


CSE 101
Slide Set 3

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Chapter 3: Operating Systems

- 3.1 The History of Operating Systems
- 3.2 Operating System Architecture
- 3.3 Coordinating the Machine's Activities
- 3.4 Handling Competition Among Processes
- 3.5 Security

Please watch the famous »Time sharing, by fernando corbato, MIT« video..
<https://mitadmissions.org/blogs/entry/mit-computer-timesharing-in-the-1960s/>

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Functions of Operating Systems

- Oversee operation of computer
- Store and retrieve files
- Schedule programs for execution
- Coordinate the execution of programs

UNIX
XENIX
NOS
LINUX
WINDOWS
MACH
MULTICS
OS/2
VMS
MACOS
IOS
AndroidOS
CP/M
DOS

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Evolution of Shared Computing

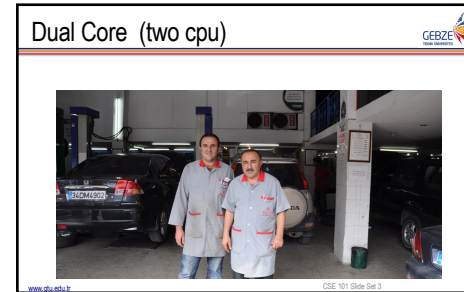
- Batch processing
- Interactive processing
 - Requires real-time processing
- Time-sharing/Multitasking
 - Implemented by Multiprogramming
- Multiprocessor machines

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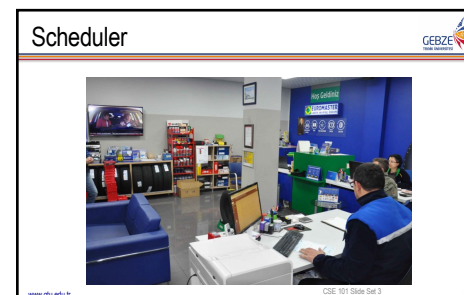
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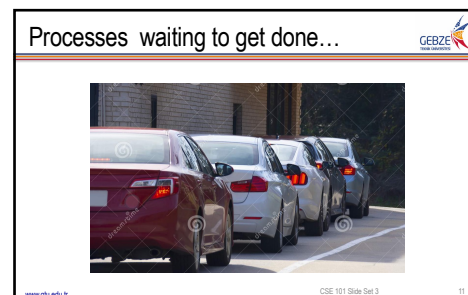
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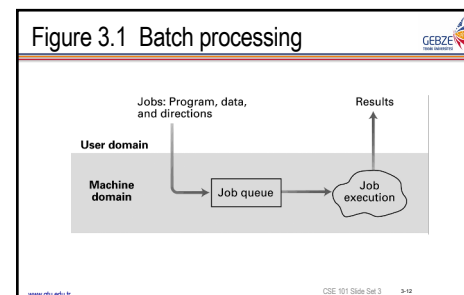
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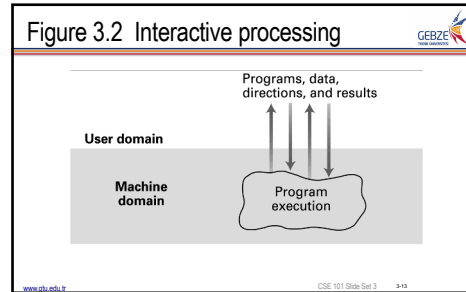
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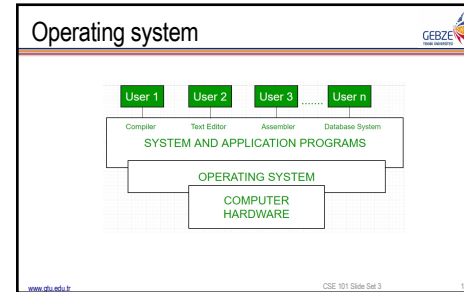
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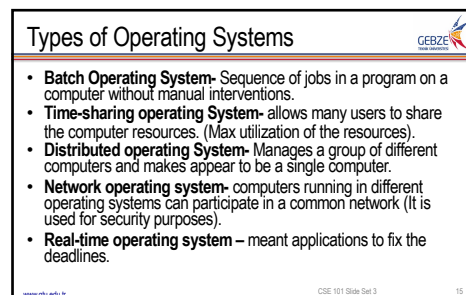
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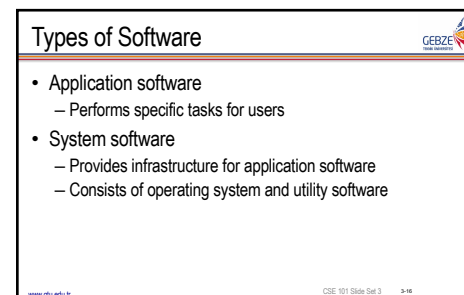
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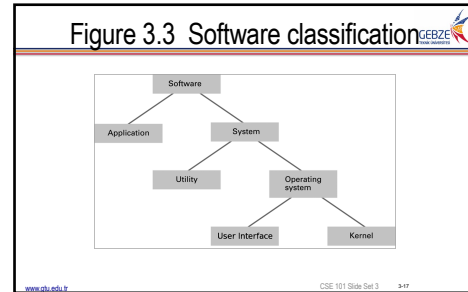
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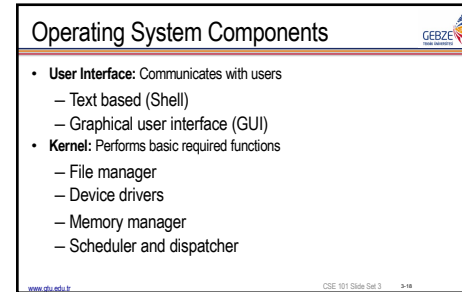
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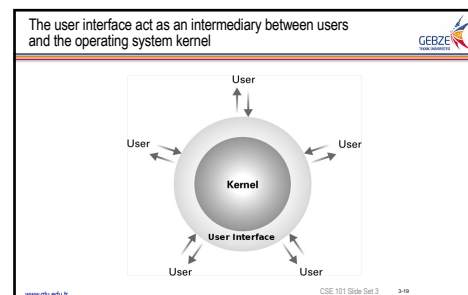
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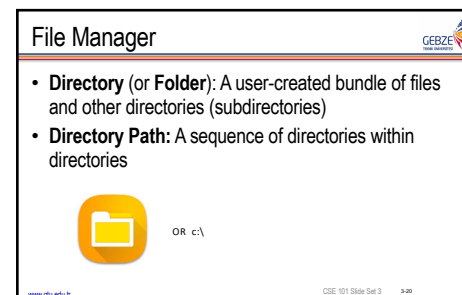
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Memory Manager

- Allocates space in main memory
- May create the illusion that the machine has more memory than it actually does (**virtual memory**) by playing a "shell game" in which blocks of data (**pages**) are shifted back and forth between main memory and mass storage

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Getting it Started (Bootstrapping)

- Boot loader:** Program in ROM (example of firmware)
 - Run by the CPU when power is turned on
 - Transfers operating system from mass storage to main memory
 - Executes jump to operating system

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Figure 3.5 The booting process

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Processes

- Process:** The activity of executing a program
- Process State:** Current status of the activity
 - Program counter
 - General purpose registers
 - Related portion of main memory

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Process Administration

- **Scheduler:** Adds new processes to the process table and removes completed processes from the process table
- **Dispatcher:** Controls the allocation of time slices to the processes in the process table
 - The end of a time slice is signaled by an interrupt.

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Scheduler



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Dispatcher

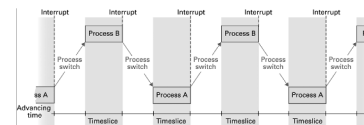


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Figure 3.6 Time-sharing between process A and process B



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Handling Competition for Resources

- **Semaphore:** A "control flag"
- **Critical Region:** A group of instructions that should be executed by only one process at a time
- **Mutual exclusion:** Requirement for proper implementation of a critical region

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Deadlock

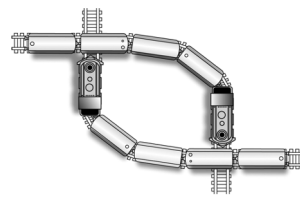
- Processes block each other from continuing
- Conditions required for deadlock
 1. Competition for non-sharable resources
 2. Resources requested on a partial basis
 3. An allocated resource can not be forcibly retrieved

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A deadlock resulting from competition for nonshareable railroad intersections

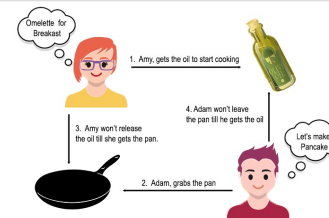


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Deadlock example



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Security


- Attacks from outside
 - Problems
 - Insecure passwords
 - Sniffing software
 - Counter measures
 - Auditing software

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Security (continued)

- Attacks from within
 - Problem: Unruly processes
 - Counter measures: Control process activities via privileged modes and privileged instructions



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Questions?

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Intro to Programming in High Level Languages

- What is high level?
- Why C

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C Programming Language




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