

CS2318

I/O

11/29/16

I/O Mapped I/O

Memory Mapped I/O

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Interface with a User

|| with a machine

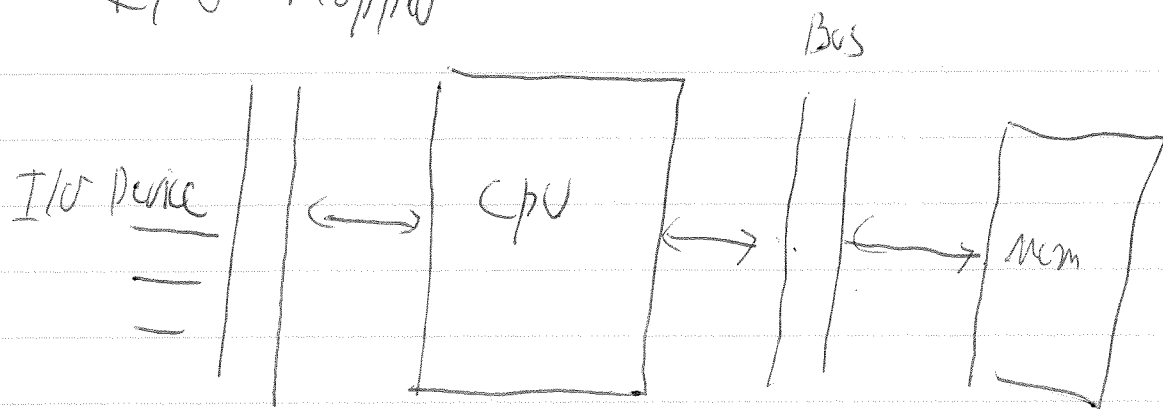
I/O mapped I/O

Special Hardware / Dedicated instruction

for I/O in the I/O space

# I/O Mapped

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I/O space

I/O Device

is associated with

a port

In / out

Address

DATA

physical  
Main

primary

memory

Memory

Space

hw / sw

~~In (100)~~

In \$R 100

read

write data to

port 100

out \$R 200

writing to a

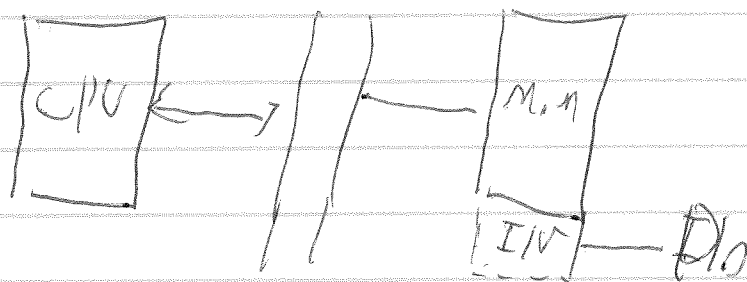
port

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## Memory Mapped I/O

Dedicate part of Memory space  
to I/O Devices

Are Expect at least 2 Registers  
per Device. These registers are  
handled as memory cells



Use LW/SW

Expect a Control / Status CS Reg

|| a data register

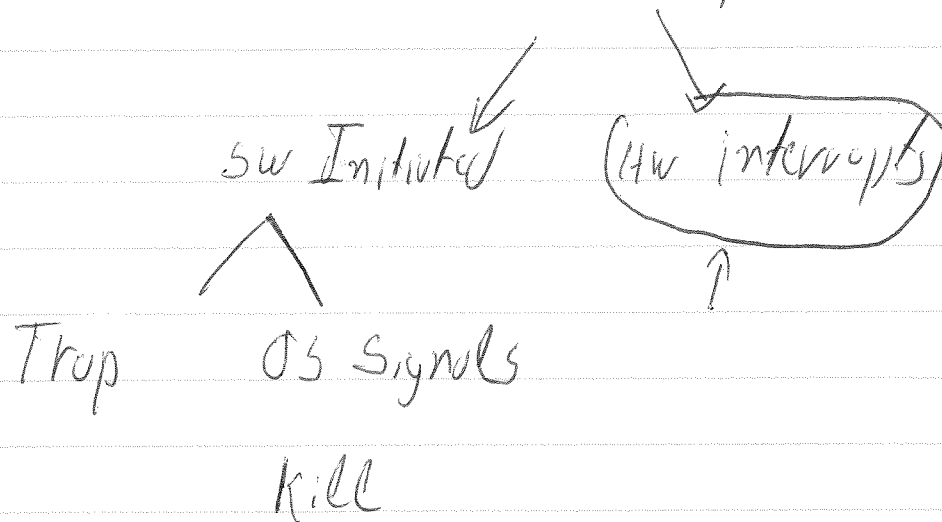
⇒ Refer to a device via

4 Reference to I/O device

Via Memory addresses of its  
Registers

Time driven  $\Rightarrow$  (polling)

Event driven  $\Rightarrow$  Interrupts



0x00000000

Base address

0x00000004

Keyboard

Data

0x00000008

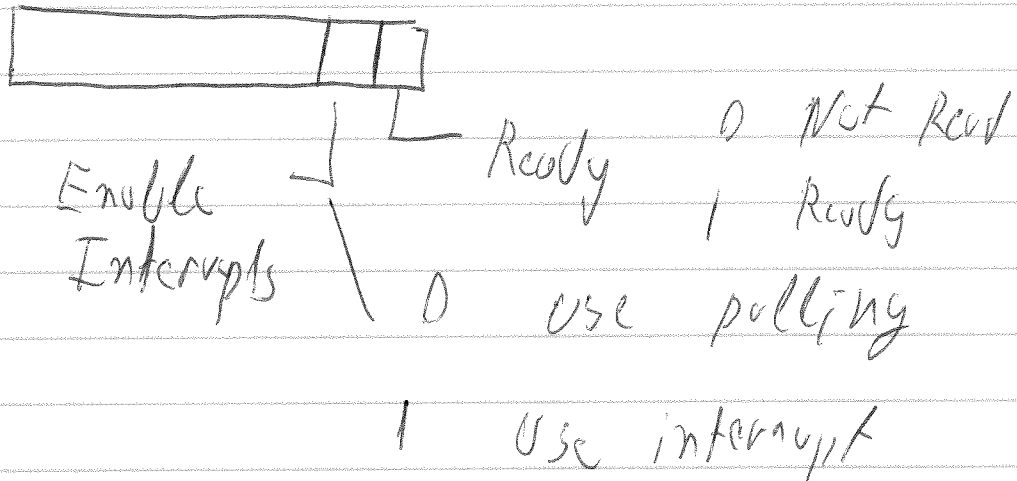
Display SC

0x0000000C

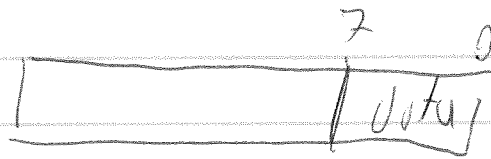
Display data

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SC Register



Data



KBD communication via polling

① ~~\$03~~, 0XFFFF0000 BusC  
KBP SC

CHK Rdy: `lw $t1, 0($03)` ← get SC

`ANDI $t1, $t1, 1` - check if 1

`BNEQZ $t1, chRdy` Loop back

`lw $t0, 4($03)` get Data

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(Assume \$03, contains base address)

XReady: LW \$t1, 8(\$03)

ANDI \$t1, \$t1, 1

BEQZ \$t1, XReady

\$t0  
contains  
the char

← SW (\$t0, ~~\$t1~~ 12(\$03))

to override the 1 <sup>in S/C</sup> (may not be  
needed) write "something" to S/C

LW \$v0, 8(\$03)

li \$t0, 0xFFFFFFFF Mosh

AND \$v0, \$v0, \$t0

SW \$v0, 8(\$03)

Pulling - Not practical bc

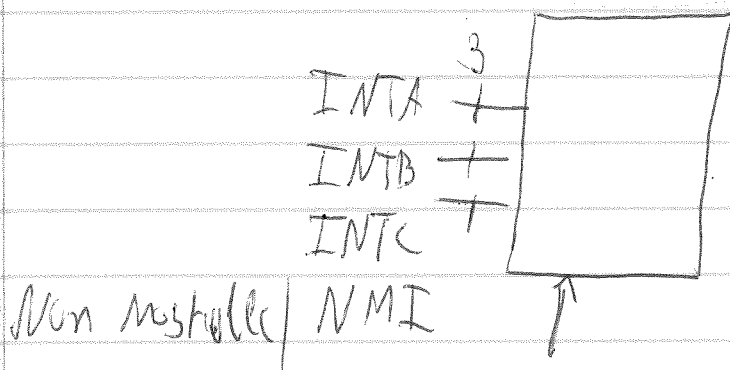
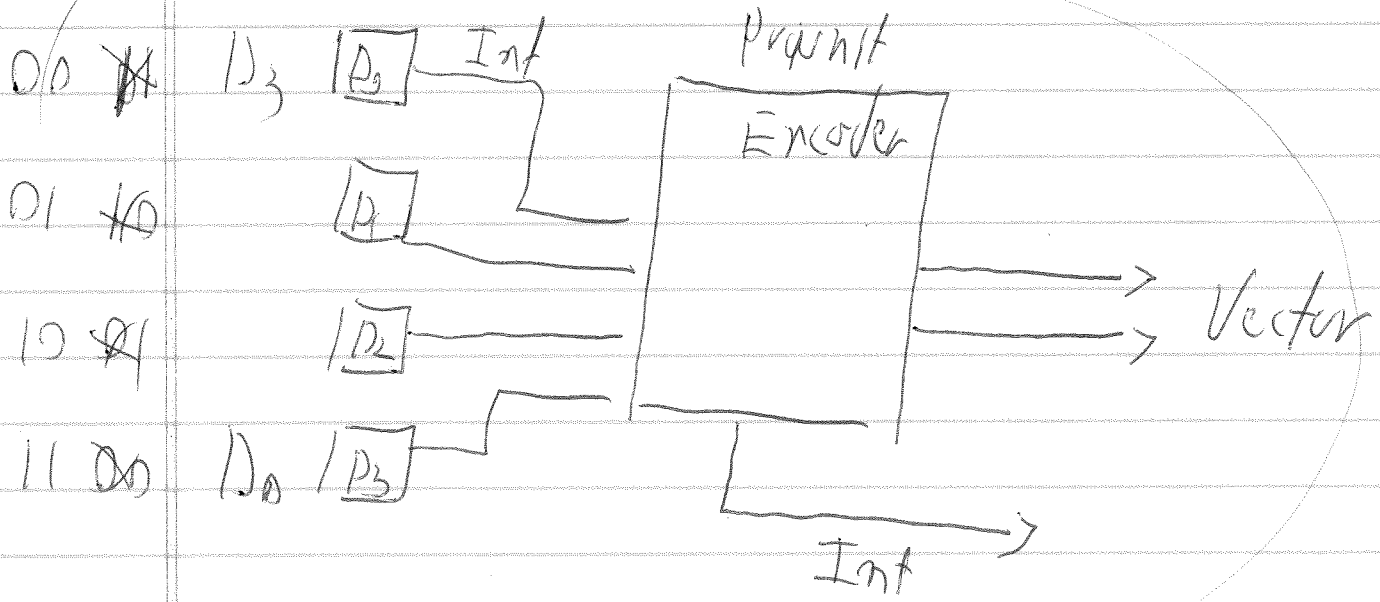
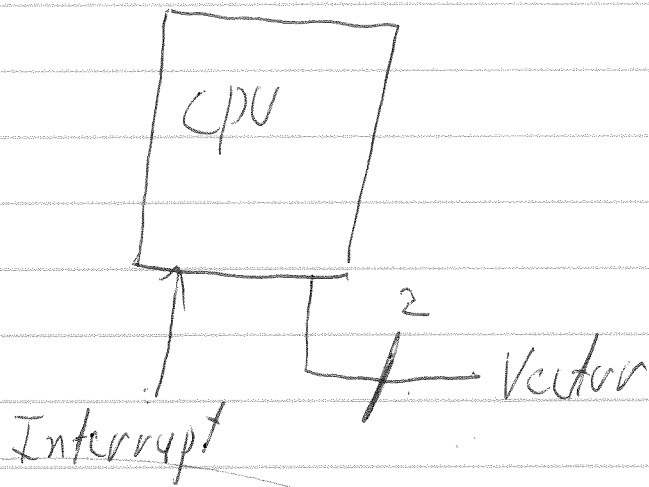
CPU has to be allocated solely for

I/O (I/O Coprocessor

DMAC (Direct Memory Access Controller))

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# Interrupts



8 Assume CPU gets an Int  
Vector is  $k$  (device  $k$ )

TRAP - with  $k$

Interrupt is causing a change  
of flow call a function that  
is associated with vector

kbd 00

screen 01

?

.

.

Device Vector

00	kbd service
01	screen service

kbd service - address of Int

Service routine for kbd



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FI BD Service Routine

DI

- disable interrupts

push some regs

[ ew / sw to device

pop

EI

enable

Ret