Operating Systems & Systems Programming

Module 2

Operating Structure and Architecture

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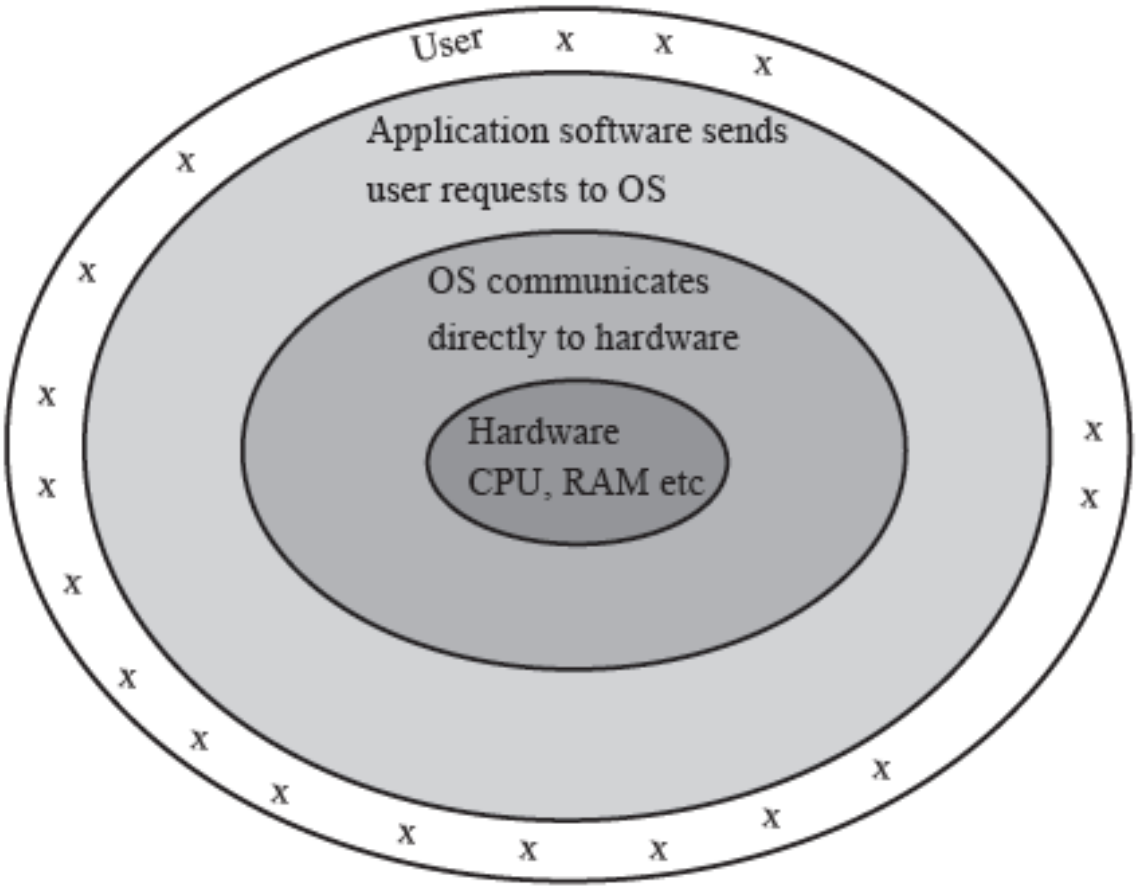
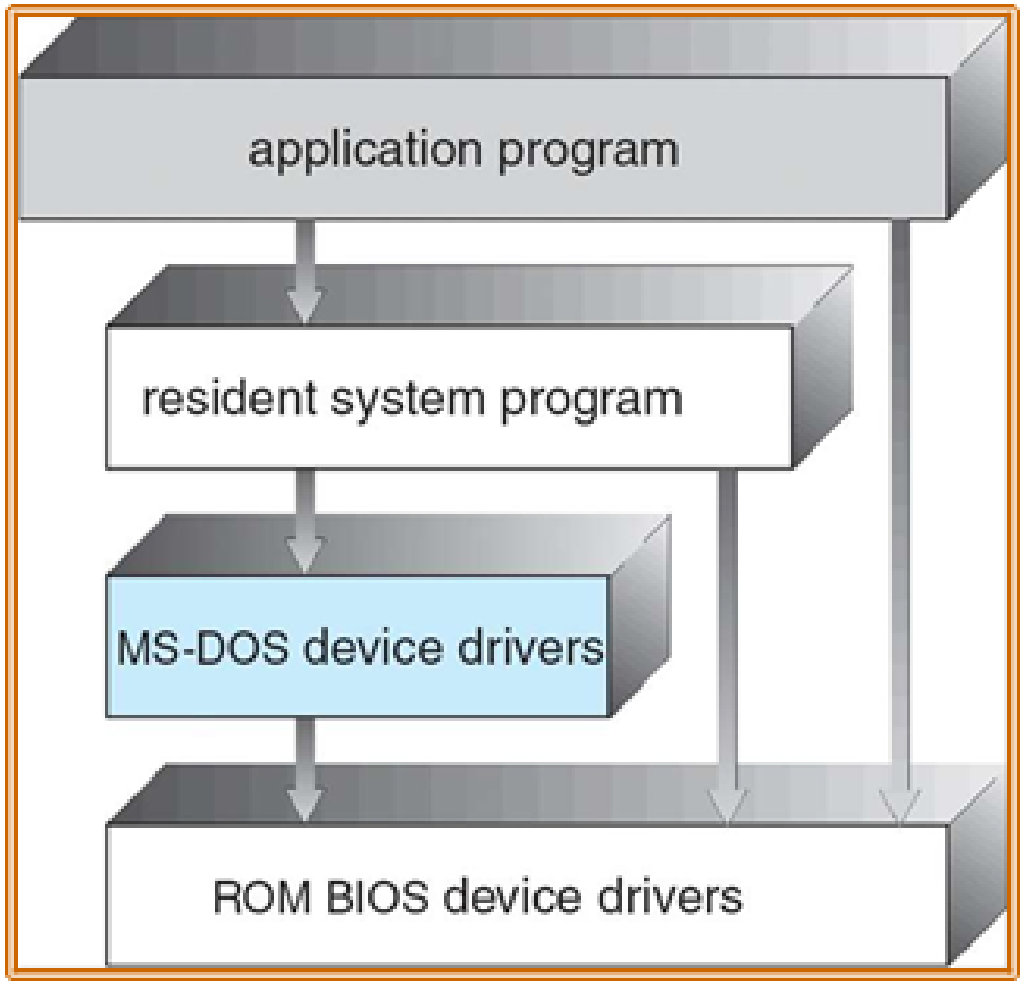
Overview

Positioning of Operating System in the computer



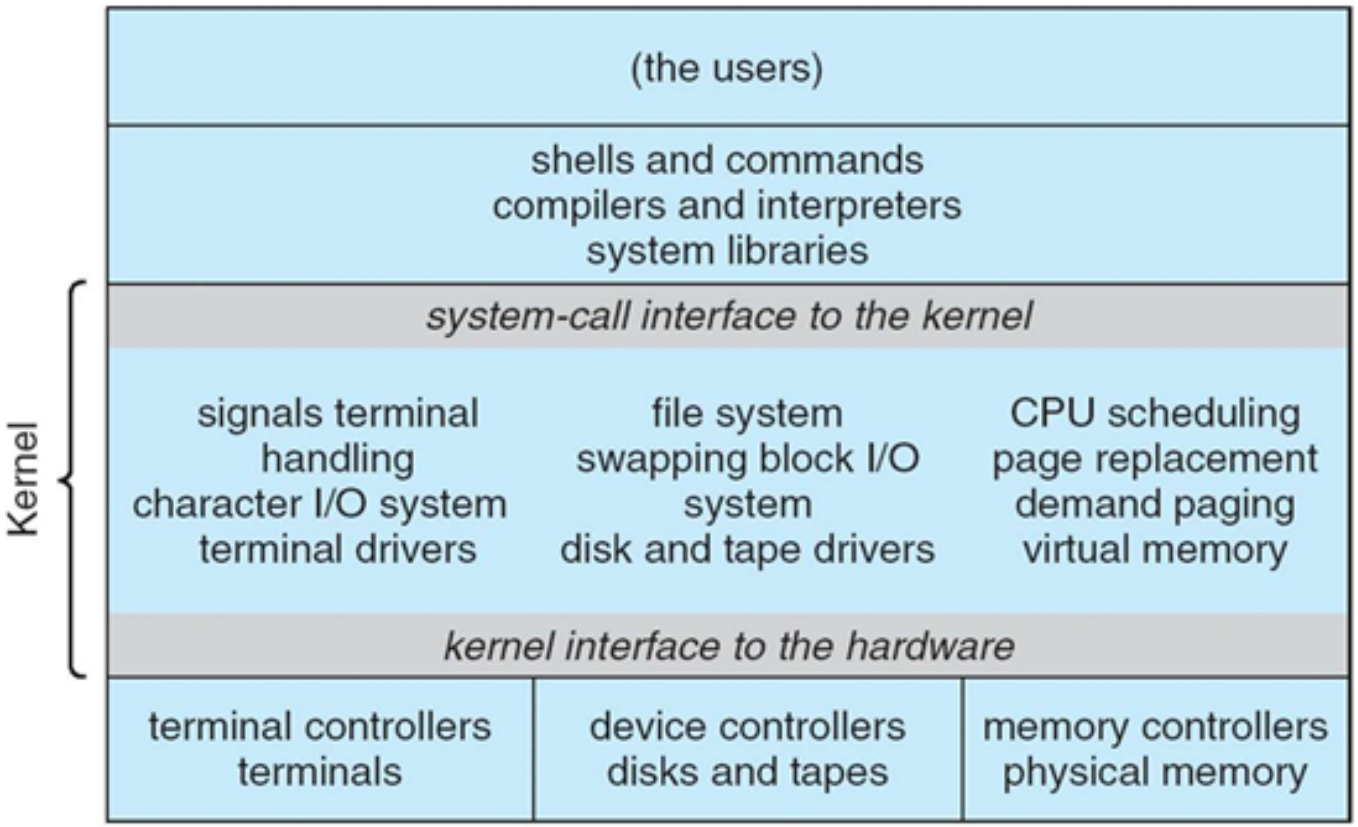
Operating System: structure

- MS-DOS provides a lot of functionality in little space.
  - Not divided into modules, Interfaces and levels of functionality are not well separated



Original UNIX System Structure

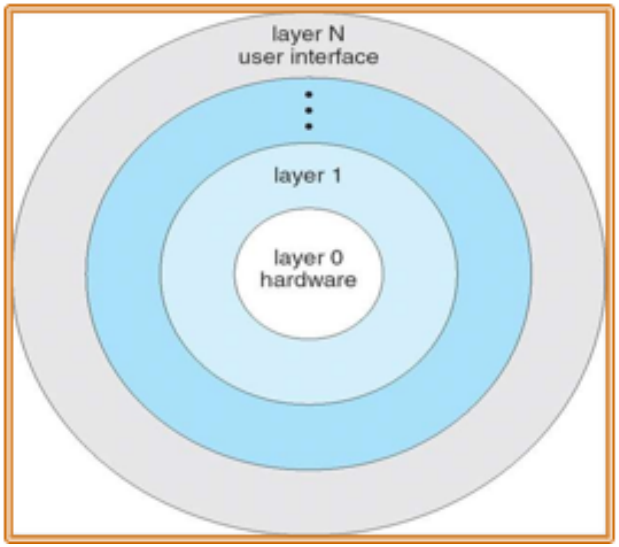
- Limited structuring, has 2 separable parts.
  - Systems programs
  - Kernel
    - everything below system call interface and above physical hardware.
    - Filesystem, CPU scheduling, memory management



Layered OS Structure

- OS divided into number of layers - bottom layer is hardware, highest layer is the user interface.
- Each layer uses functions and services of only lower- level layers.
- THE Operating System and Linux Kernel has successive layers of abstraction.

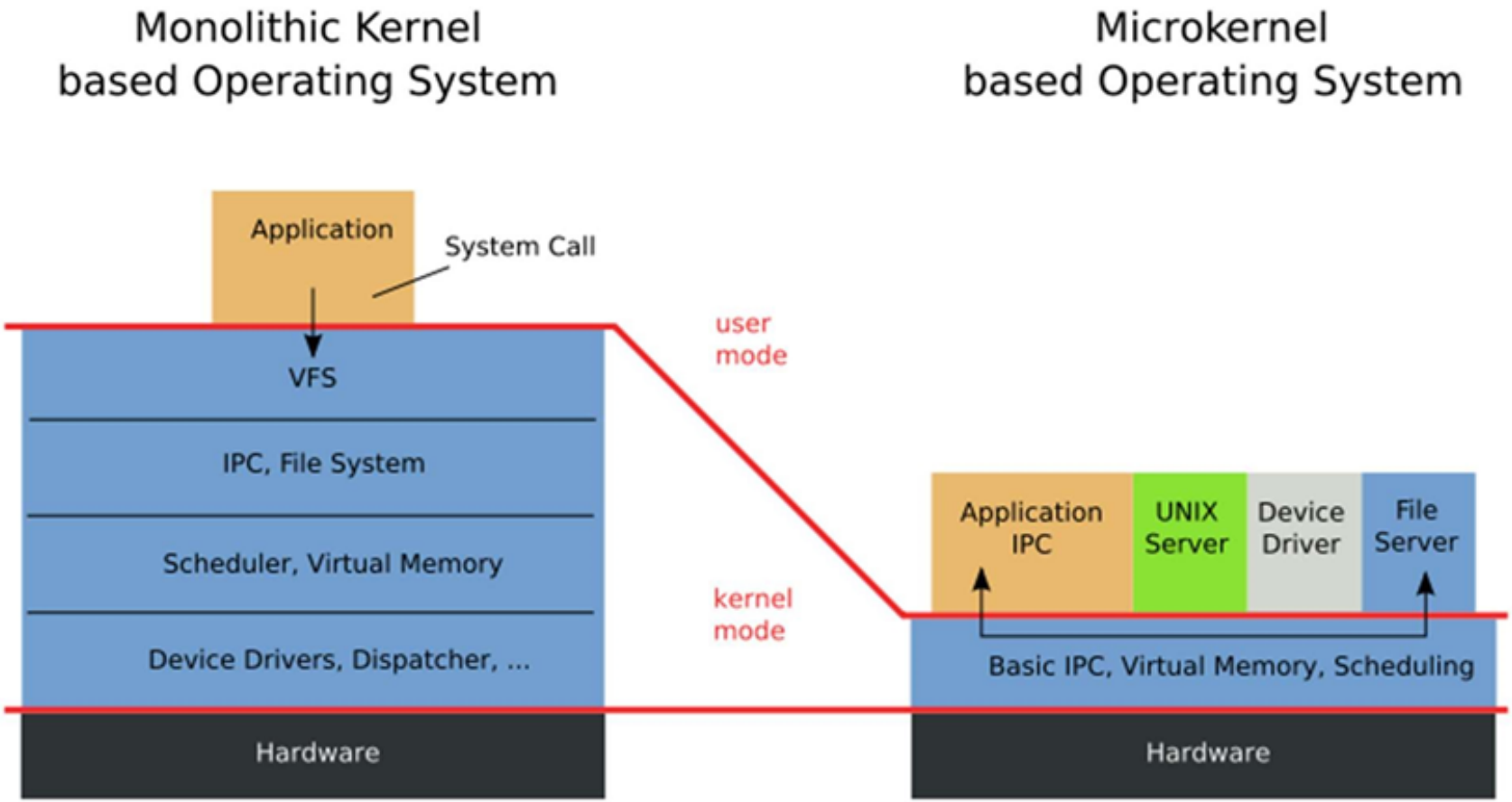
User Programs
Interface Primitives
Device Drivers and Schedulers
Virtual Memory
I/O
CPU Scheduling
Hardware



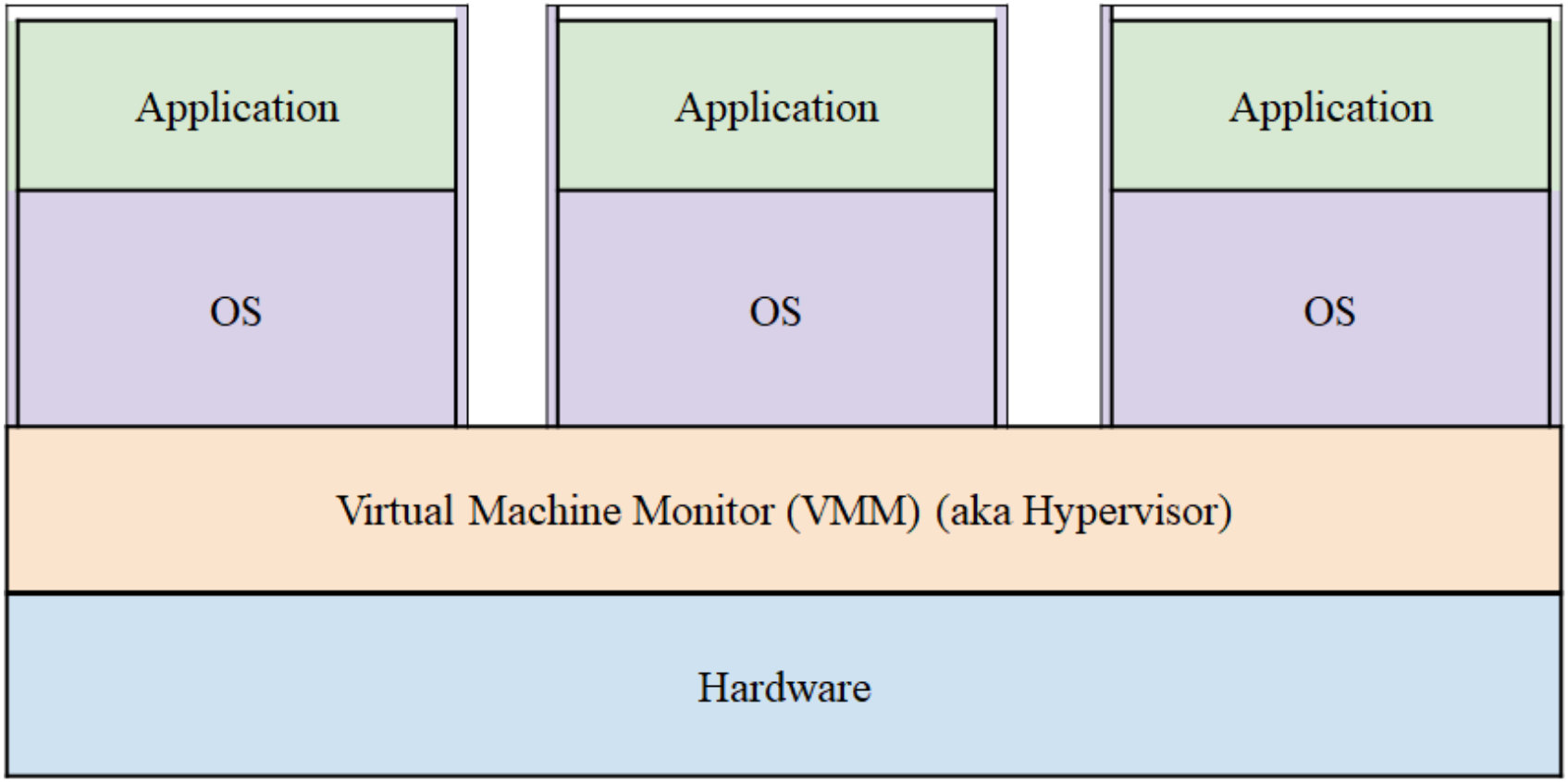
Monolithic vs. Microkernel OS

- Monolithic OSes have large kernels with a lot of components
  - Linux, Windows, Mac
- Microkernels moves as much from the kernel into "user" space
  - Small core OS components running at kernel level
  - OS Services built from many independent user-level processes
- Communication between modules with message passing
- **Benefits:**
  - Easier to extend a microkernel
  - Easier to port OS to new architectures
  - More reliable and more secure (less code is running in kernel mode)
- **Detriments:**
  - Performance overhead severe for nave implementation

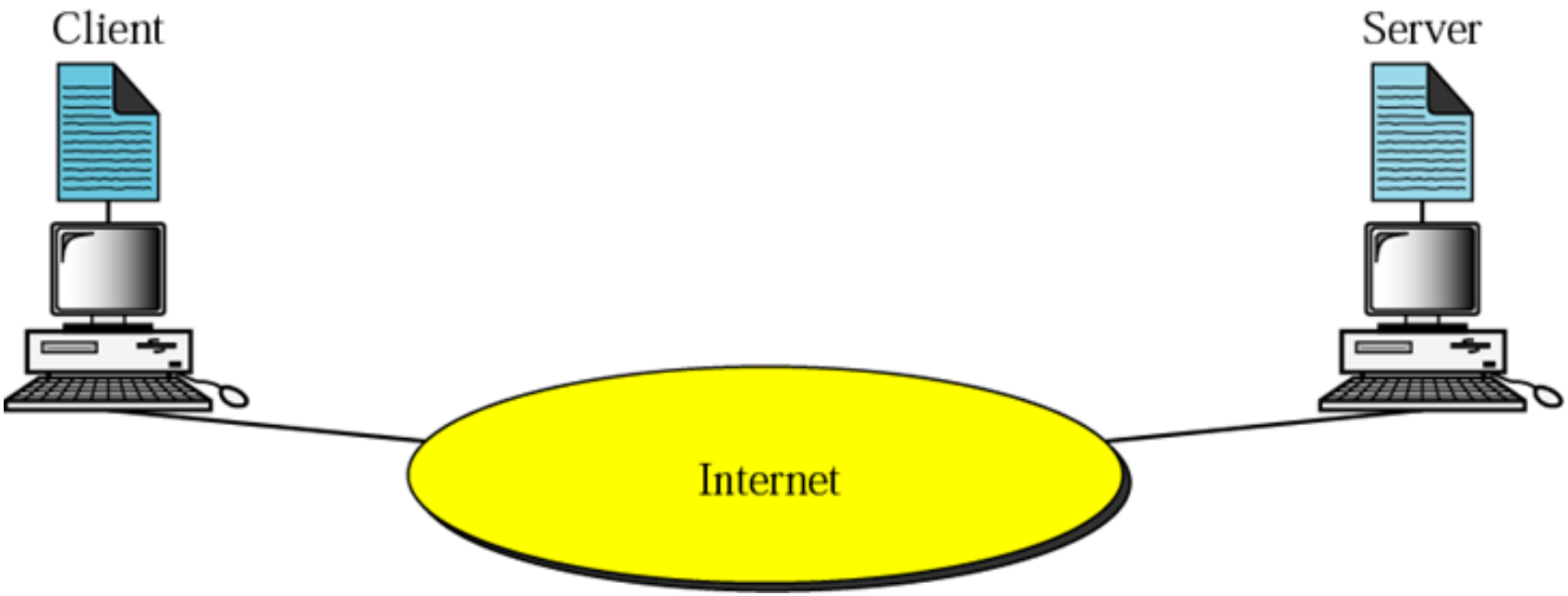
Microkernel OS



Virtual Machines Structure

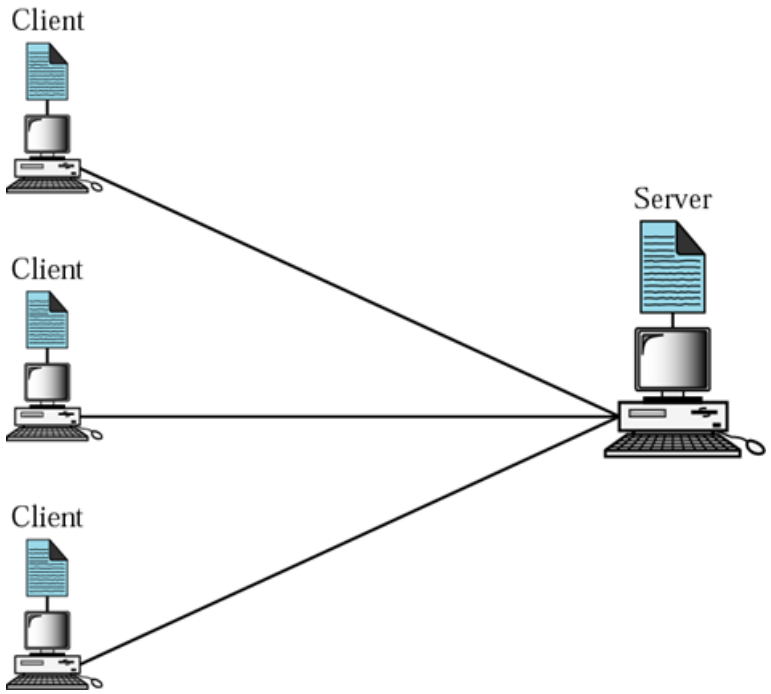


Client-Server Model



- To make any use of the Internet, application programs should run on the two endpoints of a network connection.
- The applications are the entities that communicate with each other to exchange services
- "Client" applications request service
- "Server" applications provide service.

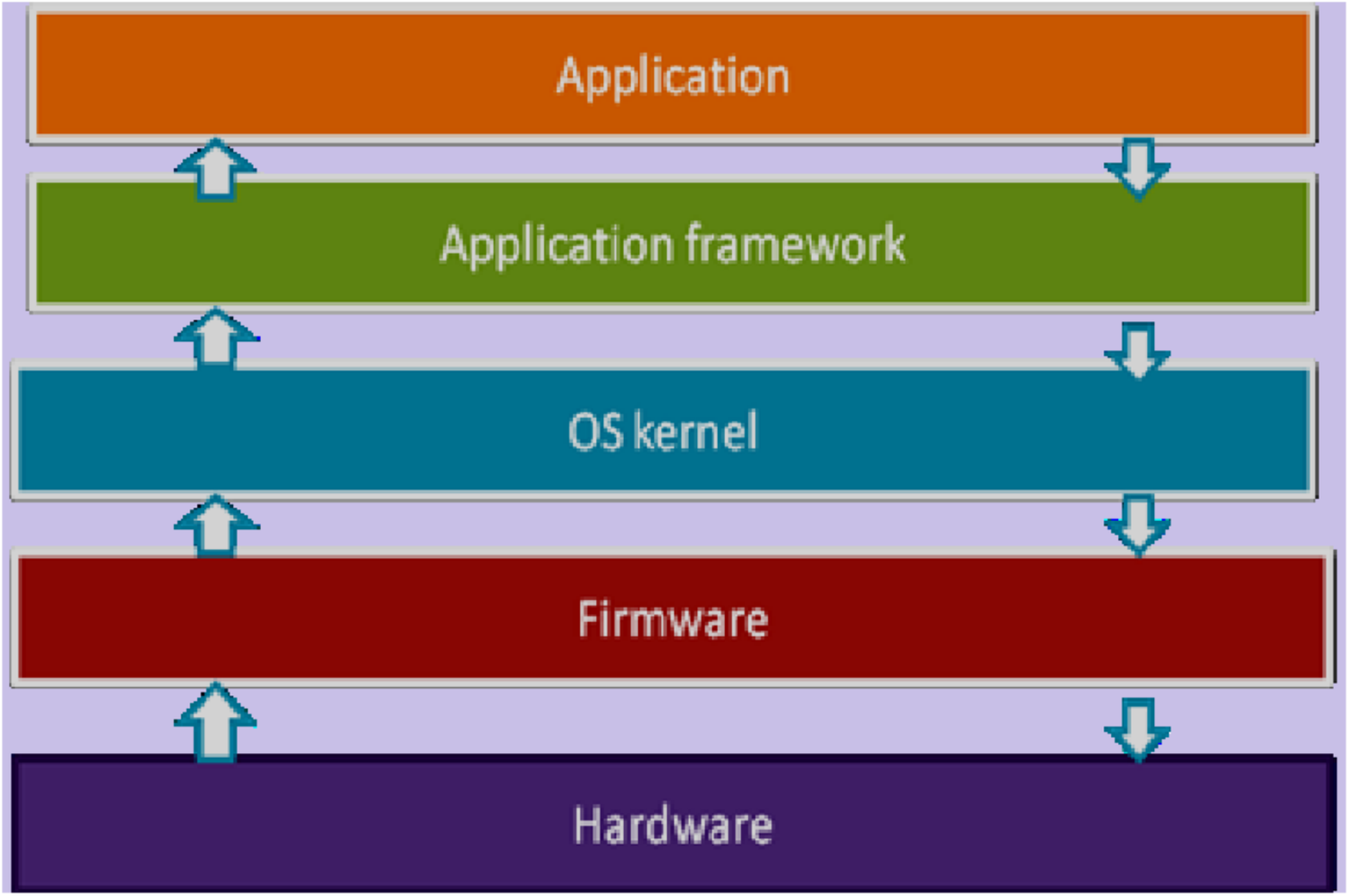
- Servers:
  - Run all the time (i.e. infinite)
  - Provide service to any client
  - Typically specialize in providing a certain type of service, e.g. Mail.
  - Listen to a well-known port and passively open connection.
- Clients
  - Run when needed, then terminate (i.e. finite)
  - Actively Open TCP or UDP connection with Servers socket.

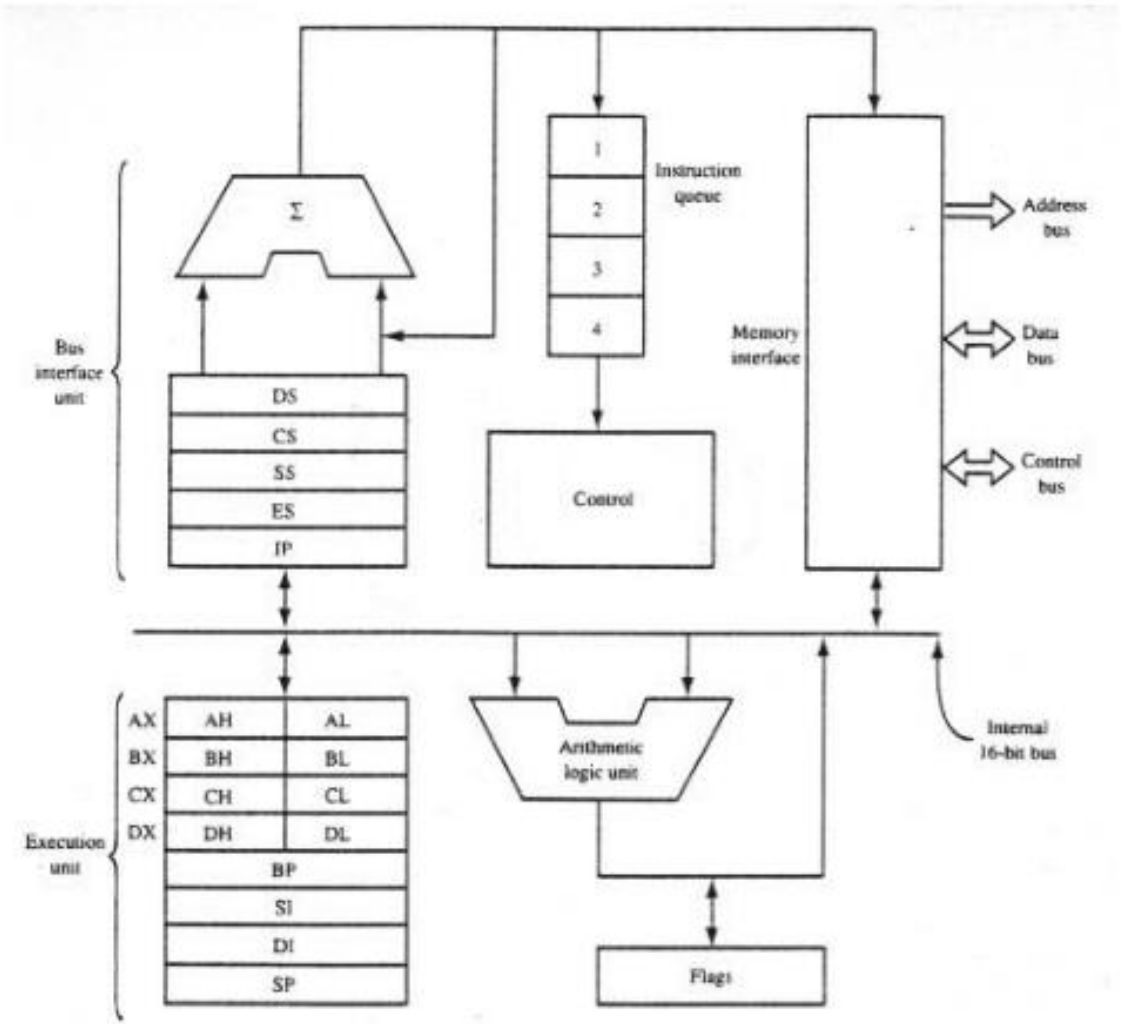


Mobile Operating System

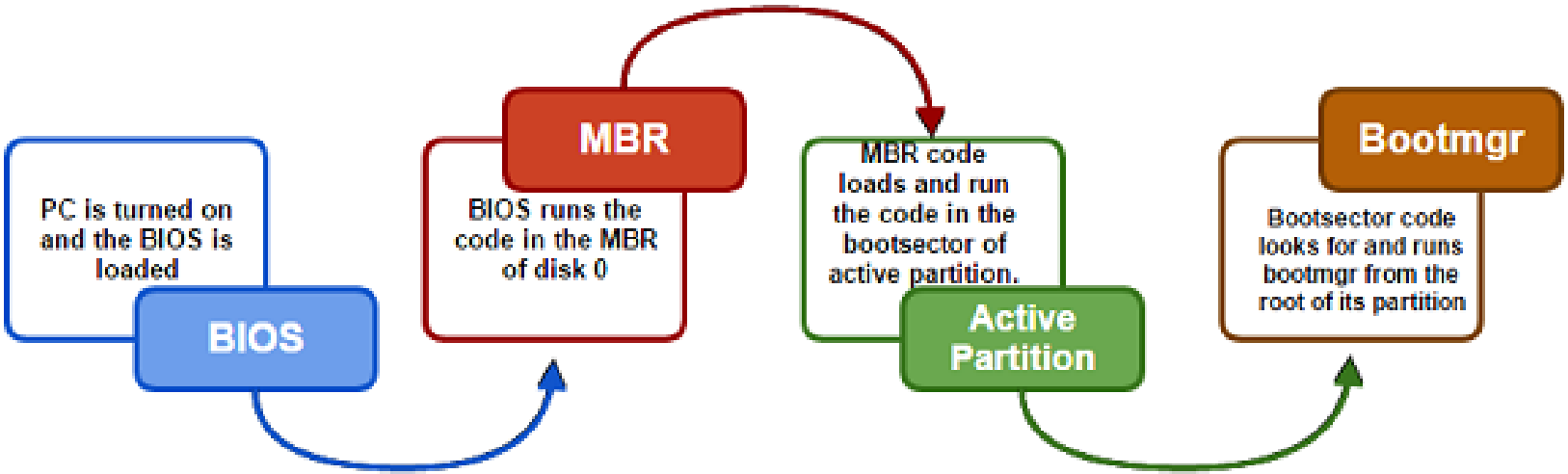
- Android was initially developed by Android Inc.
- It was released on April 9, 2000.
- Later on iPhone operating system was first introduced on January 9, 2007.
- After that microsoft developed windows mobile operating system.

Mobile Operating System Architecture




Bus interface unit
Σ
1
2
3
4
Instruction queue
Address bus
Memory interface
Data bus
Control bus
DS
CS
SS
ES
IP
Control
AX
BX
CX
DX
AH
AL
BH
BL
CH
CL
DH
DL
BP
SI
DI
SP
Execution unit
Arithmetic logic unit
Internal 16-bit bus
Flags

Booting Sequence



Interrupts

- **Hardware:** A device may trigger an interrupt by sending signal to the CPU, usually by system bus.
- **Software:** A program may trigger an interrupt by executing a special operation called system calls.

A software generated interrupt (sometimes called trap or exception) is caused either by an error (e.g., divide by zero) or a user request (e.g., an I/O request).

Thank You!!!