

CSE 4305

Computer Organization and Architecture

Lecture 7

Input/Output

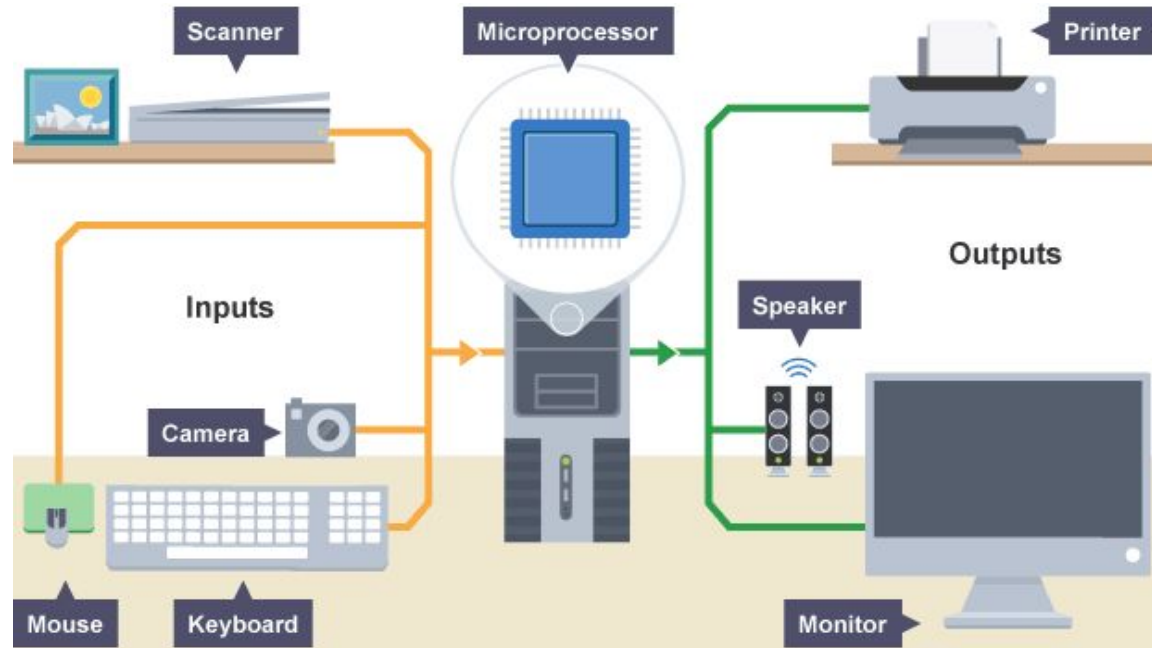
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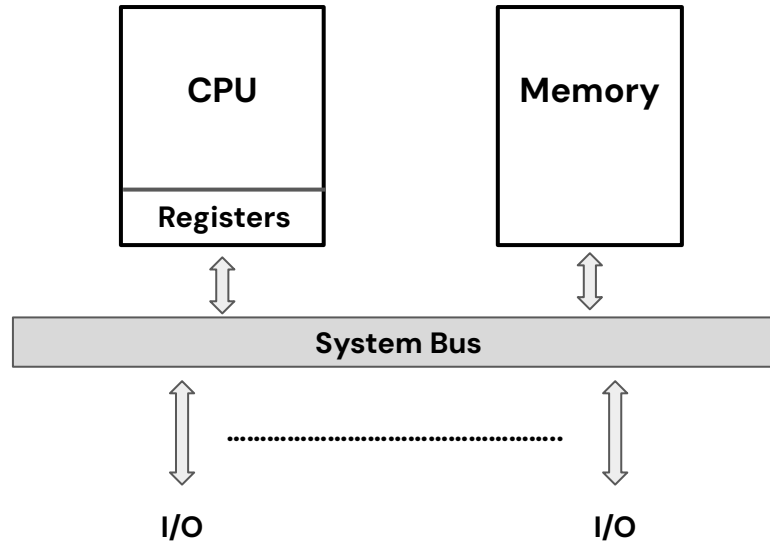
Input-Output Devices



Input-Output Organization

Can we directly connect I/O devices to system bus?

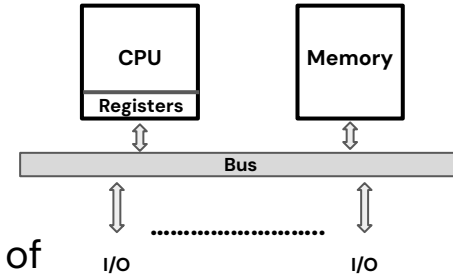
NO!



Input-Output Organization

We cannot directly connect I/O devices to system bus, because

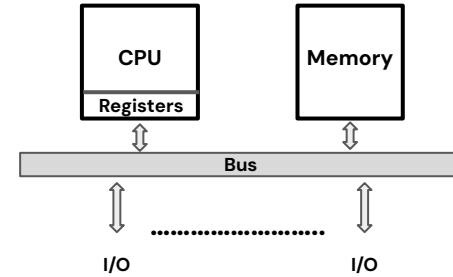
- There are a wide variety of peripherals each with varying methods of operation.
 - **Impractical to for the processor to accommodate all**
- Data transfer rates are often slower than the processor and/or memory
 - **Impractical to use the high-speed system bus to communicate directly**
- Data transfer rates may be faster than that of the processor and/or memory
 - **This mismatch may lead to inefficiencies if improperly managed**
- Peripheral often use **different data formats and word lengths**



We need I/O modules

I/O Transfer modes

- Programmed I/O
- Interrupt-Driven I/O
- Direct Memory Access (DMA)

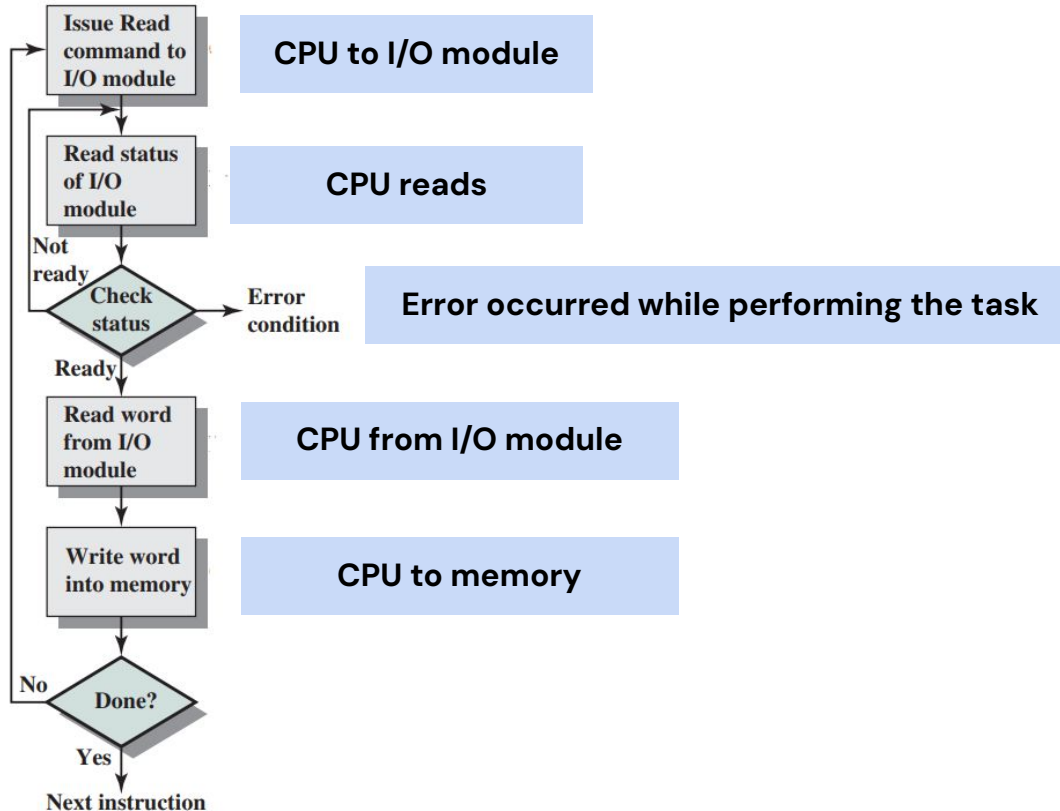


Programmed I/O

When a program is in execution, if an I/O related instruction is encountered

- The processor issues a command to the appropriate I/O module
- The I/O module will perform the requested action and then set the appropriate bits in the I/O status register.
- Processor is **not interrupted** after task is done, so
 - processor periodically checks the status of the I/O module.

Programmed I/O



Disadvantages:

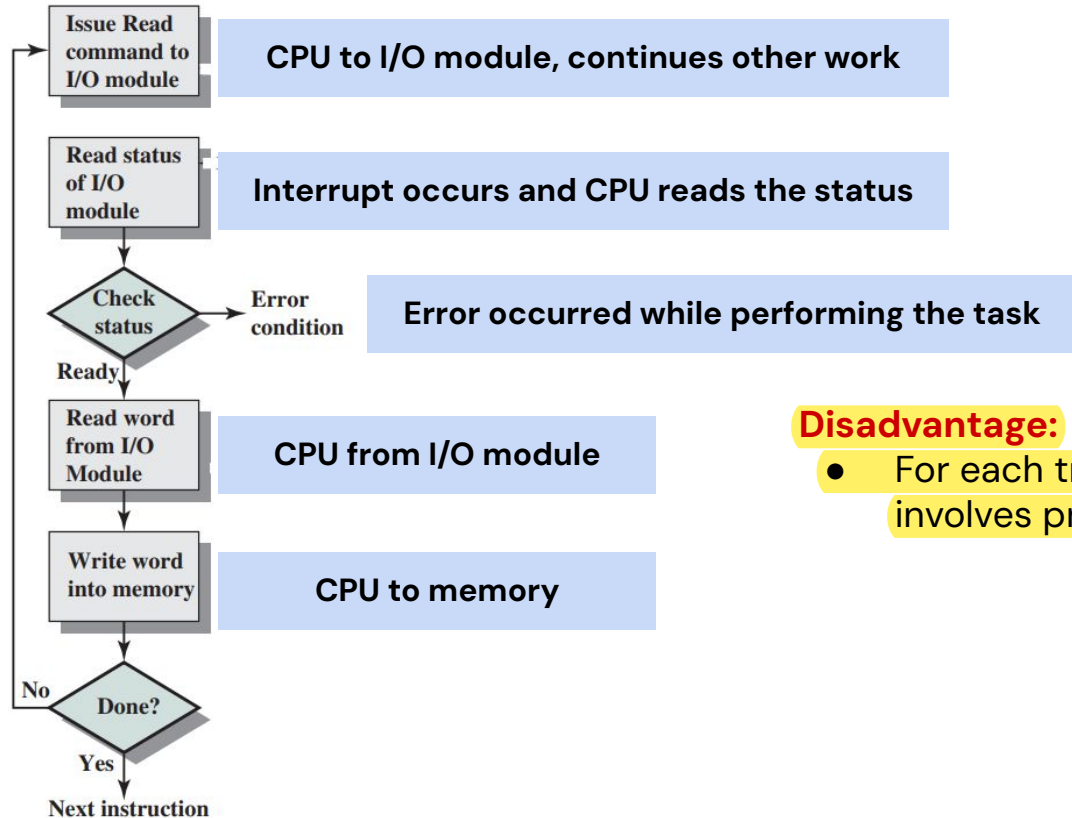
- The processor has to wait a long time for the I/O module.
- The processor, while waiting, must repeatedly interrogate the status of the I/O module.
- The performance of the entire system is severely degraded.

Interrupt-driven I/O

When a program is in execution, if an I/O related instruction is encountered

- After issuing a command to the I/O module, the processor returns to perform other useful works instead of waiting.
- Processor is **interrupted** when task is done.

Interrupt-driven I/O



Disadvantage:

- For each transfer of data it involves processor.

Direct Memory Access

- An additional module on the system bus – DMA module.
- **DMA function:** the processor issues some commands to DMA module with the following information
 - Whether to READ or WRITE (using read/write control lines)
 - Address of I/O device involved (using data lines)
 - Starting location of the memory to read or write
 - The number of words to read/ write
- DMA module transfers **entire block of data**.
- Processor is only involved at the **beginning or ending** of the transfer as **DMA module interrupts the processor after finishing transfer only.**

Reference:

1. Computer Organization and Architecture, by William Stallings, 10th edition.

Thank You!