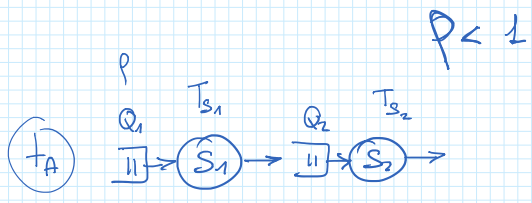
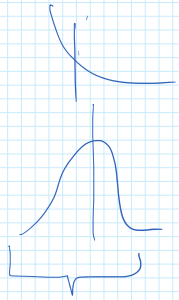


$$T_S = 10s$$

$$T_A = 5s$$

ρ fattore di utilizzo dello scudo

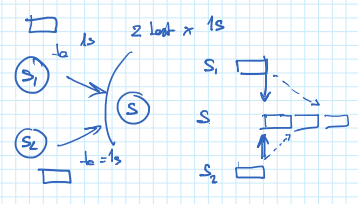
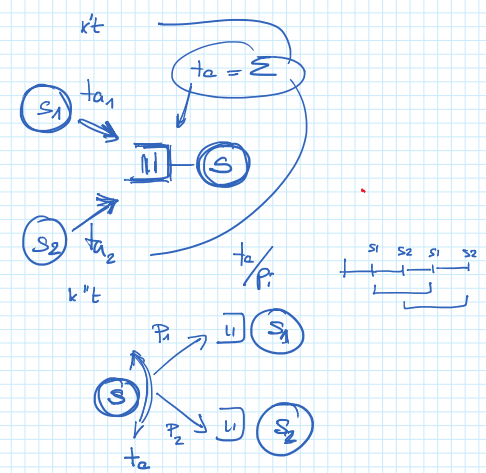
$$\rho = \frac{T_S}{T_A} = \frac{10s}{5s} = 2 > 1$$



$\rho_1 < 1$ $\rho_2 < 1$

$$\rho_1 = \frac{T_{S1}}{T_A} < 1$$

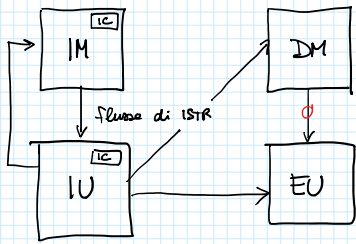
$T_{S1} < T_A$



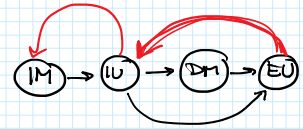
PROCESSORE PIPELINES

venerdì 2 dicembre 2016 11:57

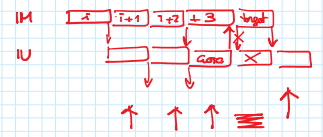
fetch
Instruction memory
Instruction unit
decodifica



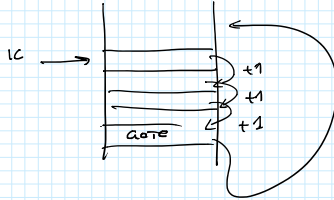
data memory
writeback
can M (LOAD, STORE)



esegui istruzioni
Aritmetico logico



1) IC nello IM
e una copia
di IC nello IU



2) Writeback nel PIPELINE

W: de IM → [OP ...]

salto
memoria
ALU

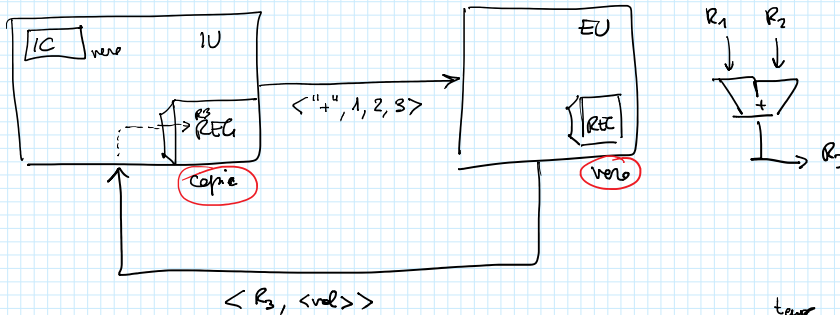
deve "interpretare e' utilizzare" → IC → tornare a IM

ordinare la load/store dello DM
< op, addr, [data] >
LD / ST
Rbase + Rindice

ordinare a EU di eseguire l'op
ADD R1, R2, R3
< op, REG[1], REG[2] >
"+"

IF: R1, Rn, loop [IF | i | W | off]
(R1 < Rn ? IC + off : IC + 1) → IC
= 5

< op, 1, 2, 3 > e nello EU mette
una copia dei registri
"+"



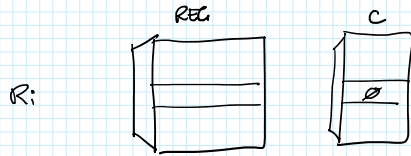
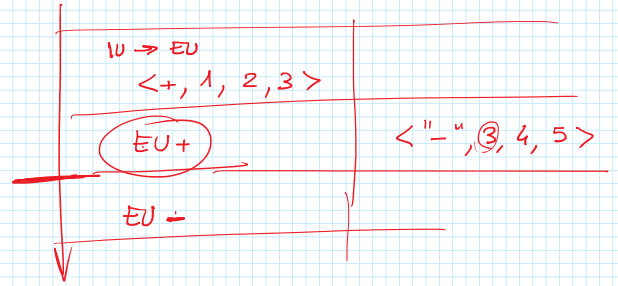
1) Reg solo nello IU

ADD R1, R2, R3
SUB R3, R4, R5

IU → EU
< +, REG[1], REG[2] >
EU +
← < R3 > IU → EU
IU R3 → R3
< -, REG[3], REG[4] >

2) Reg. sono nello EU
e la IU ne ha una copia

SOLO BUONA!



C_i minimo delle istruzioni uscite allo EU o alla DM che modificano R:

$IU \rightarrow EU \quad \langle +, 1, 2, 3 \rangle$

$C_3 ++$

quando EU mi comunica che R_3 è stato scritto con $\langle val \rangle$
IU scrive val in $R_3 \quad C_3 --$

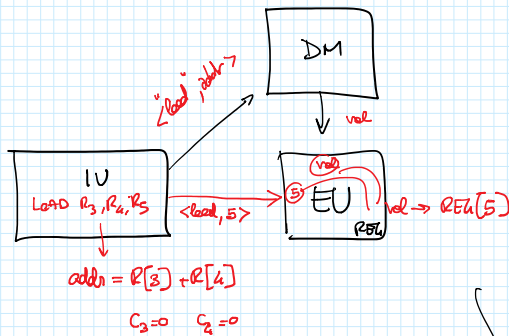
È molto che IU "legge" R: or blocco se $C_i \neq \emptyset$!

LOAD R_{base}, R_3, R_x

$R[3] + R[base] \rightarrow ADDR$
"LOAD" $\rightarrow OP$

lettura se $C_3 \neq \emptyset$

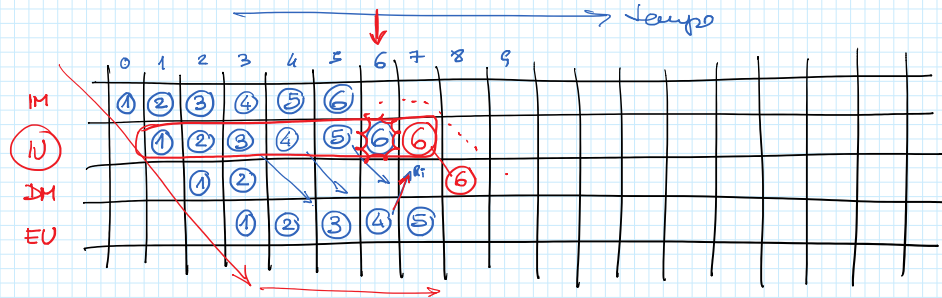
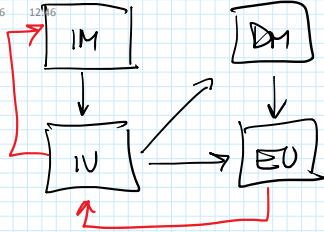
LOAD
LOAD



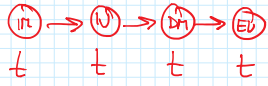
ANTICIPAZIONE:

risorse a implementare IU IM DM EU che lavorano in un tempo t

- At IM riesce a prendere $M[ic] \rightarrow IU$
 $ic+1$ o $ic-1$
- At IU riesce a decodificare istr
- At EU riesce a fare un op ALU
- At DM riesce a fare un load o store



t
 t



$$T_s = \max\{t, t, t, t\} = t$$

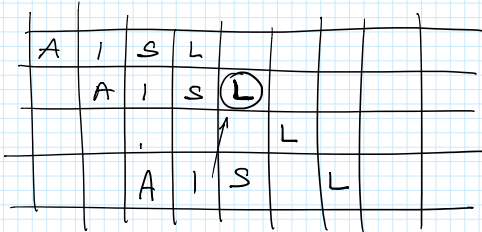
$$m = 6$$

- ① LOAD R_{base}, R_i, R_1
- ② LOAD R_{base}, R_i, R_2
- ③ ADD R_1, R_2, R_3
- ④ INC R_i
- ⑤ SUB R_{sum}, R_i, R_{sum}
- ⑥ STORE R_{base}, R_i, R_3

$$T_c \approx m T_s \approx 6t$$

ADD
 INC
 SUB
 LOAD R_b, R_i, R_3

$\rightarrow DM \langle load, R[E], R[E] \rangle$
 $\rightarrow EU \langle load, 3 \rangle$



ADD R_1, R_2, R_3
 INC R_i
 SUB R_3, R_i, R_3
 STORE R_b, R_i, R_3

