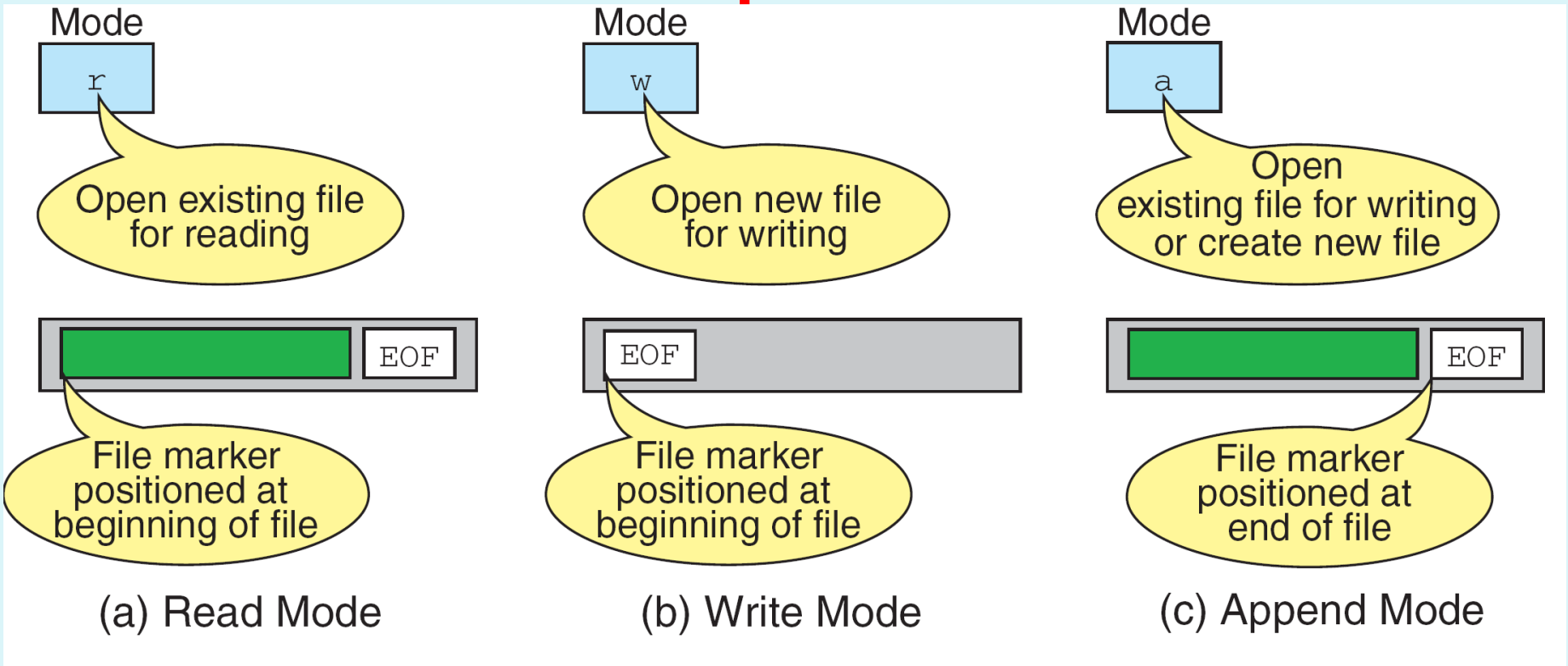
The basic file operations are

- fopen - open a file- specify how its opened (read/write) and type (binary/text)
- fclose - close an opened file
- fread - read from a file
- fwrite - write to a file
- fseek/fsetpos - move a file pointer to somewhere in a file.
- ftell/fgetpos - tell you where the file pointer is located.

File Open Modes

Mode	Meaning
r	Open text file in read mode • If file exists, the marker is positioned at beginning. • If file doesn't exist, error returned.
w	Open text file in write mode • If file exists, it is erased. • If file doesn't exist, it is created.
a	Open text file in append mode • If file exists, the marker is positioned at end. • If file doesn't exist, it is created.

More on File Open Modes



(a) Read Mode (b) Write Mode (c) Append Mode

Additionally,

- “r+” (read + write) In this mode we can also write and modify existing data .The file to be opened must exist and the previous data of file is not erased . This mode is also called update mode.
- “w+“(write + read) If the file doesn’t exist then a new file is created and if the file exists than the previous data is erased.
- “a+”(append + read) In this mode we can append as well as read the existing file .

A structure named FILE is defined in the file stdio.h that contains all the information about file like :

i)Name of file

ii)Status

iii)Buffer size

iv)current position

v)end of file status

File Open

- The file open function (**fopen**) serves two purposes:
  - It makes the connection between the physical file and the stream.
  - It creates “a program file structure to store the information” .
- Syntax:
  FILE***fopen(“filename”, “mode”);**

More On **fopen**

- On success fopen() returns a pointer of type FILE and on error it returns NULL.
- We assign the return value of **fopen** to our pointer variable:

```
FILE *p1;
p1= fopen("MYFILE.TXT", "w");
p1= fopen("A:\\DOCUMENTS\\MYFILE.TXT", "w");
```

Errors in fopen

- If an error occurs in opening a file ,then fopen() returns NULL.

```
 FILE *p;
 p=fopen("abc.txt", "r");
 if(p==NULL)
{
 printf("Error in opening file");
  exit(1);
}
```

Errors may occur due to following reasons

- If we try to open a file in read mode and If the file doesn't exists or we do not have read permission on that file.
- If we try to create a file but there is no space on disk or we don't have write permissions.
- If we try to create a file that already exists and we don't have permission to delete that file.
- Operating system limits the number of files that can be opened at a time and we are trying to open more files than that number.

Closing a File

- When we finish with a mode, we need to close the file before ending the program or beginning another mode with that same file.
- To close a file, we use `fclose` and the pointer variable:
  `fclose(p1);`

fprintf()

Syntax:

```
fprintf (fp,"string",variables);
```

Example:

```
int i = 12;
float x = 2.356;
char ch = 's';
FILE *fp;
fp=fopen("out.txt","w");
fprintf (fp, "%d %f %c", i, x, ch);
```

fscanf()

Syntax:

```
fscanf (fp,"string",identifiers);
```

Example:

```
FILE *fp;
Fp=fopen(“input.txt”,”r”);
int i;
fscanf (fp,“%d",i);
```

getc()

Syntax:

identifier = getc (file pointer);

Example:

```
FILE *fp;
fp=fopen("input.txt","r");
char ch;
ch = getc (fp);
```

putc()

write a single character to the output file, pointed to by fp.

Example:

```
FILE *fp;
char ch;
putc (ch,fp);
```

End of File

- There are a number of ways to test for the end-of-file condition. Another way is to use the value returned by the *fscanf* function:

```
FILE *fptr1;
int istatus ;
istatus = fscanf (fptr1, "%d", &var) ;
if ( istatus == feof(fptr1) )
{
        printf ("End-of-file encountered.\n”) ;
}
```

Reading and Writing Files

```
#include <stdio.h>
int main ( )
{
   FILE *outfile, *infile ;
   int b = 5, f ;
   float a = 13.72, c = 6.68, e, g ;
   outfile = fopen ("testdata", "w") ;
   fprintf (outfile, “ %f %d %f ", a, b, c) ;
   fclose (outfile) ;
   infile = fopen ("testdata", "r") ;
   fscanf (infile,"%f %d %f", &e, &f, &g) ;
   printf (“ %f %d %f \n ", a, b, c) ;
   printf (“ %f %d %f \n ", e, f, g) ;
}
```

Example

```
#include <stdio.h>
#include<conio.h>
void main()
{
    char ch;
    FILE *fp;
    fp=fopen("out.txt","r");
    while(!feof(fp))
      {
      ch=getc(fp);
      printf("\n%c",ch);
    }
    getch();
 }
```

fread ()

Declaration:

```
size_t fread(void *ptr, size_t size, size_t n, FILE *stream);
```

Remarks:

fread reads a specified number of equal-sized data items from an input stream into a block.

ptr = Points to a block into which data is read
size = Length of each item read, in bytes
n = Number of items read
stream = file pointer

Example

Example:

```
#include <stdio.h>
int main()
{
    FILE *f;
    char buffer[11];
    if (f = fopen("fred.txt", “r”))
    {
    fread(buffer, 1, 10, f);
    buffer[10] = 0;
    fclose(f);
    printf("first 10 characters of the file:\n%s\n", buffer);
     }
 return 0;
}
```

fwrite()

Declaration:

```
size_t fwrite(const void *ptr, size_t size, size_t n, FILE*stream);
```

Remarks:

fwrite appends a specified number of equal-sized data items to an output file.

ptr = Pointer to any object; the data written begins at ptr
size = Length of each item of data
n =Number of data items to be appended
stream = file pointer

Example

Example:

```
#include <stdio.h>
int main()
{
    char a[10]={'1','2','3','4','5','6','7','8','9','a'};
    FILE *fs;
    fs=fopen("Project.txt","w");
    fwrite(a,1,10,fs);
    fclose(fs);
    return 0;
}
```

fseek()

This function sets the file position indicator for the stream pointed to by stream or you can say it seeks a specified place within a file and modify it.

SEEK_SET	**Seeks from beginning of file**
SEEK_CUR	**Seeks from current position**
SEEK_END	**Seeks from end of file**

Example:

```
#include <stdio.h>
int main()
{
        FILE * f;
        f = fopen("myfile.txt", "w");
        fputs("Hello World", f);
        fseek(f, 6, SEEK_SET);        SEEK_CUR,   SEEK_END
        fputs(" India", f);
        fclose(f);
        return 0;
    }
```

ftell()

offset = ftell(file pointer);

"ftell" returns the current position for input or output on the file

```
#include <stdio.h>

int main(void)
{
  FILE *stream;
  stream = fopen("MYFILE.TXT", "w");
  fprintf(stream, "This is a test");
  printf("The file pointer is at byte %ld\n", ftell(stream));
  fclose(stream);
  return 0;
}
```