

system() in C/C++

exec family of functions
in Cint (1 sign bit + 31 data
bits) keyword in C

Program error signals

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Difference between fork() and exec()



Every application(program) comes into execution through means of process, **process** is a running instance of a program. Processes are created through different system calls, most popular are **fork()** and **exec()**

fork()

```
pid_t pid = fork();
```

fork() creates a new process by duplicating the calling process, The new process, referred to as child, is an exact duplicate of the calling process, referred to as parent, except for the following :

1. The child has its own unique process ID, and this PID does not match the ID of any existing process group.
2. The child's parent process ID is the same as the parent's process ID.

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3. The child does not inherit its parent's memory locks and semaphore adjustments.
4. The child does not inherit outstanding asynchronous I/O operations from its parent nor does it inherit any asynchronous I/O contexts from its parent.

Return value of fork()

On success, the PID of the child process is returned in the parent, and 0 is returned in the child. On failure, -1 is returned in the parent, no child process is created, and errno is set appropriately.

[Detailed article on fork system call](#)

exec()

The exec() family of functions **replaces** the current process image with a new process image. It loads the program into the current process space and runs it from the entry point.

The exec() family consists of following functions, I have implemented **execv()** in following C program, you can try rest as an exercise

```
int execl(const char *path, const char *arg, ...);
int execlp(const char *file, const char *arg, ...);
int execlx(const char *path, const char *arg, ...,
           char * const envp[]);
int execv(const char *path, char *const argv[]);
int execvp(const char *file, char *const argv[]);
int execvpe(const char *file, char *const argv[],
```

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How does a C program executes?

strrev() function in C

```
char *const envp[]);
```

fork vs exec

- fork starts a new process which is a copy of the one that calls it, while exec replaces the current process image with another (different) one.
- Both parent and child processes are executed simultaneously in case of fork() while Control never returns to the original program unless there is an exec() error.



```
// C program to illustrate use of fork() &  
// exec() system call for process creation
```



```
#include <stdio.h>  
#include <sys/types.h>  
#include <unistd.h>  
#include <stdlib.h>  
#include <errno.h>  
#include <sys/wait.h>
```

```
int main(){  
    pid_t pid;  
    int ret = 1;  
    int status;  
    pid = fork();  
    if (pid == -1){  
  
        // pid == -1 means error occurred  
        printf("can't fork, error occurred\n");  
        exit(EXIT_FAILURE);  
    }  
    else if (pid == 0){
```

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#pragma Directive in C/C++

```
// pid == 0 means child process created
// getpid() returns process id of calling process
printf("child process, pid = %u\n",getpid())

// the argv list first argument should point
// filename associated with file being executed
// the array pointer must be terminated by NULL
// pointer
char * argv_list[] = {"ls","-lart","/home",NULL}

// the execv() only return if error occurred.
// The return value is -1
execv("ls",argv_list);
exit(0);
}
else{
// a positive number is returned for the pid
// parent process
// getppid() returns process id of parent of
// calling process
printf("parent process, pid = %u\n",getppid())

// the parent process calls waitpid() on the
// waitpid() system call suspends execution of
// calling process until a child specified by
// argument has changed state
// see wait() man page for all the flags or
// used here
if (waitpid(pid, &status, 0) > 0) {

if (WIFEXITED(status) && !WEXITSTATUS(status))
printf("program execution successful\n")

else if (WIFEXITED(status) && WEXITSTATUS(status) == 127) {

// execv failed
printf("execv failed\n");
}
```

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```
    }
    else
        printf("program terminated norr
            " but returned a non-zero st
    }
    else
        printf("program didn't terminate noi
    }
    else {
        // waitpid() failed
        printf("waitpid() failed\n");
    }
    exit(0);
}
return 0;
}
```

Output:

```
parent process, pid = 11523
child process, pid = 14188
Program execution successfull
```

References :

Linux man pages

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