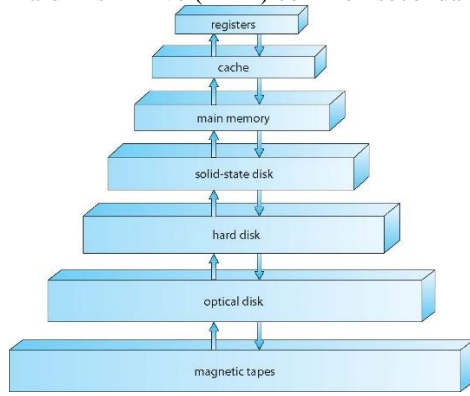
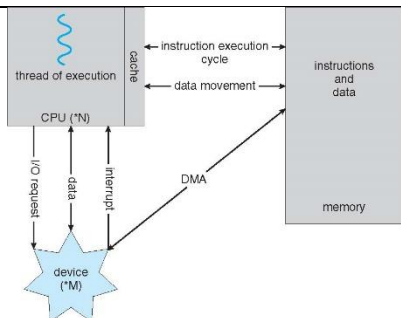
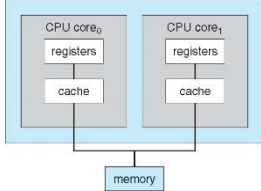
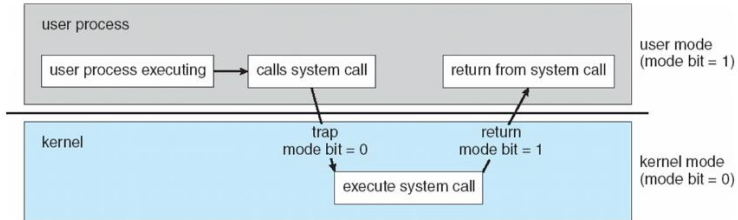


What is an Operating System?	<ul style="list-style-type: none"> <li>Manages the computer's hardware</li> <li>Intermediary between the computer user and the computer hardware</li> <li>Basis for application programs to interface with</li> </ul>
Where are computers used?	
Operating system Purposes	<ul style="list-style-type: none"> <li>Mainframe - designed primarily to optimize utilization of hardware</li> <li>PC – support complex games, business applications, everything in-between</li> <li>Mobile – provide an environment for easy user interface</li> </ul>
What does an Operating System do?	<ul style="list-style-type: none"> <li>A computer system can be divided into four components <ul style="list-style-type: none"> <li>Hardware</li> <li>Operating system</li> <li>Application programs</li> <li>Users</li> </ul> </li> </ul>
System view	<ul style="list-style-type: none"> <li>Operating System can be viewed as a resource allocator: <ul style="list-style-type: none"> <li>CPU time</li> <li>Memory space</li> <li>File-storage space</li> <li>I/O devices</li> </ul> </li> <li>Operating System can be viewed as a control program: <ul style="list-style-type: none"> <li>Manage execution of user programs to prevent errors</li> <li>“” to prevent improper use</li> <li>Concerned with the operation and control of I/O devices</li> </ul> </li> </ul>
Defining an Operating System	<ul style="list-style-type: none"> <li>No clear definition</li> <li>Kernel ‘program’ – YES</li> <li>System ‘programs’ – YES</li> <li>Application programs -NO</li> <li>In 1998, the US States Department of Justice filed a lawsuit against Microsoft for what? <ul style="list-style-type: none"> <li>Internet explorer was too integrated into the system; trying to gather data</li> </ul> </li> </ul>
Computer Startup	<ul style="list-style-type: none"> <li>Initial program, bootstrap rgoram loads</li> </ul>

	<ul style="list-style-type: none"> <li>○ Stored in firmware           <ul style="list-style-type: none"> <li>▪ ROM (read-only memory)</li> <li>▪ EEPROM (Electrically erasable programmable read-only memory)</li> </ul> </li> <li>○ Initializes all aspects of the system</li> <li>○ Load the operating system kernel into memory</li> </ul>
Computer Startup	<ul style="list-style-type: none"> <li>• System processes/daemons           <ul style="list-style-type: none"> <li>○ Programs loaded into memory at boot time that runs the entire time the kernel is running</li> </ul> </li> <li>• Interrupt           <ul style="list-style-type: none"> <li>○ Signals an event that has occurred</li> <li>○ Hardware may trigger them at any time, usually by the way of a system bus</li> <li>○ Software may trigger them by using a 'system call' (can also be referred to as a monitor call)</li> <li>○ CPU transfers execution to a fixed location (starting address for a service routine for that interrupt)</li> </ul> </li> </ul>
Main Memory	<ul style="list-style-type: none"> <li>• Ideal for all programs to reside in memory permanently</li> <li>• This is not possible           <ul style="list-style-type: none"> <li>○ Main memory is too small to store all needed programs</li> <li>○ Main memory is 'volatile', which means it loses its contents when power is turned off, or otherwise lost</li> </ul> </li> </ul>
Secondary Storage	<ul style="list-style-type: none"> <li>• Extension of main memory</li> <li>• Hold large quantities of data permanently</li> <li>• Hard Disk Drive (HDD) common secondary-storage device</li> </ul>  <ul style="list-style-type: none"> <li>• Solid-state disks – faster than hard disks, nonvolatile</li> <li>• NVRAM – nonvolatile storage. DRAM with battery backup power</li> </ul>
Computer Overview	
Multiprocessor Systems	<ul style="list-style-type: none"> <li>• System with 2 or more processors</li> <li>• Shared computer bus, clock, memory, peripheral devices           <ul style="list-style-type: none"> <li>○ Varying shared components, not always consistent</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>Initially only available in servers, but have made their way to desktops, laptops, and mobile devices</li> </ul>
Multiprocessor Systems	<ul style="list-style-type: none"> <li>Increased throughput</li> <li>Economy of scale               <ul style="list-style-type: none"> <li>Shared multi CPU access to a single storage device as opposed to multiple CPUs individually housed and multiple storage devices</li> </ul> </li> <li>Increased reliability</li> <li>Asymmetric multiprocessing               <ul style="list-style-type: none"> <li>One boss, assigns work to the worker processors</li> </ul> </li> <li>Symmetric multiprocessing (SMPD)</li> </ul>
Multicore Systems	<p>Multicore – multiple computing cores on a single chip</p> 
Multiprogramming	<ul style="list-style-type: none"> <li>Job pool               <ul style="list-style-type: none"> <li>Resides on disk</li> <li>Small number of jobs reside in memory</li> <li>CPU chooses a job and begins to work on it</li> </ul> </li> <li>What “real-world” scenarios does this mimic?               <ul style="list-style-type: none"> <li>Printers, contractors, mail delivery, prioritizing</li> </ul> </li> </ul>
Dual-Mode Operation	<ul style="list-style-type: none"> <li>Why?               <ul style="list-style-type: none"> <li>Provides system protection</li> <li>Prevent user processes from:</li> <li>Infinite loops</li> <li>“Hogging” resources</li> <li>Affecting other users</li> </ul> </li> </ul> 
Timer	<ul style="list-style-type: none"> <li>Set to interrupt the computer after a fixed period of time</li> </ul>