

Lecture 32  
July 25

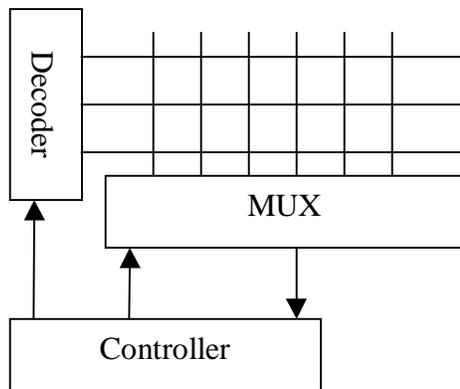
### I/O addressing

- Memory mapped I/O
- Isolated I/O configuration
  - o Distinct control lines for memory and I/O
  - o Allows separate address space
- I/O processor (data channel)
  - o A separate I/O processor ( or I/O processor)
  - o Handles communication with I/O devices
  - o Free the CPU to do other work

### Some Peripherals

#### The keyboard

- An input devices with a very slow data rate
- Must be able to detect the key press the user makes
  - o Including multiple key press (e.g. ctrl -a)
- It is built on a “scan matrix”
  - o Each key is on two lines from a grid of wires
  - o When pressed a connection is made



- To check if a key is pressed, the controller:
  - o Sends a signal to the decoder that activates the corresponding output
  - o Set the multiplexer to output the value from the corresponding input
  - o If MUX is 1, the key is down
- Each key is scanned hundreds of times per second
  - o When it is pressed, the controller sends a key down signal
  - o When it is released it sends a key up signal

## Video

- The video controller in a modern PC has a lot of processing power
- The CPU doesn't have to actual pixel data to the display
  - o It can send high-level commands to the video interfaces
- The graphics card turns these commands into actual pixels that can be sent to the monitor
  - o This requires a dedicated processor (GPU) and memory ( for the pixel data, textures, etc)

## Hard disk

- The primary non-volatile storage for most computers
- Data is stored on magnetic platters
  - o Parts of the pallet can be magnetized (or not) to store a 0 or 1.
- Each surface of the disk must have a read/write head \*(top and bottom )
- To read/write from the particular part, the head must be over it
  - o Must get the head to the correct "track"
  - o Must wait for the disk to spin to the right sector