

# Operating Systems-I

## Report-Asgn-1

The program written will provide the amount of time necessary to run a shell command through the command line interface using `fork()`, `exec()`, IPC and shared memory concepts.

### Steps:

1. We have used POSIX API for shared memory. First we create a shared memory object using the `shm_open()` system call, as follows:

```
shm_fd = shm_open(name, O_CREAT | O_RDWR, 0666);
```

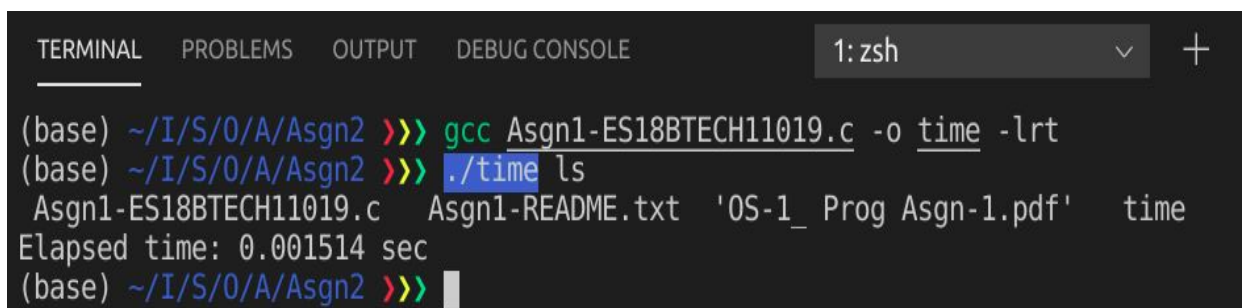
2. Once the object is established, the `ftruncate()` function is used to configure the size of the object in bytes.

```
ftruncate(shm_fd,SIZE);
```

3. `mmap()` function establishes a memory-mapped file containing the shared-memory object. It also returns a pointer to the memory-mapped file that is used for accessing the shared-memory object.

```
ptr = mmap(0,SIZE, PROT_READ |PROT_WRITE, MAP_SHARED, shm_fd, 0);
```

4. We use the `gettimeofday()` function to know the elapsed time difference between the parent and child processes.
5. First we `fork()` a child process and write the contents of time from `time_val` object to the shared memory. We wait for the child process to finish execution using `wait()` command and then note the time difference.



```
TERMINAL  PROBLEMS  OUTPUT  DEBUG CONSOLE  1: zsh  +
(base) ~/I/S/O/A/Asgn2 >>> gcc Asgn1-ES18BTECH11019.c -o time -lrt
(base) ~/I/S/O/A/Asgn2 >>> ./time ls
Asgn1-ES18BTECH11019.c  Asgn1-README.txt  'OS-1_Prog Asgn-1.pdf'  time
Elapsed time: 0.001514 sec
(base) ~/I/S/O/A/Asgn2 >>>
```

6. “**exec**” command fails if the given input through the shell is not a valid “**executable**” shell command. For example **cd**, **break** etc.

A terminal window with a dark background and light-colored text. At the top, there are tabs labeled 'TERMINAL', 'PROBLEMS', 'OUTPUT', and 'DEBUG CONSOLE'. The 'TERMINAL' tab is active. In the top right corner, it says '1: zsh'. The terminal shows the following sequence of commands and output:  
(base) ~/I/S/O/A/Asgn2 >>> gcc Asgn1-ES18BTECH11019.c -o time -lrt  
(base) ~/I/S/O/A/Asgn2 >>> ./time cd ..  
exec Failed!! Not an executable command  
Elapsed time: 0.000638 sec  
(base) ~/I/S/O/A/Asgn2 >>>   
The command './time cd ..' is highlighted in blue in the original image.

**Why?**

**A:** When a shell executes a command, it does **fork()** and the child process uses **exec()** to execute the command entered by the user. For example, if the entered command is 'ls', the shell arranges to execute **/bin/ls** with one argument, **ls**. However, if the command selected executes the **chdir()** system call, that affects the child process, but does not affect the parent shell. So, the shell has to handle the **cd** command itself, **not via fork() and exec()**. Hence “**cd**” is a special builtin command **not an executable** hence the “**exec**” fails.

**Source:** [StackOverflow](https://stackoverflow.com/questions/11111111/why-does-exec-fail-for-cd)