

CS2318

09/15/16

~~usual~~ "Usual" flow

Fetch

Fetch Load inst
Inc pc

Execute

~~in sequence~~ Sequential mode

Fetch: ~~IR ← M ← PC~~

1) $IR \leftarrow M[PC]$

2) $PC \leftarrow PC + 4$ (inc pc)

Execute

Add subtract Load
store

2

in change of flow

Fetch Load IR $IR \leftarrow M[PC]$

$PC \leftarrow PC + 4$

Execute Modify PC

Condition un-conditional

Types of Branch Inst.

- 1) Classification Conditional/Unconditional
- 2) Relative (Relative to PC in MIPS)
or Absolute
- 3) Range

3

BEQ, BNE
BLT BLE ...

conditional
Relative
 $\pm 2^{15}$ words

B

Unconditional
Relative

J (JAL)

Unconditional
not relative
Restricted.
In 0 segment of 2^{28}
words

JR $\$R_5$

$PC \leftarrow \$R_5$ Uncond.
Absolute

Range 2^{32} bytes

Assume I want to jump to unconditionally

0xABCDCAFE

4

BEA ~~inst~~ 1 inst.

BLT 2 RWR Inst

J B 1 Inst

JA $\$R_5$ we have to place
the Target in ~~$\$R_5$~~

$\$R_5$

For now Assume that $\$R_5$ contains
on address

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a = factorial(N);

compiling it

factorial () {

return ()
}

Transmit argument to function

(In MIPS \$A0 to \$A3)

In "Every" CPU can use
the stack)

Provide return value

\$V0 \$V1 or stack

6
→ $a = \text{factorial}(\text{args})$ change of flow

\vdots
 $\text{factorial}(\text{args}) \{$

return (value)
 $\}$

go back to the calling function

To the next instruction

in MIPS

1000 JAL factorial

→ 1004

15000 factorial: start executing factorial

→ return

7

- JAL ~~function~~ Target

~~$\$RA \leftarrow \beta(\text{CTARGET})$~~

$\$RA \leftarrow PC$ (Return Address)

$PC \leftarrow \beta(\text{TARGET})$

$\beta(\text{TARGET})$ absolute address

within a segment

- Ret JR $\$RA$ return

\Rightarrow Do not use $\$RA$ as general

purpose

Only one level of nesting

To support 'more' levels use

a stack

P

Multiply / Divide

multiply $|n| \times |n| \rightarrow 2n$

add $|n| + |n| \rightarrow (n+1)$

$R_5 \times R_6 \quad 64$

~~Hi~~

$[Hi, Lo] \leftarrow R_5 \times R_6$

$[Hi, Lo] \leftarrow R_5 / R_6$

$Hi \leftarrow R_5 \% R_6$

$Lo \leftarrow R_5 / R_6$

mfhi \$R0 \$R1 \leftarrow hi
mflr \$R0 \$R0 \leftarrow lo

mfhi \$R5 \$R5 \leftarrow hi
mflr \$R5 lo

10

MULT \$R_S, \$R_T

9

[H_i; L_o] ← \$R_S * \$R_T

└ mve \$R_D, \$R_S, \$R_T

[: mult \$R_S, \$R_T

[mfbw \$R_D