Operating System

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Components of Operating System

The four components of operating system are

- memory management
- device management
- process management
- information management.

All these resources are valuable and it is the function of operating system to see that they are used efficiently to resolve conflicts arising from competition among the various users.

The operating system must keep track of states of each resource, decide which process is to get the resource, allocate it and eventually reclaim it.

Functions 4 components

The measure functions of all these 4 resources are shown below:

(1)Memory Management

(a) Keep track of the resources/memory.

(b)In a multi programming environment it decides which job has priority/chance to get the resources and for how much time.

(c)Allocate the resources (memory) when the process requests it.

(d)Reclaim the resources (memory) when the process no longer needs it.

(2)Process Management

(a)Keep track of the resources (processor and status of the processor).

(b)Decide who will have a chance to use the processor.

(c)Allocate the resource (processor to a process by setting of the necessary hardware register).

(d)Reclaim the resources when the process surrenders that processor uses.

Functions 4 components Contd…

(3)Device management

(a)Keep track of the resources (devices). This is called the I/O traffic controller.
(b)Decides an efficient way to allocate the resources (devices).
(c)Allocate the resources (device) and initiate the I/O operation.
(d)Reclaim the resources.
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(4)Information Management

(a)Keep track of the resource (information).
(b)Decide who to get use of the resources.
(c)Allocate the resources i.e., open a file.
(d)De-allocate the resources i.e., close a file.
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Operating System Views

- Resource allocator
  - to allocate resources (software and hardware) of the computer system and manage them efficiently.
- Control program
  - Controls execution of user programs and operation of I/O devices.
- Kernel
  - The program that executes forever (everything else is an application with respect to the kernel).

Operating system roles

- **Referee**
  - Resource allocation among users, applications
  - Isolation of different users, applications from each other
  - Communication between users, applications
- **Illusionist**
  - Each application appears to have the entire machine to itself
  - Infinite number of processors, (near) infinite amount of memory, reliable storage, reliable network transport
- **Glue**
  - Libraries, user interface widgets, …
  - Reduces cost of developing software

Goals of an Operating System

- Simplify the execution of user programs and make solving user problems easier.
- Use computer hardware efficiently.
  - Allow sharing of hardware and software resources.
- Make application software portable and versatile.
- Provide isolation, security and protection among user programs.
- Improve overall system reliability
    - error confinement, fault tolerance, reconfiguration.

Why should I study Operating Systems?

- Need to understand interaction between the hardware and applications
  - New applications, new hardware..
  - Inherent aspect of society today
- Need to understand basic principles in the design of computer systems
  - efficient resource management, security, flexibility
- Increasing need for specialized operating systems
  - e.g. embedded operating systems for devices - cell phones, sensors and controllers
  - real-time operating systems - aircraft control, multimedia services

The OS is Everywhere

```
main(int argc, char **argv)
{ int fd = open(argv[1], O_RDONLY);
   if (fd < 0) {
     fprintf(stderr, "Failed to open\n");
     exit(-1);
   }
   while (1) {
     if (read(fd, &c, sizeof c) != 1)
       exit(-1);
    putc( c )
  }
}
```

- Edit
- Compile
- Run/Create Process
- Invoke main
- Open file
  - check access
  - cache
  - read character
- Write character
- Terminate process on EOF or Err

% cc main.c
% ./a.out /tmp/foo.bar