##OS Operations

Interrupt driven (hardware or software)
- Hardware
- Software (Exception or trap)
  - Software error (division by zero)
  - Request for OS service
  - Other process problems like infinite loop, processes modifying OS or other processes.

Dual mode operation allows OS to protect itself
- User mode and kernel mode
- Mode bit provided by hardware
  - Provides ability to distinguish between user and kernel code.
  - Some instructions designated as privileged, only executable in kernel mode
  - System call changes to kernel mode, return from call resets to user mode.
- Increasingly CPUs support multi-mode operations
  - Virtual Machine Manager (VMM) mode for guest VMs

Transition from User to Kernel mode
- Timer to prevent infinite loops
  - Timer to interrupt after x time
  - Counter that decreases by the physical clock.
  - OS sets the counter (priviledged)
  - Counter is zero, generate interrupt
  - Setup before scheduling process to regain control or terminate process.

Process Management

- A process is a program in execution. It is a unit of work in the system. Program is a passive entity, process is a active entity.
- Process needs resources:
  - CPU, memory, I/O, etc
  - Initialization data
- Process termination requires reclaim of any reusable resources.
- Single-Threaded process has one program counter specifying next instruction to execute.
  - Process exec instructions sequentially
- Multi-Threaded process has one program counter per thread.
- Typically systems have many processes, some user, some OS running concurrently on one or more CPUs
  - Concurrency by multiplexing the CPU among the processes

Process Management Activities

- OS is responsible for:
  - Create/Delete both user and system processes.
  - Suspending/Resuming processes
  - Provide mechanism for process:
    - Synchronization
    - Communication
    - Deadlock handling