1. UNIX Environment

(A) What does the BIN directory contain? What does the DEV directory contain?

These two directories contain most of the programs for the system. The /bin directory has the essential programs that the system requires to operate, while /usr/bin contains applications for the system's users.

The /dev directory is a special directory, since it does not really contain files in the usual sense. Rather, it contains devices that are available to the system. In Linux (like Unix), devices are treated like files. You can read and write devices as though they were files. For example /dev/fd0 is the first floppy disk drive, /dev/sda (/dev/hda on older systems) is the first IDE hard drive. All the devices that the kernel understands are represented here.

(C) What is the name of the system call (command) that can overwrite the default address?

(D) What happens to a child process if its parent is terminated?

(E) What are the return values for the FORK() command, and what are their meanings?

(F) Define a ZOMBIE process.

A Zombie is created when a parent process does not use the wait system call after a child dies to read its exit status, and an orphan is child process that is reclaimed by init when the original parent process terminates before the child.

(G) Explain the main difference between a MODE SWITCH and a FULL CONTEXT SWITCH. Give examples of each type of switch.

A **process switch**(AKA context switch) is what it is called when the processor switches from one thread/process to another. This causes the contents of the cpu registers and instruction pointer to be saved. The registers and instruction pointer for the new task will then be loaded into the processor and execution of the new process will start/resume. The old program is no longer executing, but it's state is saved in memory for when the kernel decides that it is ready to execute it again. This is what gives the illusion of multitasking, while in reality, only a single process can run at a time on a cpu.

A **context switch** can occur by hardware or software. A hardware interrupt can occur from a device such as the keyboard,mouse,or system timer, causing code to begin executing the interrupt code. Software switches are occurred as a result of the kernel manually performing a task switch. This is how the scheduler usually makes a context switch.

A mode switch is what is referred to when the cpu changes privilege levels. The kernel works at a higher privilege than a standard user task. In order for the user task to access things controlled by the kernel, it is necessary fro a mode switch to occur. The currently executing process does NOT change during a mode switch. The processor uses these modes(aka rings) to protect the OS from misbehaving or malicious programs, as well as controlling concurrent access to ram, io devices,etc. A mode switch must occur for a software context switch to occur. Only the Kernel can cause a context switch.

Note: The idea of a general protection fault is that a user application has tried to do something that it isn't allowed to do, such as accessing certain parts of it's address space that is not accessible to it.

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