
Master of Computer Applications

CAPOL403R01: Computer Organization & Architecture

Unit V: Lecture 1
IO Modules

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Need for IO modules

- There are a wide variety of peripherals with various methods of operation.
 - Wide variety of logics are needed
- The data transfer rate of peripherals is often much slower than that of the memory or processor
 - High speed system bus cannot be used to connect the peripherals
- The data transfer rate of some peripherals is faster than that of the memory or processor
 - Mismatch of speed occurs
- Peripherals often use different data formats and word lengths than the computer

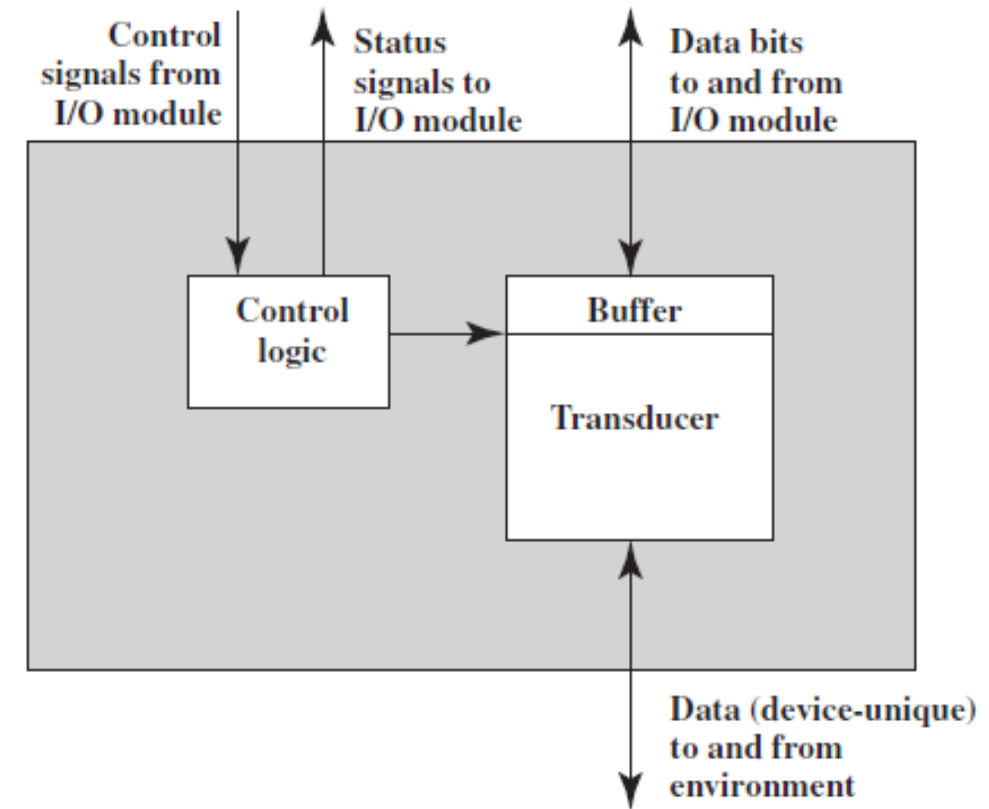
External devices

- Categories

- Human readable: Suitable for communicating with the computer user
 - Example: Keyboard, monitor
- Machine readable: Suitable for communicating with equipment
 - Example: Disk drives
- Communication: Suitable for communicating with remote devices

External devices...

- Interface signals with the IO module
 - Control
 - Function that the device will perform
 - Status
 - It indicates the state of the device
 - Data
 - Group of bits sent to / received from IO modules
- Control Logic
 - It is associated with the device to control the device's operation under the direction of IO module
- Transducer
 - Conversion of electrical signal to physical signal or vice versa



IO modules

- Types

- IO Processor:

- It takes most of the processor work and presents a high level interface to the processor

- IO Controller (Device Controller)

- It is quite primitive
 - It requires detailed control

- Functions

- Control and timing
 - Processor communication
 - Device communication
 - Data buffering
 - Error detection

Control and timing

- It is used to co-ordinate the flow of traffic between internal resources and external devices
- For example, consider data read from an external device:
 - Processor needs the status information of the device and asks IO module
 - IO module returns the status of the device
 - If the device is available and ready to send data, processor commands IO to get the data
 - IO module obtains data in units (8 or 16 bits) from external device
 - The data are transferred to the processor from IO module
 - If the device is busy, not functioning etc., the processor may wait for some time and asks the IO module to check the status again
 - Usually, after some iterations this will be informed to the user by invoking an ISR

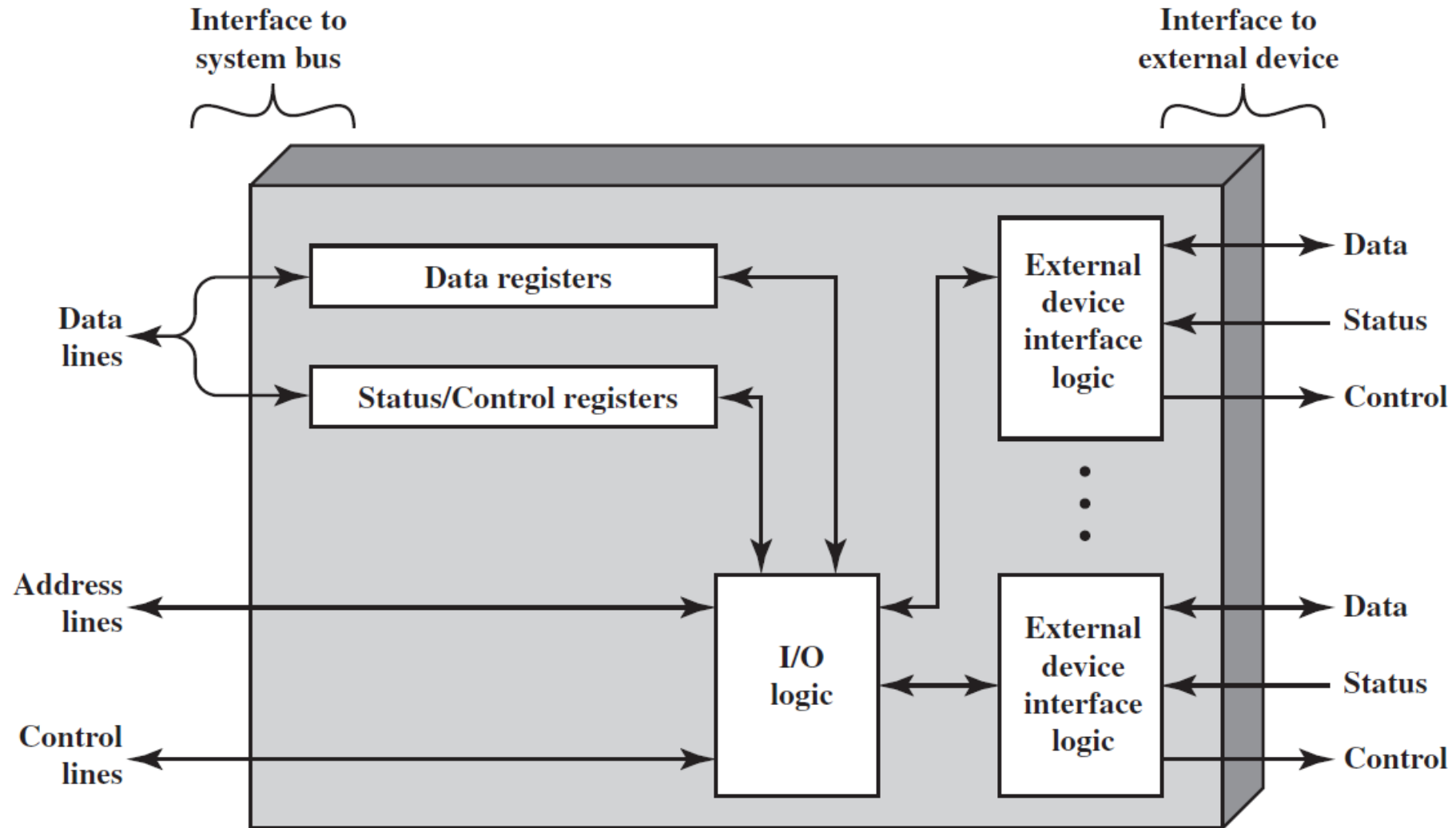
Processor Communication

- Command decoding
 - The IO module accepts commands from the processor
 - These are usually sent through control bus
- Data
 - Data are exchanged between the processor and the I/O module over the data bus
- Status reporting
 - The device usually is slow – speed mismatch will occur
 - The status of the device should be informed to the processor
 - Error conditions are also considered as status
- Address recognition
 - IO module should recognize the peripheral from the attached peripherals

Other functions

- Device communication
 - IO module sends the commands in the peripheral's format
 - IO module gets (sends) the data in peripheral's format
- Data buffering
 - The data rate into and out of processor or memory is very high
 - The data rate into and out of peripherals are low
 - The data rate of different peripherals may be different (usually the collection covers a wide range of data rate)
 - Data from main memory come to IO in a rapid burst
 - They are buffered in IO and transmitted to the peripheral's in their own rate
- Error detection
 - IO module is responsible for error detection and reporting them to the processor
 - For example, paper jam in a printer has will be reported to the processor by IO module

Structure of IO module



Thank you