

# CISC 7310X

# C02a: Interrupts

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# Acknowledgement

- This slides are a revision of the slides by the authors of the textbook

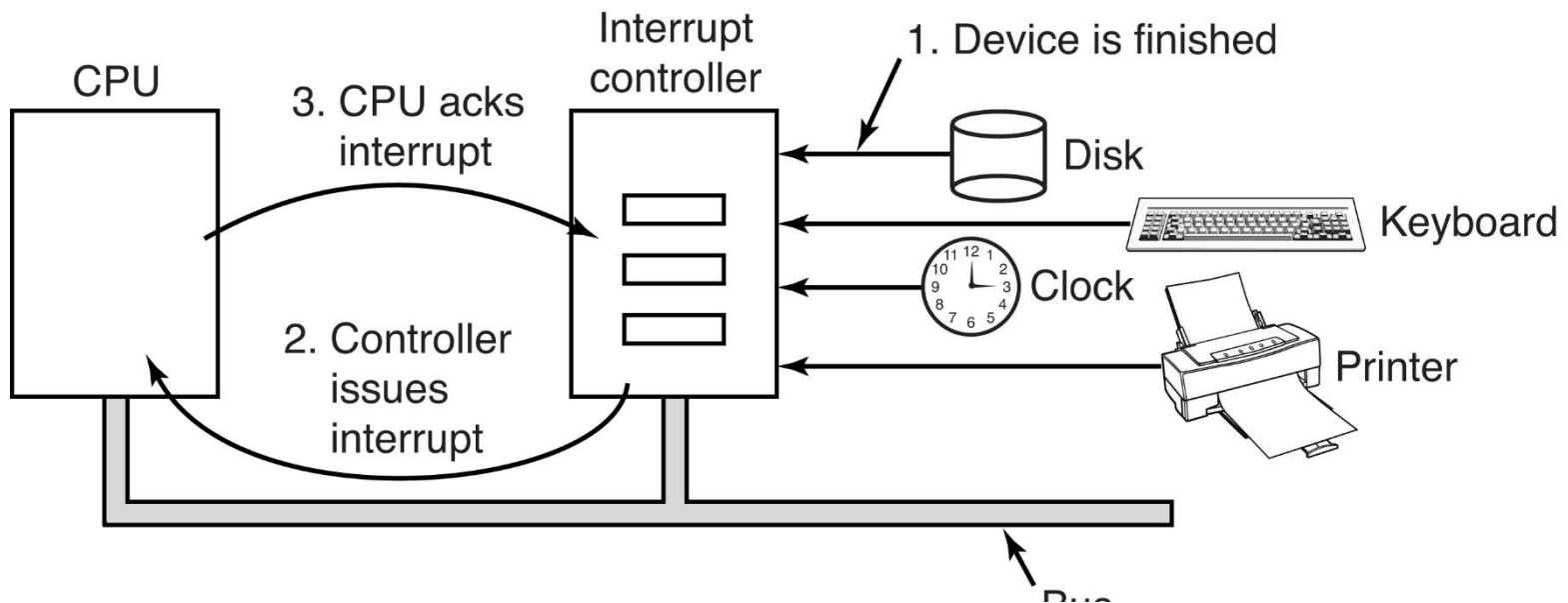
# Outline

- Concept of interrupts
- Interrupt service routing, interrupt vector, and interrupt vector table
- Interrupt handling
- Interrupt design consideration

# OS and Interrupts

- An operating system is interrupt driven
  - Timers
  - I/O
  - ...

# How an Interrupt Happens?



- [Figure 5-5 in Tanenbaum & Bos, 2014]

# Interrupts

- Interrupt transfers control to the interrupt service routine generally, through the interrupt vector, which contains the addresses of all the service routines
- Interrupt architecture must save the address of the interrupted instruction
- A trap or exception is a software-generated interrupt caused either by an error or a user request

# Interrupt Vectors

- Address to interrupt routines
  - Some PC event/interrupt-vector numbering

Vector Number	Description
0	Divide Error
1	Debug Exception
...	
6	Invalid Opcode
...	
32-255	Maskable Interrupts (device generated)

# Handling Interrupt

- CPU senses its interrupt-request line after each instruction
- When it is "lit", CPU saves the current state
  - Example: push registers PSW and PC to the stack
- CPU jumps to the interrupt-handler routine at a fixed address in the memory
- Interrupt-handler routine completes its task and restore the CPU state
  - Pop the registers from the stack

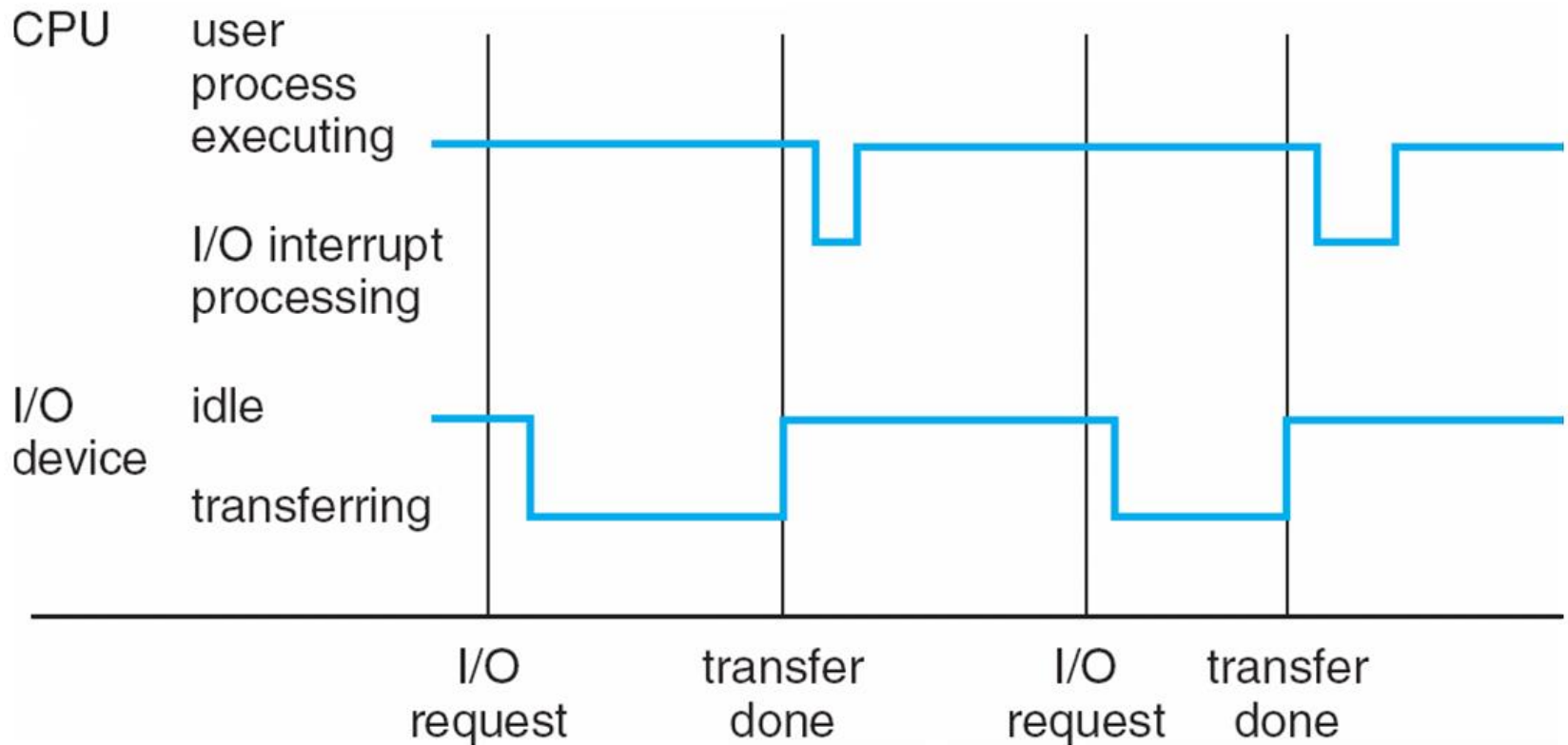


# Design Consideration:

## Interrupts

- Maskable and nonmaskable interrupts
- Interrupt priorities and interrupt chaining
- Exceptions and software interrupts (traps)
- Precise and imprecise interrupts

# Interrupt Timeline



# Exceptions and Interrupts

- Interrupt mechanism also used for exceptions
  - Terminate process, crash system due to hardware error
- Page fault executes when memory access error
  - System call executes via trap to trigger kernel to execute request
- Multi-CPU systems can process interrupts concurrently
  - If operating system designed to handle it
- Used for time-sensitive processing, frequent, must be fast

# Questions?

- Reviewed the concept of interrupts