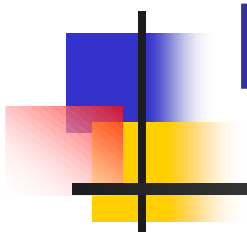
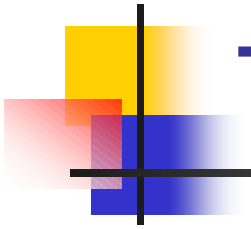


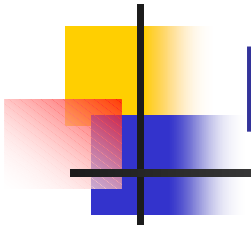
Memory Mapped IO

(and the CerfBoard)



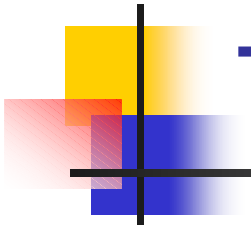
The problem

- How many IO pins are available on the 8051?
- What if you are using interrupts, serial, etc…?
- We want a consistent interface to I/O devices



External Data Memory

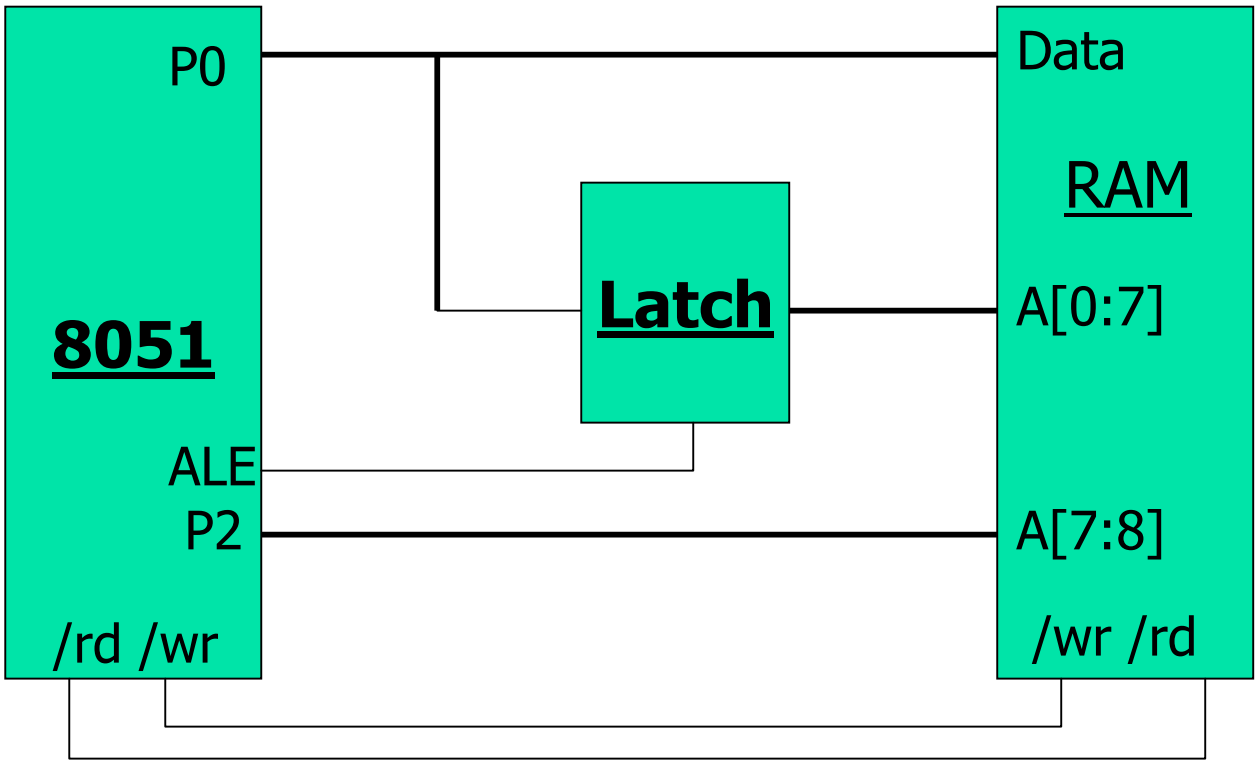
- 4k byte RAM chip
- Interface:
  - Bi-directional data bus
  - Address bus. How big?
  - /wr and /rd
  - /ce = Chip Enable



The 8051 interface

- P0 does double duty
  - When ALE is high, P0 is the lower 8 bits of the address
  - When it's low, P0 is the data bus
  - We need a latch
- P3.6 = /wr
- P3.7 = /rd

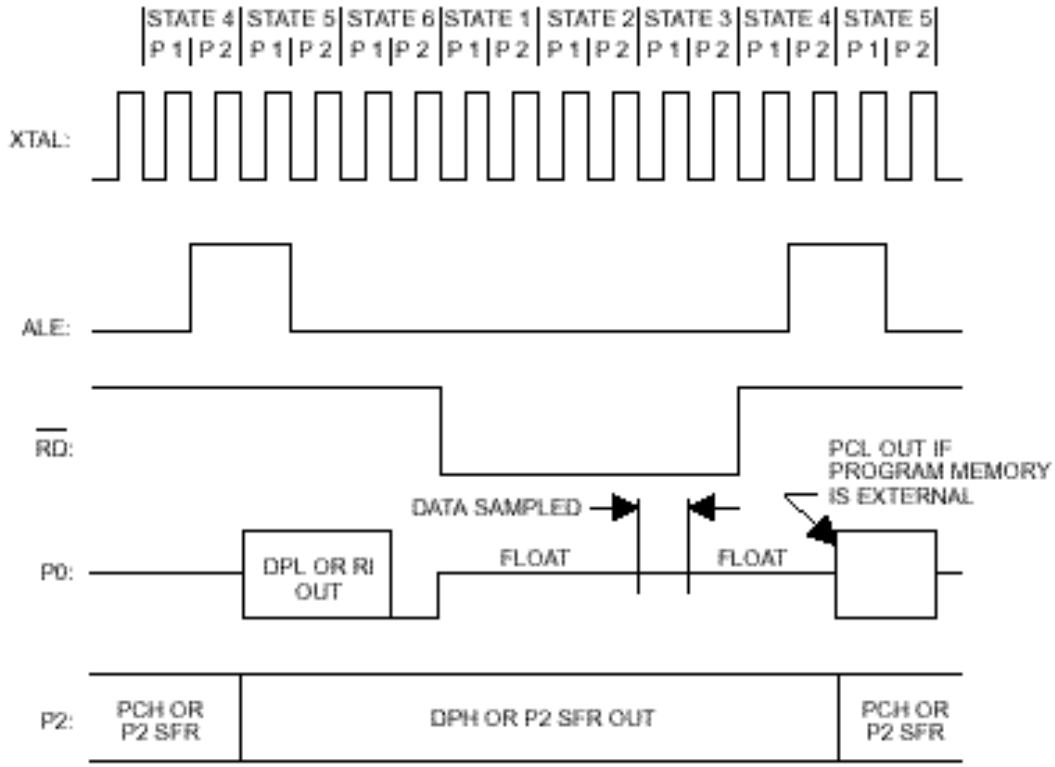
Block Diagram



External Data Memory Read

ALE's falling edge
Latches the address

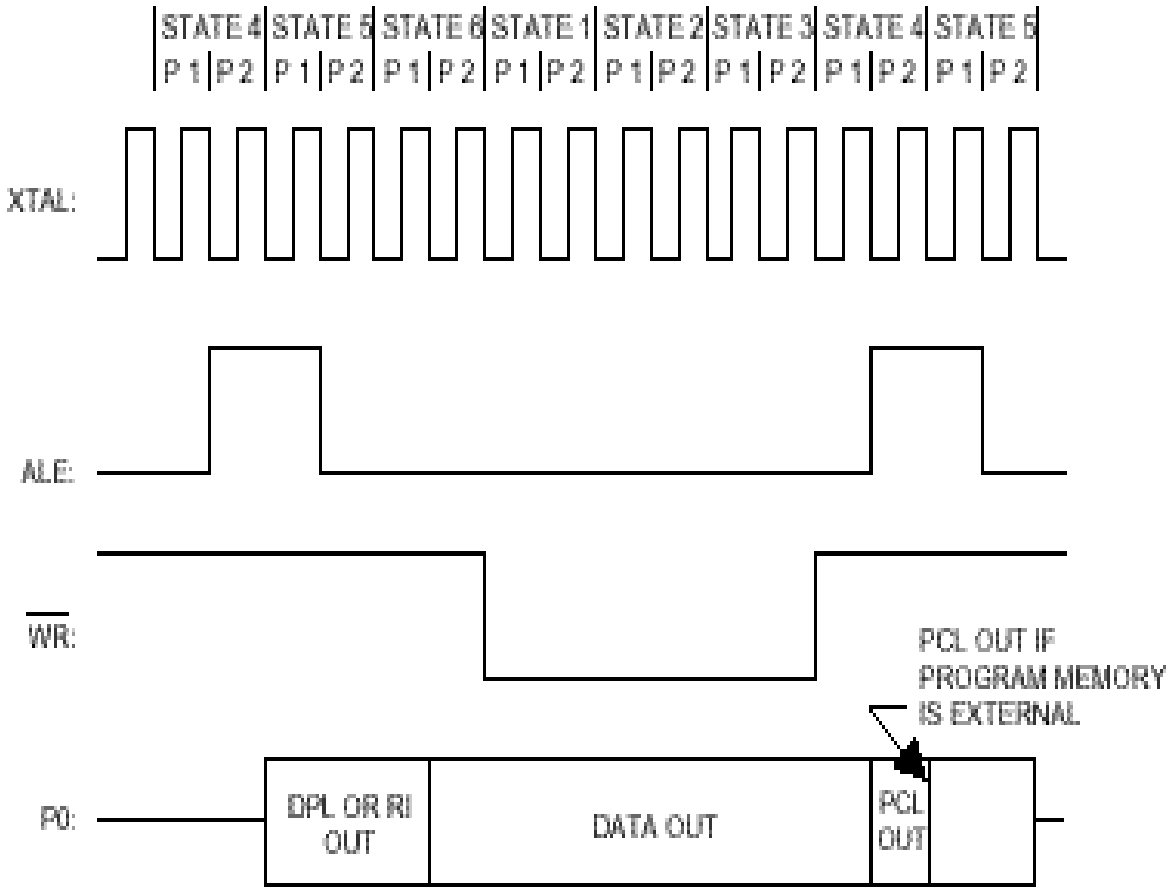
When /rd is low the
Data bus must be
stable

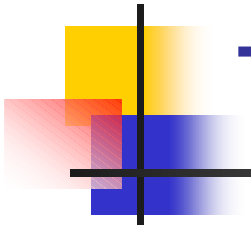


External Data Memory Write

ALE's falling edge
Latches the address

Data output is stable
While /wr is low





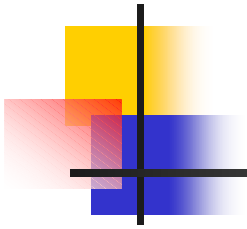
The Software Side

- Use the MOVX instruction to access external data memory

```
MOV R0, #external_address
MOVX A,@R0  # uses only 8-bit address for external RAM
```

Or

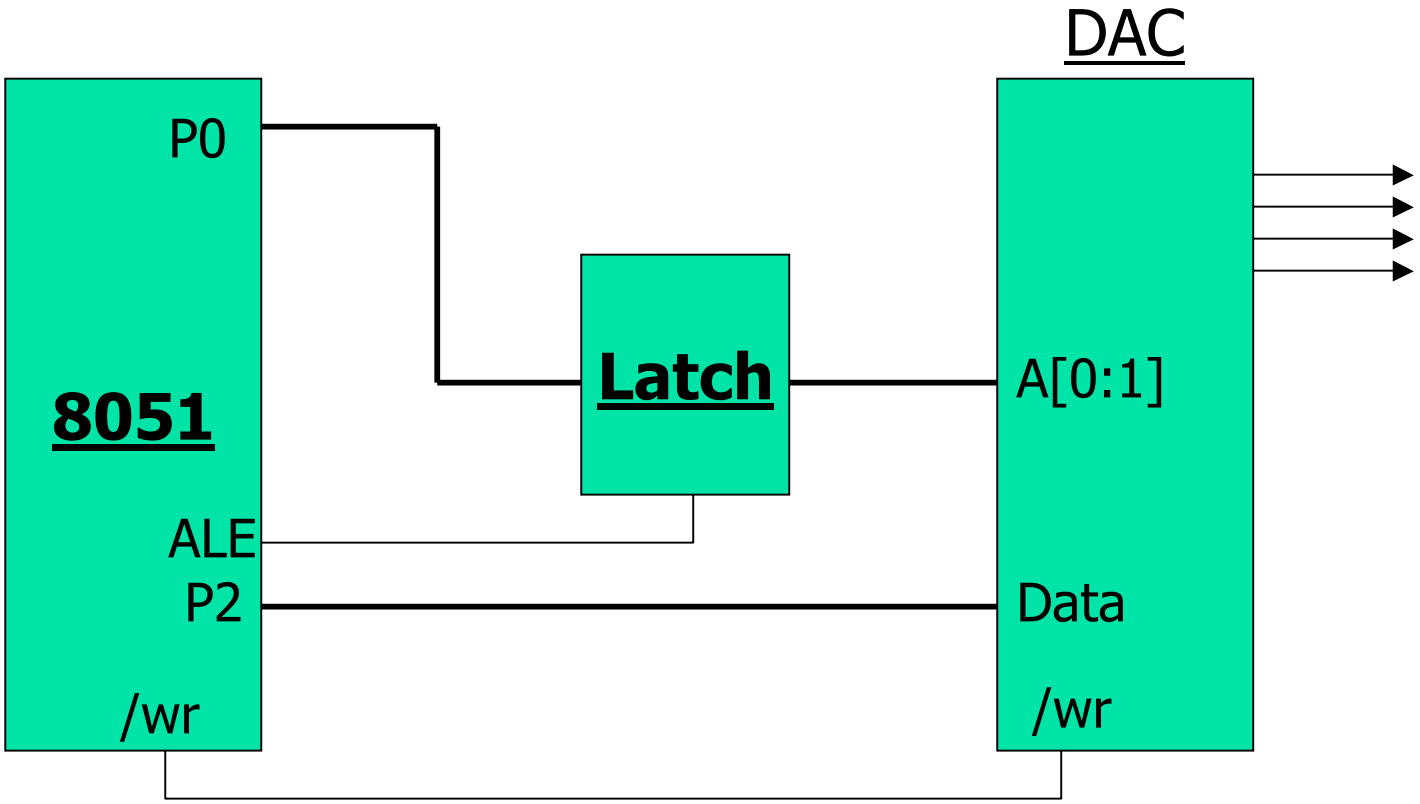
```
MOV  DPL, #external_address_high
MOV  DPH, #external_address_low
MOVX A, @DPTR;
```

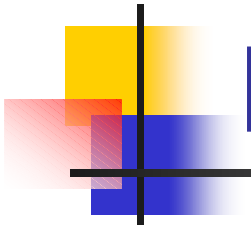


Hooking up I/O Devices

- Why not put I/O stuff in the address space?
- Let's hook up a DAC (Digital to Analog Converter)
  - 4 analog outputs (address bits?)
  - 8 data bits
  - We can only write to it

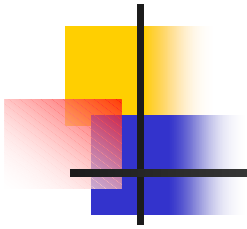
Block Diagram





Memory Mapped I/O

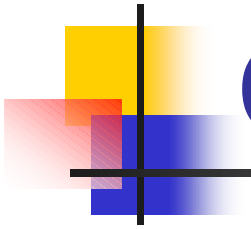
- How do we use it?
  - MOV A, 45 ;what we want to send
  - MOV R0, 1 ; select output #2
  - MOVX @R0, A ; write it
- What if we did:
  - MOV R0, 4
  - What output will we write to?



More devices

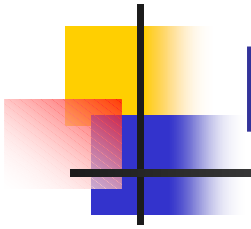
- More DACs
- RAM
- ADC (Analog to Digital)
- LCD
- Keyboards
- More IO pins
- Disk drives

The CerfBoard



Overview

- StrongARM 1100 processor
  - 200mhz
- Ethernet, USB
- 32MB RAM, 16meg Flash ROM
- Compact Flash slot
- 3 RS232 Serial Ports (one for console)
- 16 GPIO pins



Memory Mapped I/O

- *Lots* of devices are memory mapped on the CerfBoard
  - GPIO registers
  - Power Management Registers
  - Serial Registers
  - Interrupt Control Registers
  - Compact Flash