

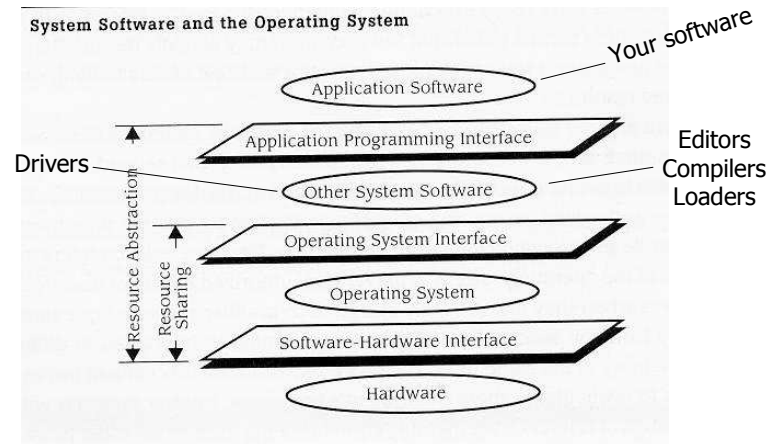
Chapter 1

CS 3204: Introduction

What is an Operating System (OS) ?

- Definition 1:
 - An OS is the *interface* between the hardware and the software environment, equivalent to an *extended* or *virtual* machine
- Definition 2:
 - An OS is a *resource manager* – provides “resource abstraction”
- In fact, it achieves 1 through 2.
- Therefore, both definitions are applicable at some times.

System Software and the OS interface



from the textbook

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Resource Abstraction

- How does the OS “manage resources” ?
 - By providing *Resource Abstraction* to the other system software and applications
- What is Abstraction ?
 - Abstraction hides the details
- *Resource Abstraction*
 - hides the “nitty-gritty” details of the underlying resource

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Resource Abstraction ... an example

(Consider the C language statement `fprintf`)

```
fprintf ( fileId , "%d" , var1 )
```



```
write ( block , 100 , device , 266 , 9 )
```



```
load ( block , 100 , device )
```

```
seek ( device , 266 )
```

```
out ( device , 9 )
```

Multi-level
abstraction

Resource Abstraction

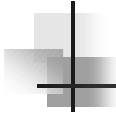
- Typical resource abstractions

- Memory

- Disk

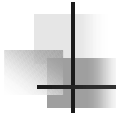
- Keyboard

- Monitor



Resource Sharing

- Managing resources through abstractions implies the ability to '*share resources*'
- Types of Sharing:
 - Space Multiplexed
 - Divided into 2 or more distinct units of resource
 - Example: disk, memory
 - Time multiplexed
 - Exclusive control for a short period of time
 - Example: processor



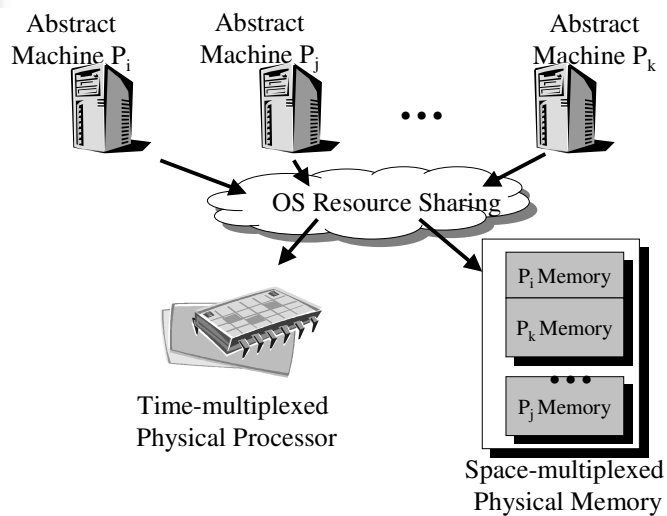
Resource Sharing

- Multiple processes accessing same resource concurrently
- Isolation: only one processor has access at any given time

Terminology

- Concurrency
 - The simultaneous execution of different programs
 - Types of Concurrency
 - **Physical** – multiple processors ———▶ Simultaneous access to memory
 - Example: CPU, I/O
 - **Logical** – interleaved execution ———▶ Lost updates
 - Example: processes
- Multiprogramming
 - The concurrent execution of multiple programs on a single processor
 - Could be space-multiplexed into memory and time-multiplexed in processors

Multiprogramming



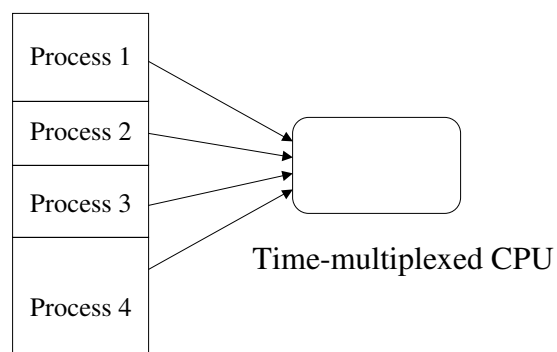
Multiprogramming(2)

- Technique for sharing the CPU among runnable processes
 - Process may be blocked on I/O
 - Process may be blocked waiting for other resource, including the CPU
- While one process is blocked, another might be able to run
- Multiprogramming OS accomplishes CPU sharing “automatically” – scheduling
- Reduces time to run all processes

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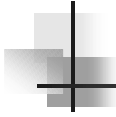
How Multiprogramming Works



Space-multiplexed Memory

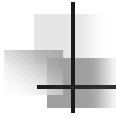
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OS Strategies for Providing Services

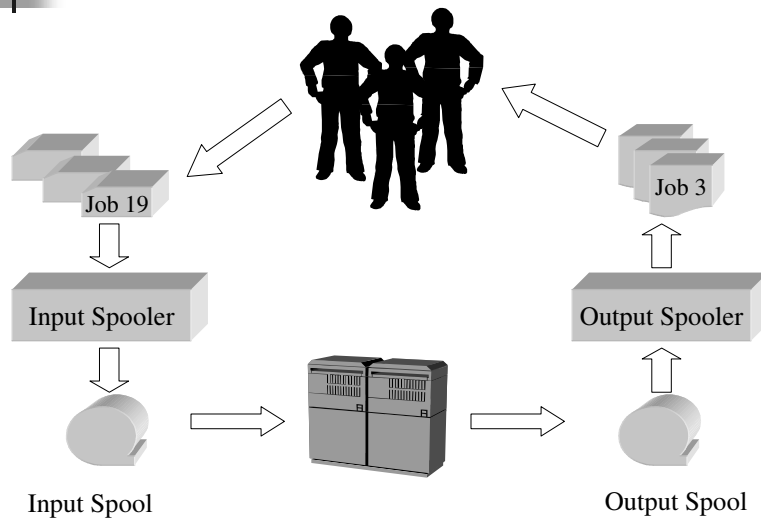
- Batch
- Time share
- PCs and Workstations
- Process Control & Real-time systems
- Networked
- Distributed
- Small computers



Batch processing systems

- Sequentially loaded set of jobs
- Supported multiprogramming
- Jobs compete for Resources
 - 1st: memory
 - 2nd: processor
 - 3rd: ???
- No “real time” interaction between user and computer
- Current examples include .bat files under DOS – Windows, shell files under Unix/Linux

Batch Processing



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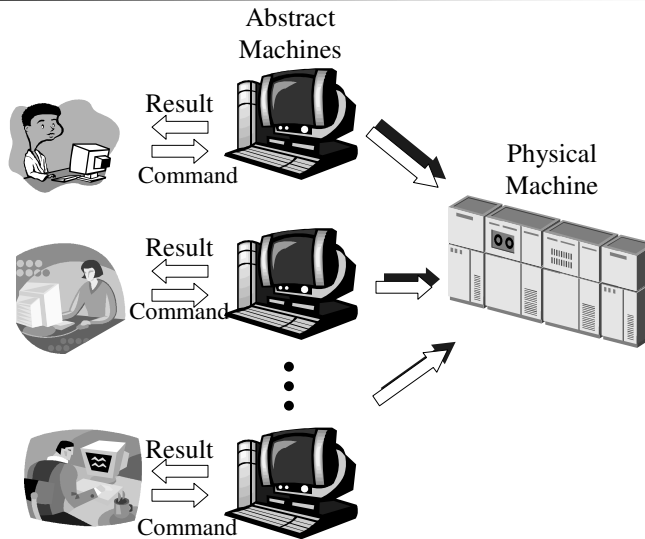
Time share (1970s)

- Multiprogramming environment
- Multiple interactive users
- Why time-share (TS) ?
 - To spread the cost of large machine
 - To fully utilize computing power
- TS provides each user with his/her own Virtual Machine

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Time share system...



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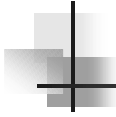
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Time share... ctd.

- TS eventually supported multitasking
 - Multitasking:
 - A time share system that support multiple processes per user, where.
 - A process is a "program in execution"
- TS elevated the importance of
 - Need for barriers and safeguards among users and there processes - User/User & Process/Process
 - Memory protection
 - File Protection

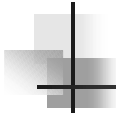
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Personal Computers (PCs) & Workstations

- Originally
 - Single User
 - Single Processor
- Now
 - Single or Multiple Users
 - Multiprogrammed



PCs Workstations... Evolution

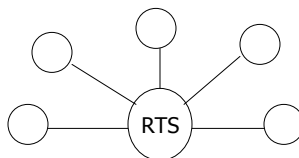
- Earlier machines
 - Too large, too expensive, and too fast for one person
- ➡
- Mini-computers
 - Smaller versions (like DEC PDP), yet they too grew in size
- ➡
- Micro-computer
 - Single chip processor
- ➡
- Workstation
 - Multiple user
 - Multiprogrammed
 - Multitasking

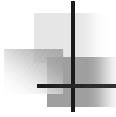
PCs & Workstations... Contribution

- Contributed to the growth of
 - Networking
 - Email
 - File server
 - Point and click interface
 - Like that in Mac and Windows

Process Control & Real time Systems

- Process Control Systems (PCS)
 - Single application monitoring one process
 - Example: System to monitor the heat of a liquid
- Real Time Systems (RTS)
 - Tied together Process Control Systems

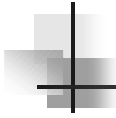




Real Time Systems... type

- Hard RTS
 - Had timing constraints that COULD NOT be missed
 - Example: Chemical processes, Nuclear power plants, Defense systems
- Soft RTS
 - Make best effort to accommodate time constraints
 - Example: Transaction processing (ATM)

RTS: Tradeoff of generality of operations/functionality to ensure that deadlines can be made

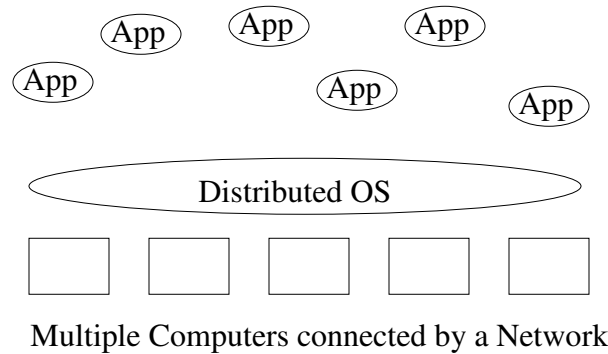


Networks of Computers

- Problem is too large
 - Partition it among machines
- Communication exchange
 - Email
 - File transfers
- Servers
 - File
 - Printer
 - Database
- Provide access to non-local resources
 - LAN, WAN
 - Client / Server

Distributed OS

- Wave of the future



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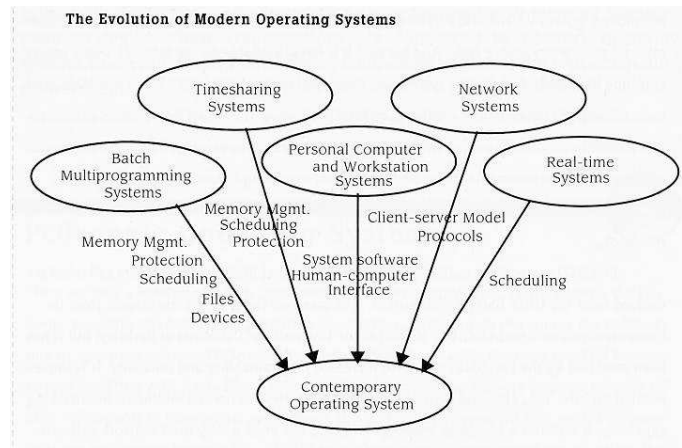
Small Computers

- PDAs, STBs, embedded systems became commercially significant
- Have an OS, but
 - Not general purpose
 - Limited hardware resources
 - Different kinds of devices
 - Touch screen, no keyboard
 - Graffiti
 - Evolving & leading to new class of Oses
- PalmOS, Pocket PC (WinCE), VxWorks, ...

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Summary



from the text book

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Examples of Modern OS

- UNIX variants (e.g. Linux) -- have evolved since 1970
- Windows NT/2K -- has evolved since 1989 (much more modern than UNIX)
 - Win2K = WinNT, V5
- Research OSes – still evolving ...
- Small computer OSes – still evolving ...

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