西安交通大学
软件学院

操作系统原理

Operating System Principle

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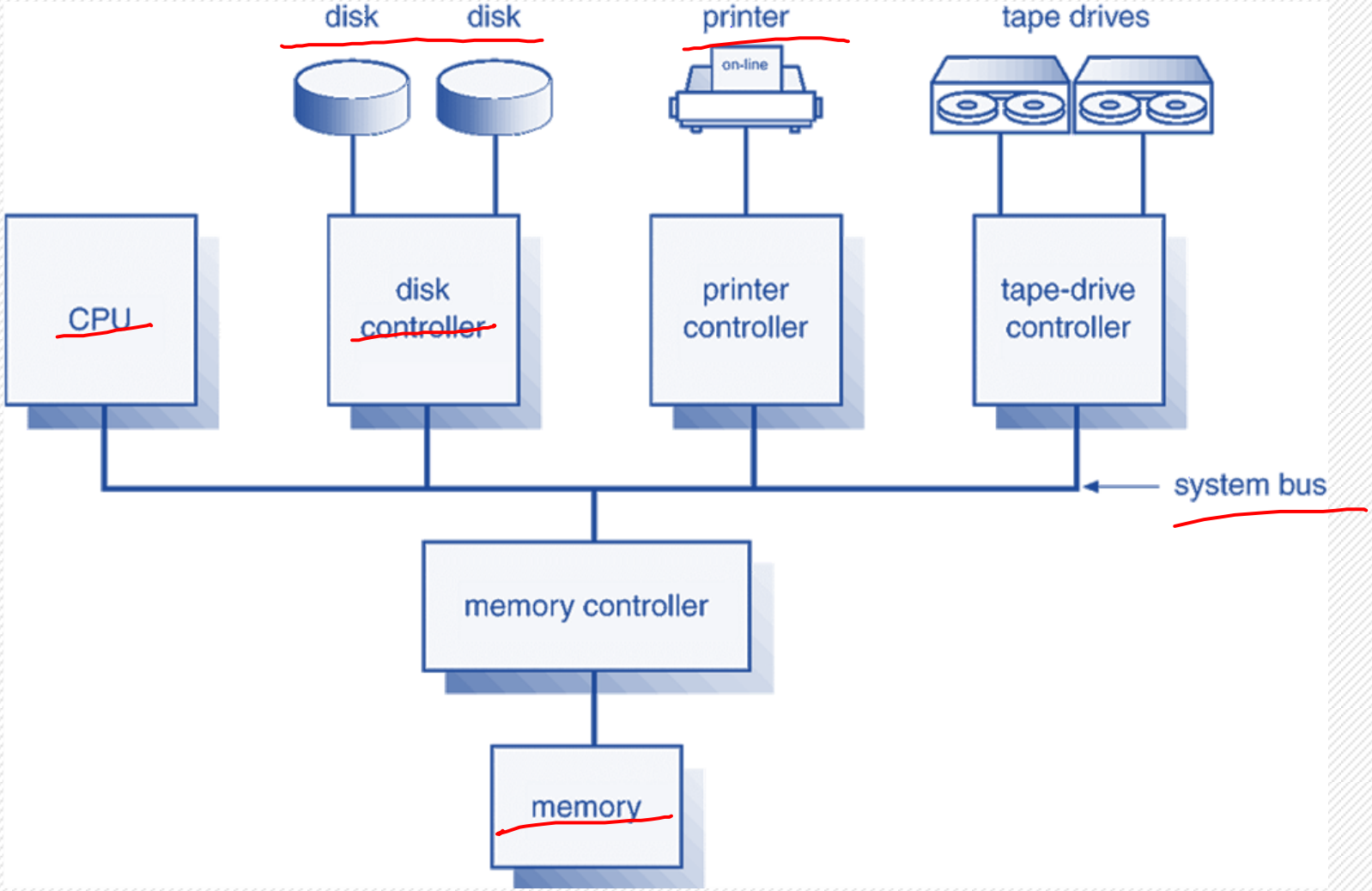
2-1 计算机硬件

Computer-System Architecture
计算机系统体系结构



Computer-System Operation
计算机系统操作

- I/O devices and the CPU can execute concurrently.
  I/O 设备与CPU可并行运行
- Each device controller is in charge of a particular device type.
  每一设备控制器负责一个设备类型
- Each device controller has a local buffer.
  每一设备控制器有一局部缓存
- CPU moves data from/to main memory to/from local buffers
  CPU 通过局部缓存与主存交换数据
- I/O is from the device to local buffer of controller.
  I/O从设备到设备控制器的局部缓存
- Device controller informs CPU that it has finished its operation by causing an interrupt.
  设备控制器通过引起中断通知CPU操作已完成

Computer-System Operation
计算机系统操作

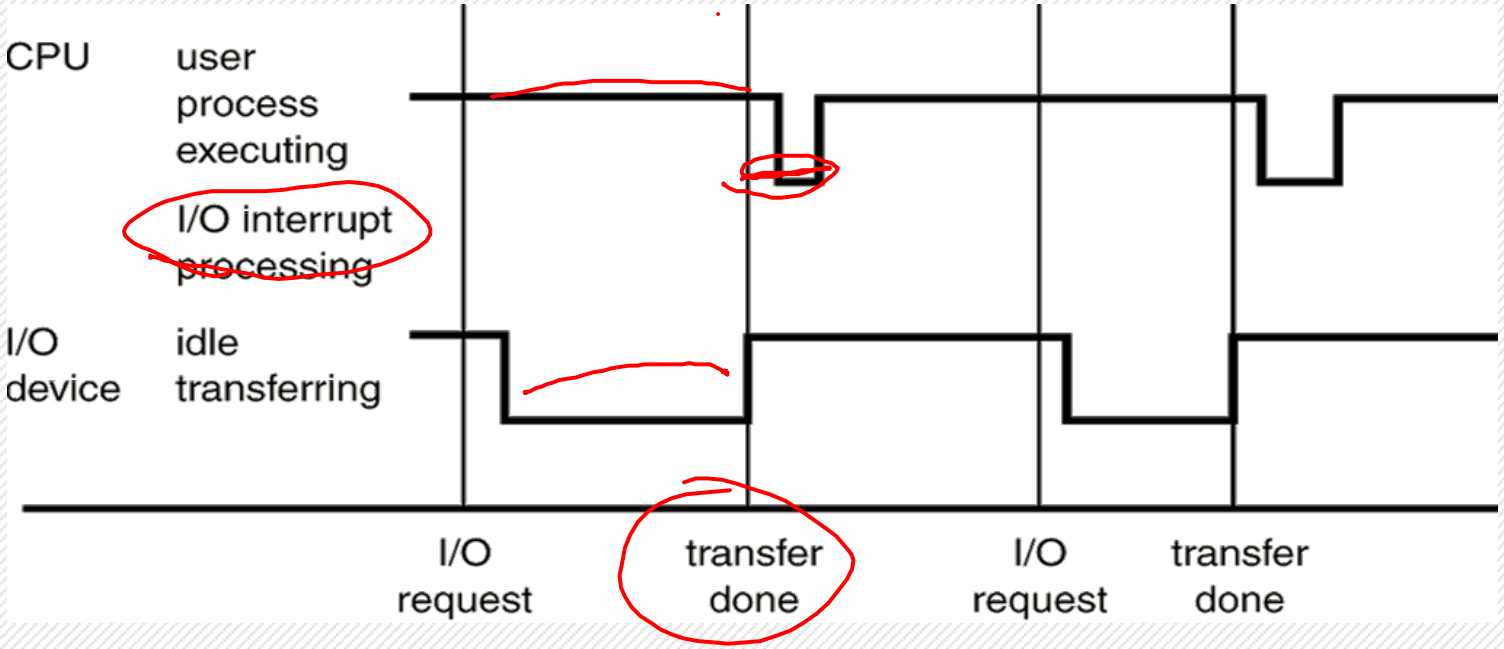
中断机制

中断定义

- hardware interrupt 硬件中断
  - ✓ device controller informs CPU that it has finished its operation by causing an *interrupt*
    - disk, timer, etc.
- software interrupt (trap) 软件中断（陷阱）
  - ✓ a trap (or an *exception异常*)
    - division by zero, invalid memory access
  - ✓ a *system call 系统调用*(also called a monitor call)
    - read( ), write( )

Computer-System Operation
计算机系统操作

Why the interrupt?



make the system more efficient and meanwhile more responsive

Computer-System Operation
计算机系统操作

a modern operating system is *interrupt driven*

现代操作系统是中断驱动的

interrupt transfers control to the interrupt service routine (*interrupt handler*) generally

中断将控制权转移到中断服务程序

01 separate segments of code determine what action should be taken for each type of interrupt

02 a generic routine to examine the interrupt information, and in turn call the specific handler

03 through the *interrupt vector*, which contains the addresses of all the service routines

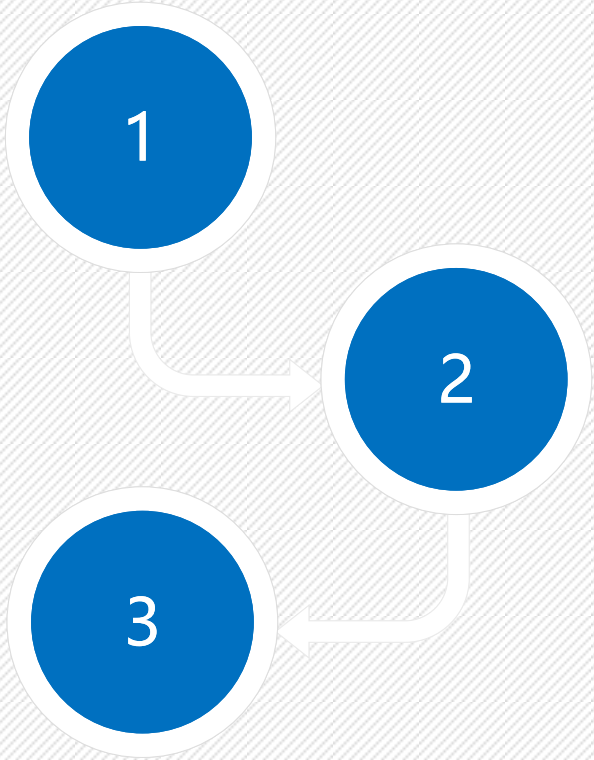
Computer-System Operation
计算机系统操作

中断向量	中断号	中断用途
00 ~ 03	0	除法溢出中断
04 ~ 07	1	单步(用于DEBUG)
08 ~ 0B	2	非屏蔽中断(NMI)
0C ~ 0F	3	断点中断(用于DEBUG)
10 ~ 13	4	溢出中断
14 ~ 17	5	打印屏幕
18 ~ 1F	6,7	保留

Computer-System Operation
计算机系统操作

I/O Structure

peripheral device(s) attached to device controller
设备与设备控制器相连



a device controller (hardware)

- local buffer storage
  本地缓冲器
- a set of registers
  一组寄存器

device driver, usually a software program embedded into an OS
设备驱动程序

Computer-System Operation
计算机系统操作

I/O Interrupts

Synchronous
同步

two ways of an I/O operation
两种I/O操作

Asynchronous
异步

01 *synchronous I/O mode*: after I/O starts, control returns to user program only upon I/O completion

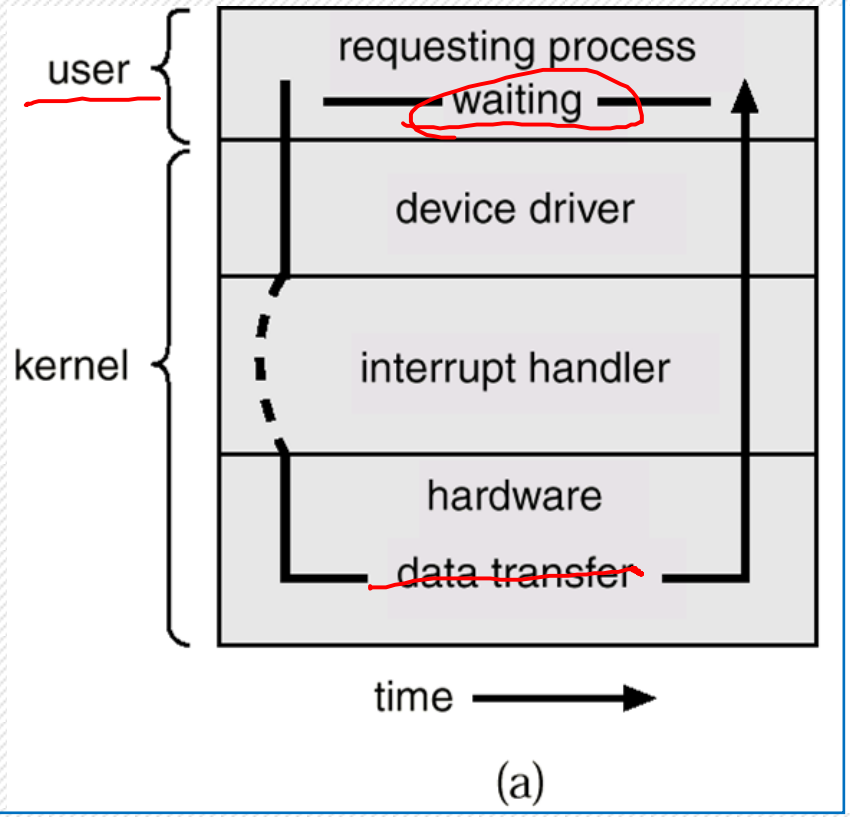
02 *asynchronous I/O mode*: after I/O starts, control returns to user program without waiting for I/O completion

the user program will be notified about the I/O completion on a later time

- Windows *message*, or *call back function*

Computer-System Operation
计算机系统操作

synchrounous



asynchrounous