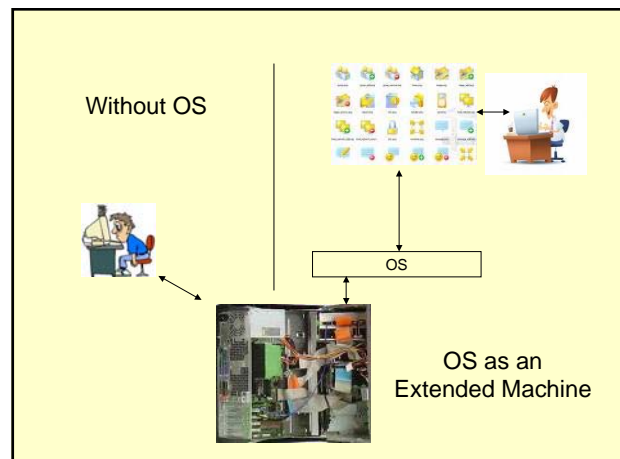


Operating Systems

- An OS:
 - controls all computer resources and provides the base upon which the application programs can be written
 - is the software layer that is on top of the hardware to manage all parts of the system, and present the user with interface or virtual machine that is easier to understand and program.
- An OS can be viewed as
 - An Extended Machine
 - A Resource Manager



Extended Machine

- Top-down (user/application centred) view
- “Beautification Principle”
 - OS hides the implementation details
 - Example: the file system of a computer vs direct programming of disk controller
- A Standardised “Virtual Machine” across different physical machines
 - allows easy program distribution
- Example:
 - reading/writing from a floppy disk requires to know:
 - 16 commands, 13 parameters packed in 9 bytes, address of disk block, recording mode, gap spacing, deleted data address mark, whether the motor is on or off and etc.
 - How stuff works: <http://computer.howstuffworks.com/floppy-disk-drive.htm>
 - Some code: <http://linuxgazette.net/issue77/krishnakumar.html>

Extended Machine

- Provides
 - stable: doesn't crash
 - portable: can run code on more than one type of machine
 - reliable: always reacts in the same way
 - safe: doesn't do something dangerous
 - well-behaved: acts in a proper manner environment
- Computer “appears” to more than it is
 - “appears” to be many processors
 - “appears” to be many, large memories
- Features:
 - threads, processes, files, communication channels

OS as a Resource Manager



OS as Resource Manager

- Support many devices simultaneously
 - e.g. keyboard, mouse, printer, speakers, microphone
- Share resources among users and programmes
 - fairly: each programme gets a change to run
 - safely: protects against corruption
 - efficiently: using the available resources to provide the best service possible
- Allocates resources to users
 - Disks, memory, network interfaces, timers, terminals/displays, laser printers, etc
 - Who's using what?
 - How is it shared?

OS as Resource Manager

- Maintains a “multi-user” illusion to several users
 - most systems allow several user “programs”
 - (even if you think you are only running one programme, there are several internal programmes running)
- Managing
 - processors: 1, 2 or several
 - memories: RAM, cache
 - timers: internal, external
 - disks
 - mice
 - network interfaces: intranet, LAN, WAN
 - laser printers: several printers, priority
 - other devices.

OS Responsibilities - Issues

- concurrency:
 - running parallel activities
 - several processing running in parallel (foreground, background)
- sharing resources
 - Within and between processes
- resource naming
 - programmes, files, devices, connections etc
- protection
 - preventing errors or malicious attacks
- Security
 - what to protect, how and how strict?
- performance
- structure

OS Responsibilities – Issues (cont.)

- Reliability and fault tolerance
 - act in a predictable manner
 - anticipate errors and plan to deal with them
- Extensibility
 - how easy is it to copy with new s/w, h/w, devices etc
- Communication
 - within processes, between processes
- Scale and growth
- Persistence
 - maintaining data
- Distribution
- Accounting

Summary

- External view:
 - user views an OS as an Extended Machine
 - hide the details of what’s “inside” the computer
- Internal view:
 - OS has to manage many resources – Resource Manager
 - has deal with the “ugliness” of the h/w interfaces,
 - deal with the complexities of many processes competing for time and resources (policeman/referee/government idea)