Welcome to Computer Science
IBDP

Beijing 101 Middle/High School

IBDP CompSci

BEIJNG 101 MSHS

Resource Management Topic 6

Last Week

♥ IDENTIFY THE LIMITATIONS OF A RANGE OF RESOURCES IN A SPECIFIED COMPUTER SYSTEM

♥ EXPLAIN THE ROLE OF THE OPERATING SYSTEM

Topic 6.1.7
Outline OS resource management techniques: scheduling, policies, multitasking, virtual memory, paging, interrupt, polling

Scheduling

♥ Scheduling is the method by which work is assigned to resources that complete the work.

♥ The work could be processes which are in turn scheduled onto hardware resources such as processors, network links or expansion cards.

♥ The algorithm used may be as simple as round-robin in which each process is given equal time (for instance 1 ms, usually between 1 ms and 100 ms) in a cycling list. So, process A executes for 1 ms, then process B, then process C, then back to process A.
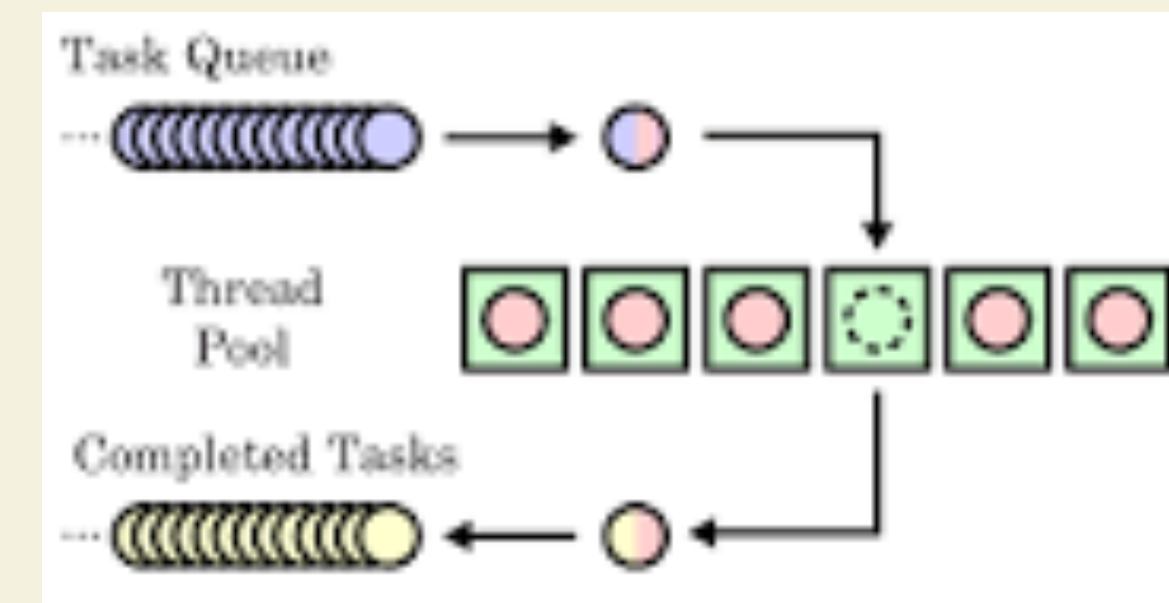
Policies

♥ THE POLICIES WHAT IS TO BE DONE WHILE THE MECHANISM

♥ SPECIFIES HOW IT IS TO BE DONE.

♥ FOR INSTANCE, THE TIMER CONSTRUCT (LIMITING THE TIME A PROCESS CAN USE THE CPU FOR) THEREBY ENSURING CPU PROTECTION IS MECHANISM.

♥ ON THE OTHER HAND, THE DECISION OF HOW LONG THE TIMER IS SET FOR A PARTICULAR USER IS A POLICY DECISION.

♥ THE SEPARATION OF MECHANISM AND POLICY IS IMPORTANT TO PROVIDE FLEXIBILITY TO A SYSTEM.
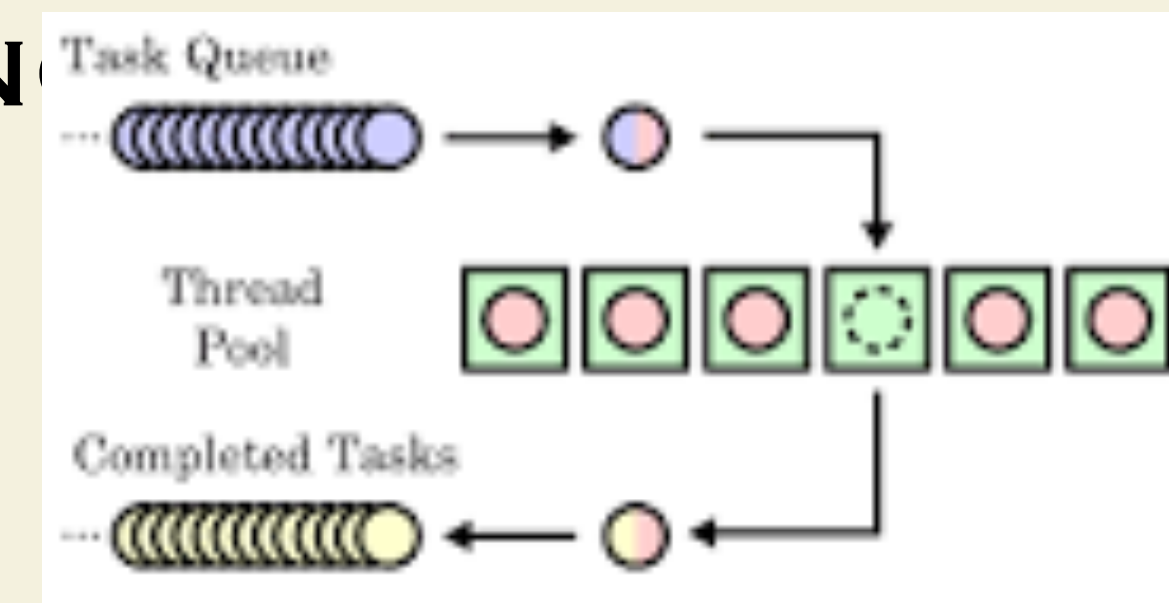
Multitasking
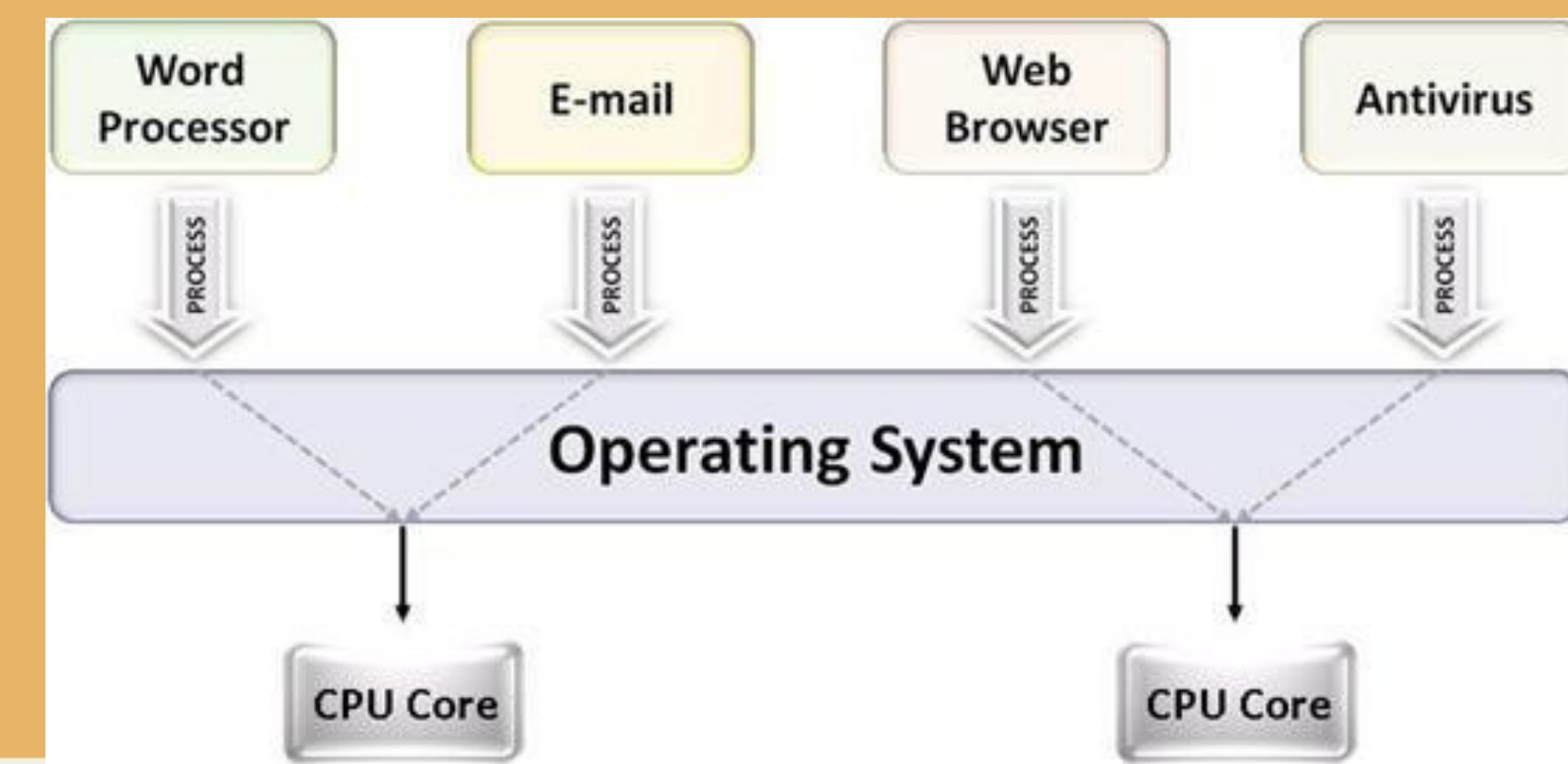
♥ Multitasking, in an operating system, is allowing a user to perform more than one computer task (such as the operation of an application program) at a time.

♥ The operating system is able to keep track of where you are in these tasks and go from one to the other without losing information.

♥ Almost all of today's operating systems can do this.

♥ When you open your Web browser and then open Word at the same time, you are causing the operating system to do multitasking.

Virtual memory

"Virtual" memory seen by the program — Main memory — Disk storage

This mapping is done by hardware in the central processor, based on tables in main memory

♥ Virtual memory is a feature of an operating system (OS) that allows a computer to compensate for shortages of physical memory by temporarily transferring pages of data from random access memory (RAM) to disk storage.

♥ Eventually, the OS will need to retrieve the data that was moved to temporarily to disk storage -- but remember, the only reason the OS moved pages of data from RAM to disk storage to begin with was because it was running out of RAM.
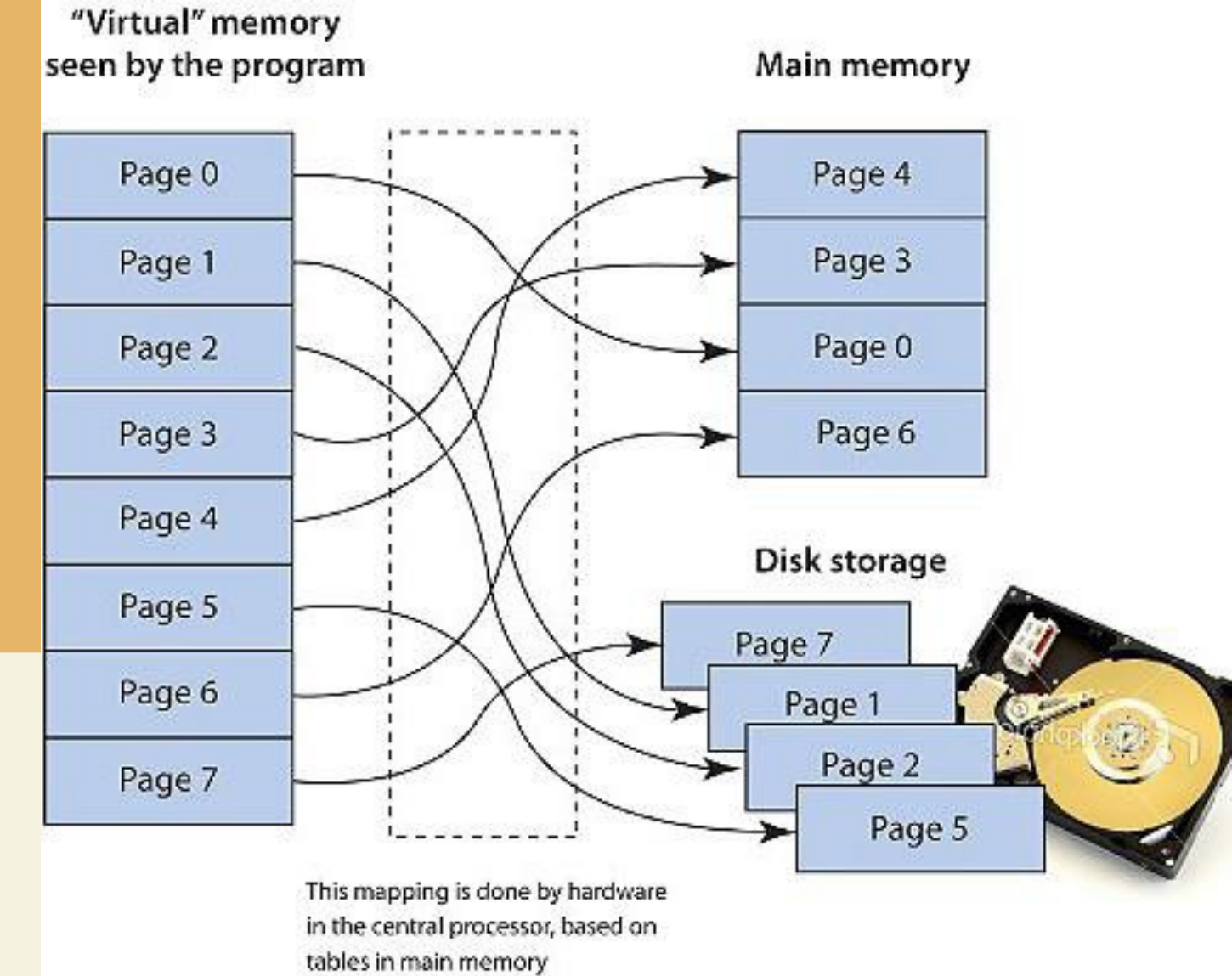
Paging
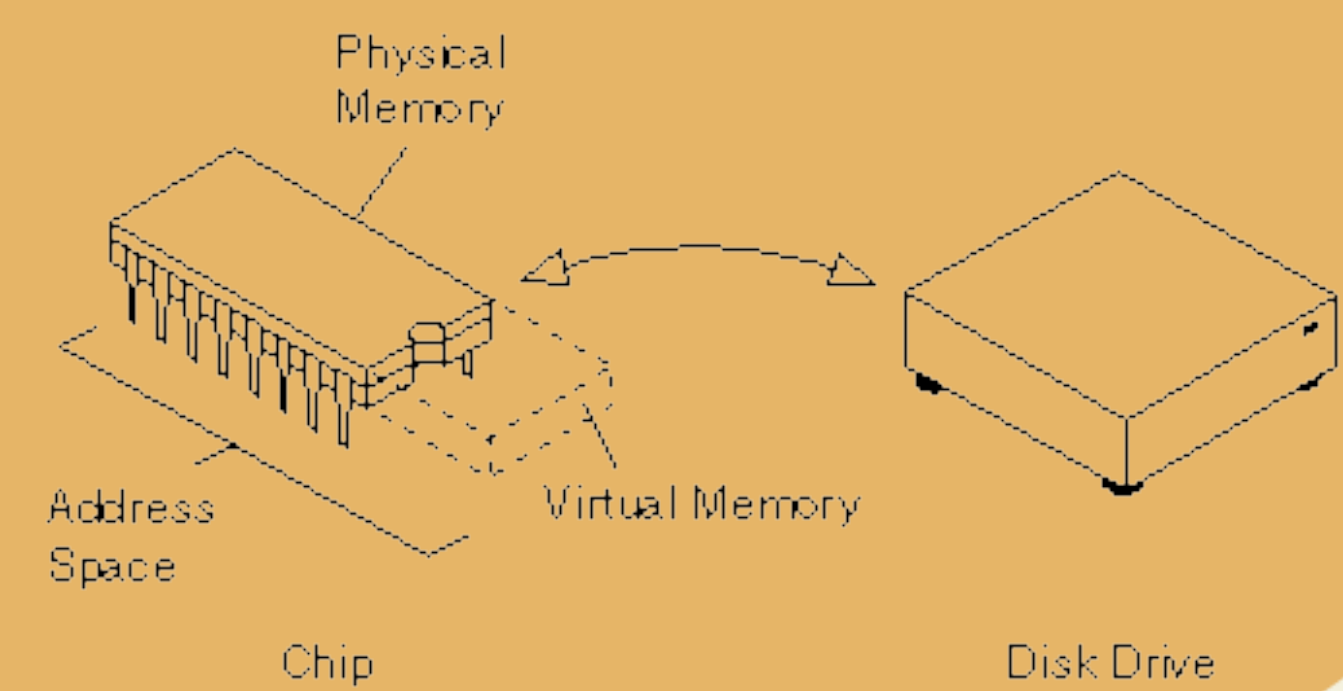
♥ When using virtual memory, the OS needs to retrieve the data that was moved to temporarily to disk storage; the only reason the OS moved pages of data from RAM to disk storage to begin with was because it was running out of RAM.

♥ To solve the problem, the operating system will need to move other pages to hard disk so it has room to bring back the pages it needs right away from temporary disk storage.

♥ This process is known as paging or swapping and the temporary storage space on the hard disk is called a pagefile or a swap file.

♥ Swapping, which happens so quickly that the end user doesn't know it's happening, is carried out by the computer's memory manager unit (MMU).

♥ The memory manager unit may use one of several algorithms to choose which page should be swapped out, including Least Recently Used (LRU),Least Frequently Used (LFU) or Most Recently Used (MRU).

Interrupt

♥ An interrupt is a signal to the processor emitted by hardware or
♥ software indicating an event that needs immediate attention.
♥ An interrupt alerts the OS to a high-priority condition requiring the interruption of the current code the processor is executing.
♥ The OS responds by suspending its current activities, saving its state, and executing a function called an interrupt handler to deal with the event.
♥ This interruption is temporary, and, after the interrupt handler
♥ finishes, the processor resumes normal activities.
♥ There are two types of interrupts:
♥ hardware interrupts
♥ software interrupts

Polling

♥ Polling is the process where the computer or controlling device waits for an external device to check for its readiness or state, often with low-level hardware.

♥ For example, when a printer is connected via a parallel port, the computer waits until the printer has received the next character.

♥ Alternative to polling?: interrupts (signals generated by devices or processes to indicate that they need attention)

♥ Although polling can be very simple, in many situations (e.g., multitasking operating systems) it is more efficient to use interrupts because it can reduce processor usage and/or bandwidth consumption.
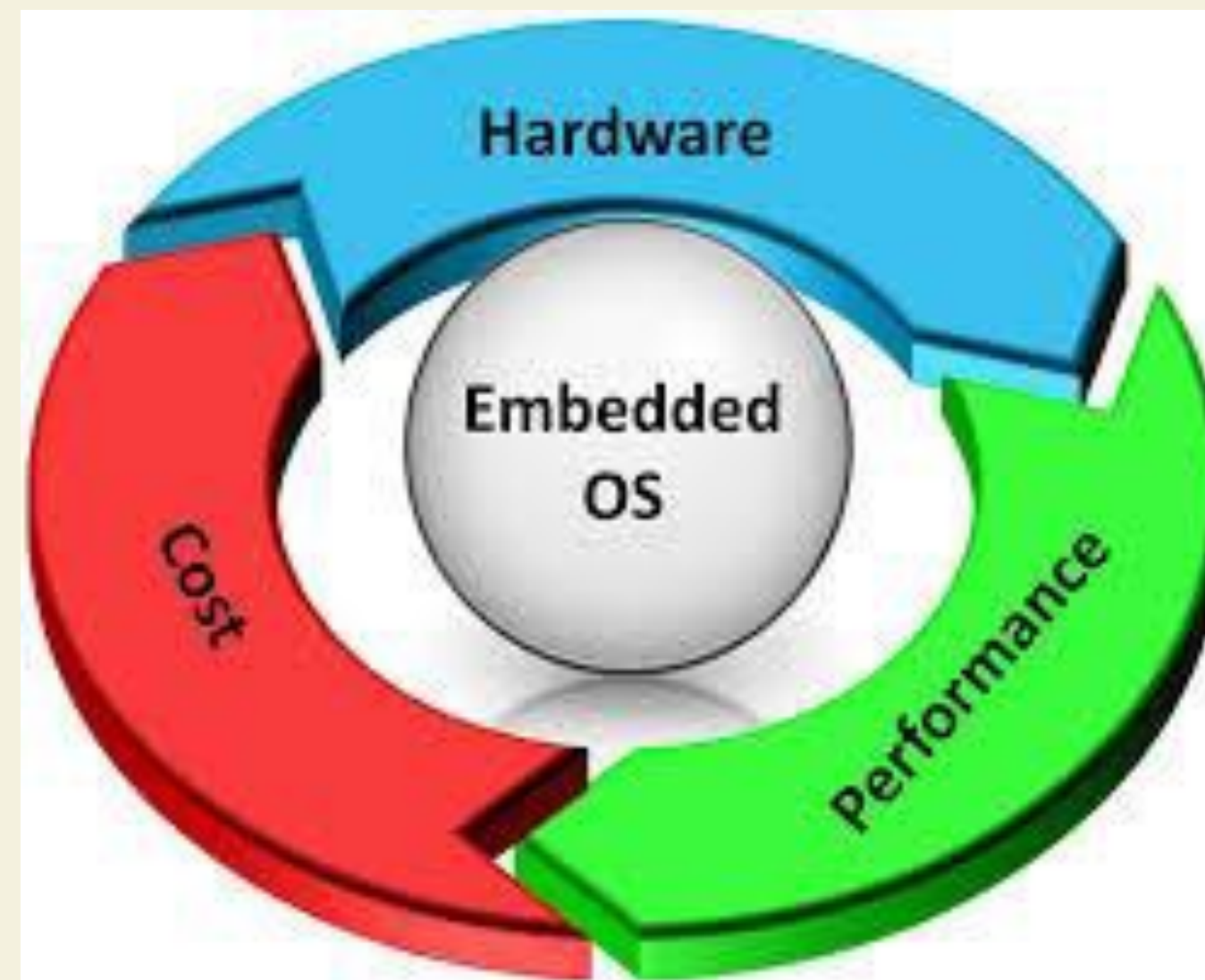
For the exams: know when & why

| Technique	When is it used?	Why is it used?
Scheduling		
Policies		
Multi-tasking		
Virtual memory		
Interrupts		
Polling		

Topic 6.1.8
Discuss the advantages of producing a dedicated operating system for a device

Examples of dedicated OS

♥ Apple's iOS 15 for iPhones/iPads only
♥ Ubuntu Kylin for Chinese users
♥ OS for a digital camera
♥ OS for satellite TV receiver box
♥ OS for satnav
♥ Different versions of Linux, particular
to each case – example Raspbian for the
Raspberry Pi
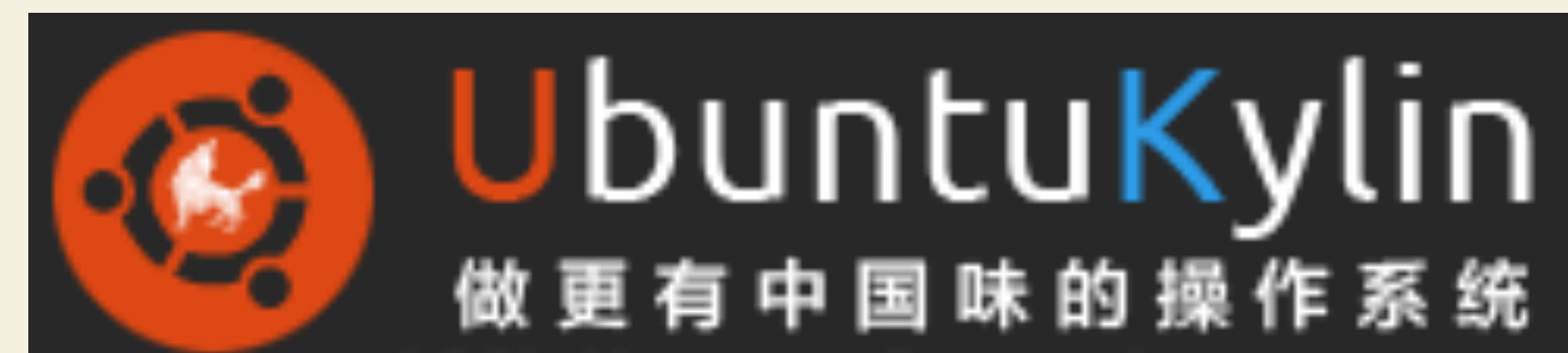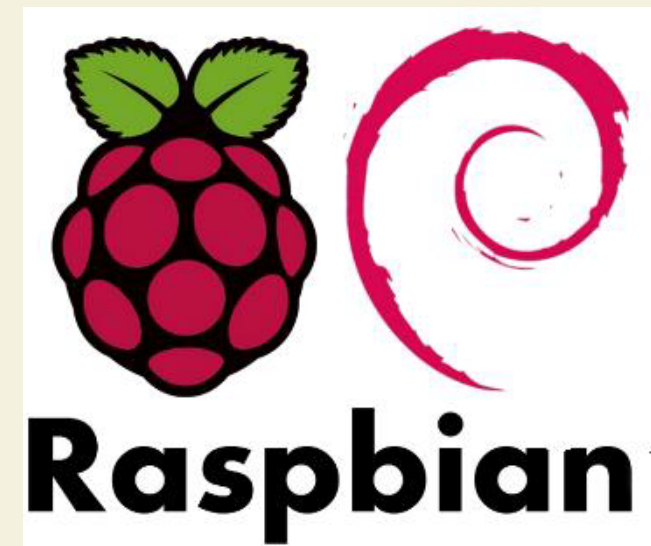
Advantages

- **Security**: A dedicated operating system ensures a higher level of security.
  - *Example*: Banks would require a dedicated operating system to prevent cyber attacks on financial transactions
- **Customisability**: Dedicated operating systems custom made to do a specific function at maximum efficiency.
  - *Example*: A 'dumb phone' OS
- **Modify priorities**: can make running some devices easier to use or better suited to their audience. By having a custom OS you can eliminate certain aspects of the OS which are not needed, reducing the size of the OS, therefore reducing the amount of secondary memory and RAM being used
 - *Example*: Raspbian Linux on Raspberry Pi

Are you able to explain these in an exam?...

♥ Advantages related to size, speed and customisation
♥ Typical example to be explained: Using a dedicated operating system for a cell phone rather than using a pre-existing operating system (e.g. difference between iOS and OS X)
♥ Issue of proprietary software

Topic 6.1.9

Outline how an operating system hides the complexity of the hardware from users and applications
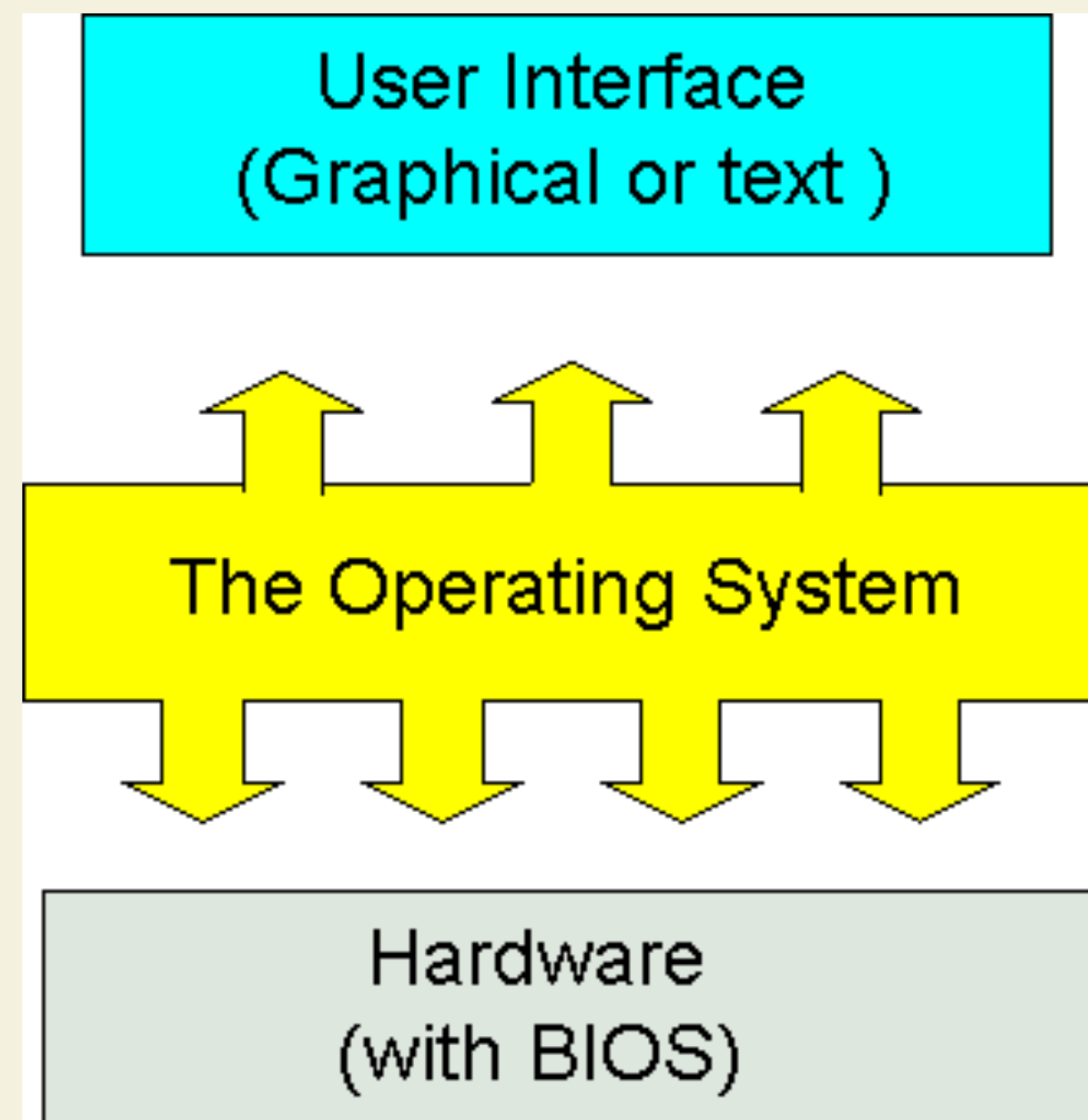
Important note

♥ Students should be aware of a range of examples where operating systems virtualize real devices, such as drive letters, virtual memory, input devices, the Java virtual machine.

♥ The issue of localization causing compatibility problems between systems in different countries is also important.

Abstraction leads to simplicity

♥ Users and applications do not see the hardware directly, but
♥ view it through the OS.
♥ This is used to hide certain hardware details from users and applications (called abstraction).
♥ Due to this abstraction, users cannot see changes in the hardware. Can be used is to make related devices appear the same from the user's point of view.
♥ For example, hard disks, floppy disks, CD-ROMs, and USB keys are all very different media, but in many OSes they appear the same to the user.
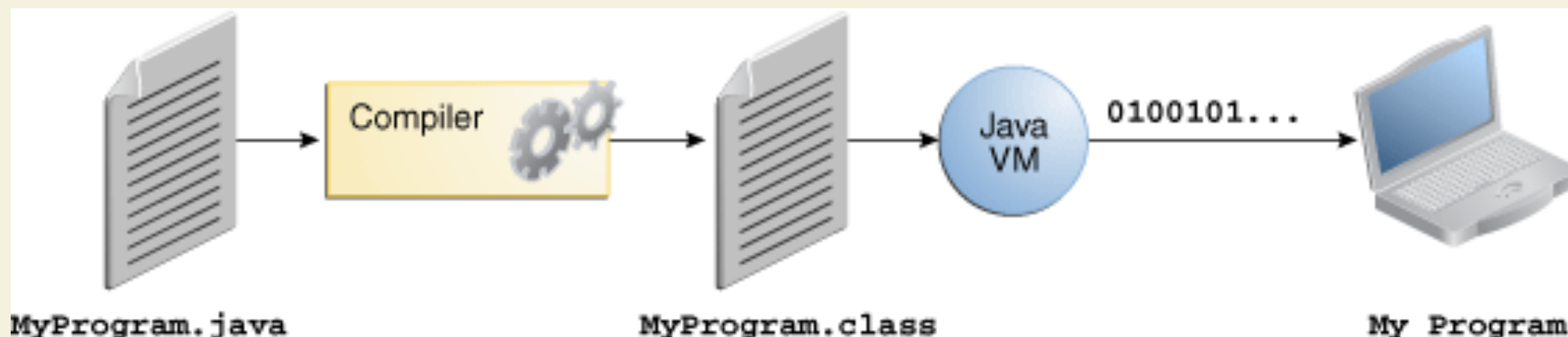
Drive letters

♥ A 'drive letter; is a single alphabetic character A through Z that has been assigned to a physical drive or drive partition in the computer.

♥ For example, a computer with a floppy drive has a drive letter of A: assigned to the drive.

♥ All computers with a hard drive will always have that default hard drive assigned to a C: drive letter

♥ CD-ROM or other drive is the next drive letter (e.g. D:) etc.
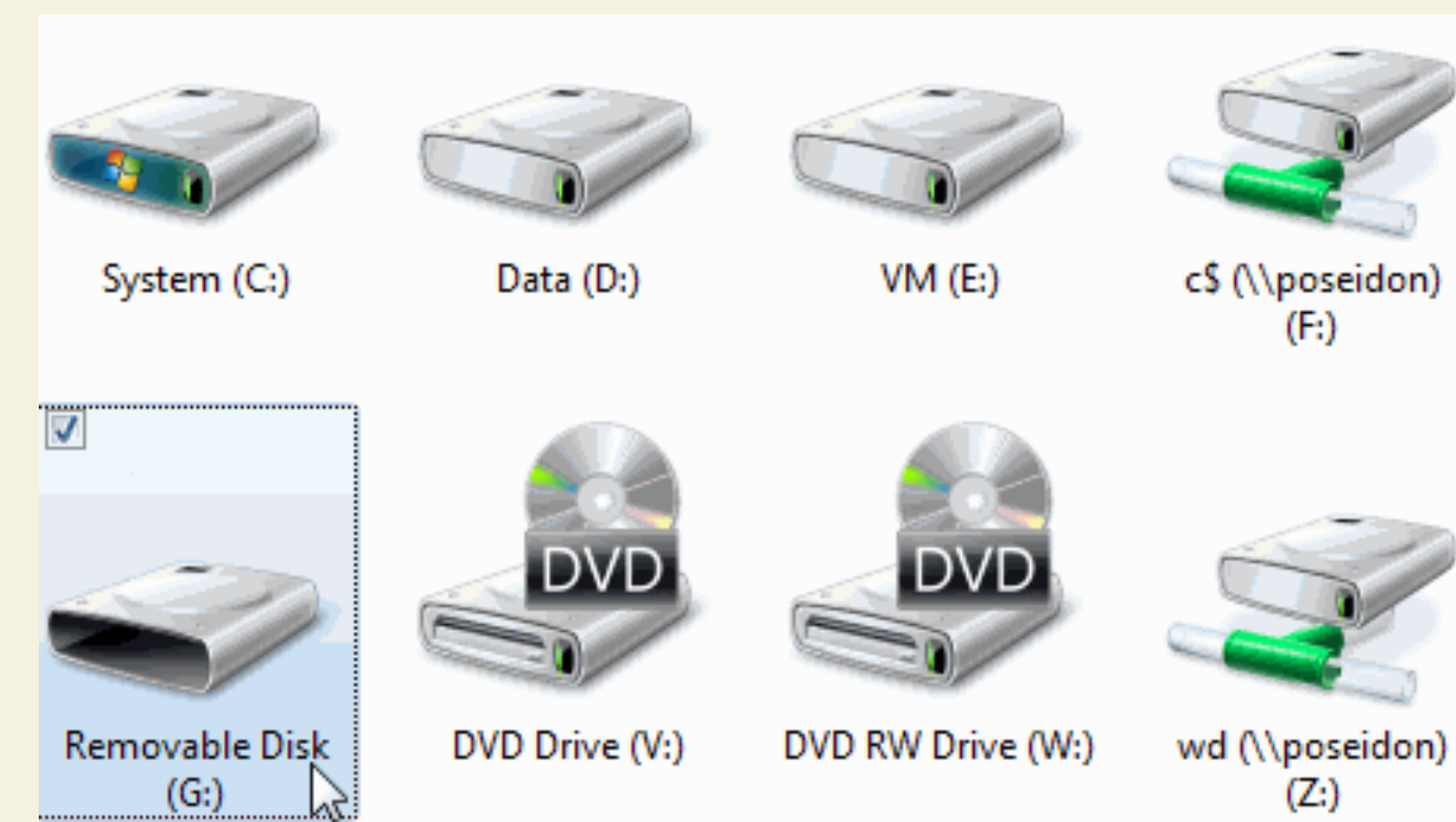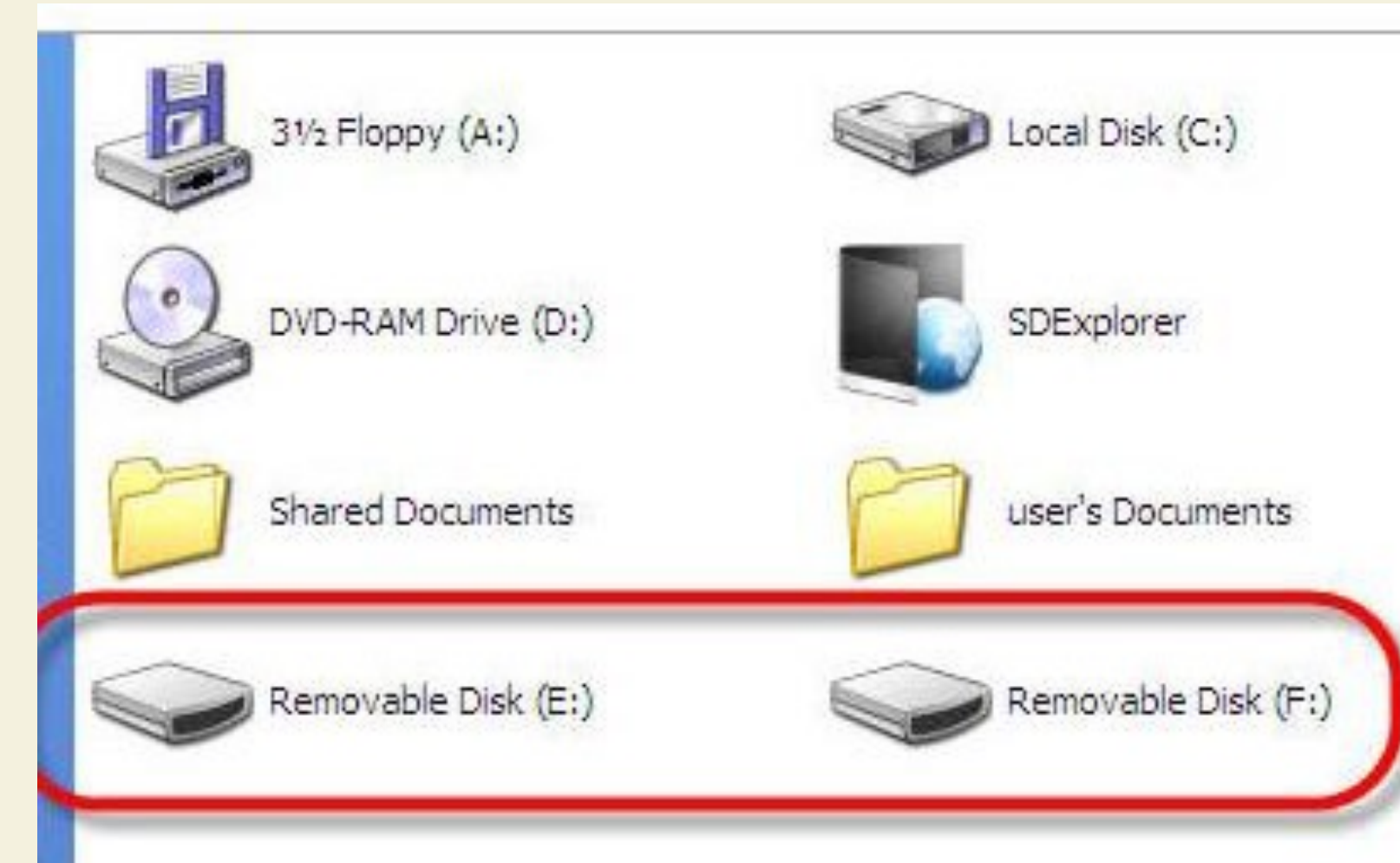
Java Virtual Machine

♥ A Java virtual machine (JVM interprets compiled Java binary code (called bytecode) for a computer's processor (or "hardware platform") so that it can perform a Java program's instructions.

♥ Each platform gets its own JVM so that Java code can run on any platform.

MyProgram.java   Compiler   MyProgram.class   Java VM   0100101...   My Program

THANK YOU
AND SEE YOU
NEXT TIME.