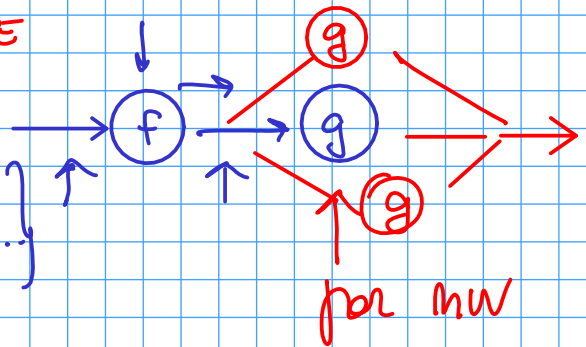


WRAPPING CODICE SEQUENZIALE

Image * f(Image * x) { ... }

wrapper(f)

"funzione"?



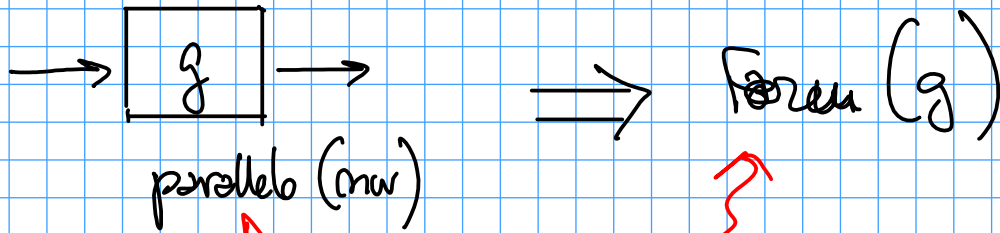
loop :

ricevere Image x

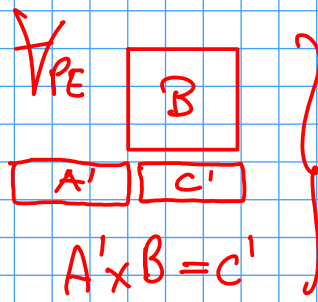
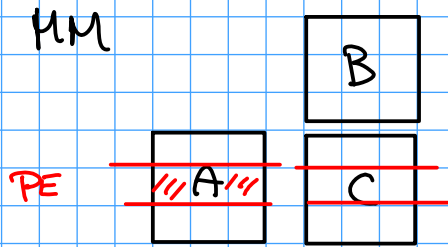
chiamo f

operatore il risultato

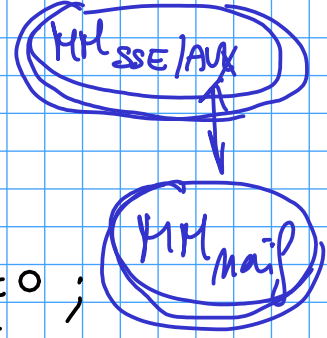
WRAPPING di codice (già) PARALLELO



interferenze dei meccanismi usati



è una MM



```

for(i = 0; i < N; i++)
  for(j = 0; j < M; j++)
    c[i][j] = 0;
for(k = 0; k < M; k++)
  for(i = 0; i < N; i++)
    for(j = 0; j < M; j++)
      c[i][j] += a[i][k] * b[k][j];

```

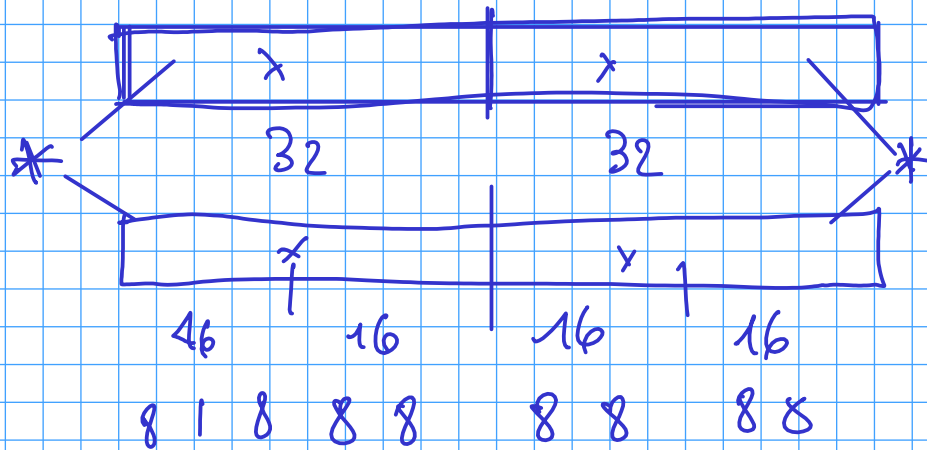
$E_{N \times M}$

in PARALLELO

MAP (MM_{seq}): { "fette" di A }

↓
 { "fette" di c } → ricostruire C

MAP = PIPE (sparte, calcolo, ricostruire)

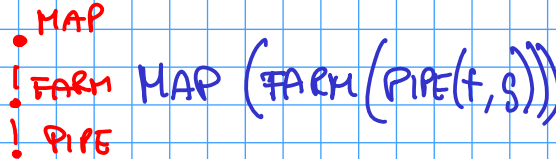


Reg 64

STREAM PARALLEL

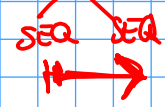
DATA PARALLEL

NESTING ARBITRARIO



ANGHE NO!

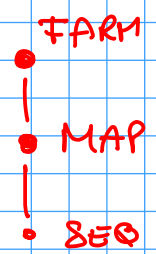
TWO TIER MODEL



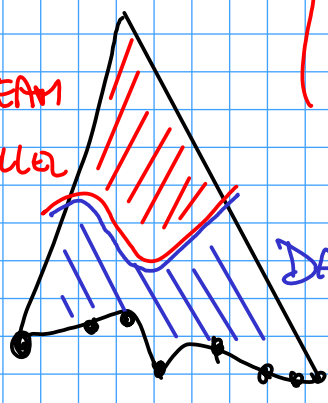
FARM(MAP(j))

VS.

FARM(seq(j))

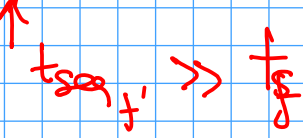


STREAM PARALLEL



DATA PARALLEL

SEQ



S

SEMANTICA $\begin{cases} \text{SEMANTICA FUNZIONALE} \\ \text{SEMANTICA PARALLELA} \end{cases}$

PIPE (S_1, S_2)

$S_1: \alpha \rightarrow \beta$ $S_2: \beta \rightarrow \gamma$ $\text{PIPE}(S_1, S_2): \alpha^* \rightarrow \gamma^*$
 $: \alpha \text{ stream} \rightarrow \gamma \text{ stream}$

$\forall x: \alpha \in \text{stream di ingresso}$
 $S_2(S_1(x)): \gamma \rightarrow \text{stream di uscita}$

stream \cong lista

let^{rec} pipe $S_1 S_2 = \text{fun}$
 $[\] \rightarrow [\]$
 $| x::rx \rightarrow S_2(S_1(x)) :: (\text{pipe } S_1 S_2 rx);$

FORM(S)

$S: \alpha \rightarrow \beta$
 $\alpha \text{ stream} \rightarrow \beta \text{ stream}$

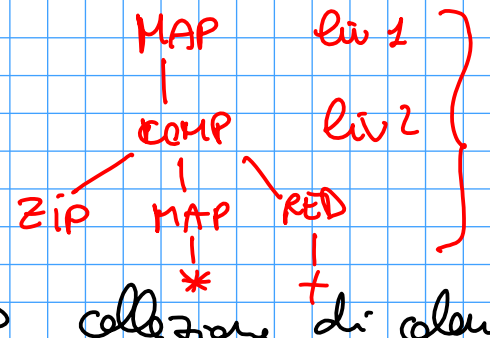
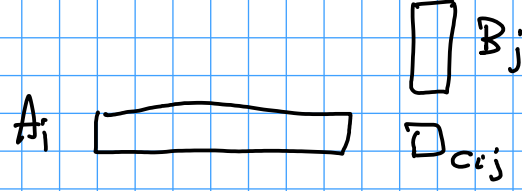
let form $S = \text{fun}$
 ~~$x \rightarrow S(x)$~~ $| [\] \rightarrow [\]$
 $| x::rx \rightarrow (S x) :: (\text{form } S rx)$

form (pipe $S_1 S_2$)
 $: \alpha \text{ stream} \rightarrow \beta \text{ stream}$

streamer $f: \alpha \text{ stream} \rightarrow \beta \text{ stream}$
 $\alpha \rightarrow \beta$

$\Delta \left\{ \begin{array}{l} \text{pipe } (S_1, S_2) \\ \text{form } (S) \end{array} \right. \quad \left. \begin{array}{l} \text{pipe } (\text{form } (S_1), \text{form } (S_2)) \\ \text{form } (\text{pipe } (S_1, S_2)) \end{array} \right\}$

pregz \cong streamer (Δ)



A collezione di righe

B collezione di colonne

liv 1 MAP (IP) Caricamento (Righe x colonne)



IP

x₁ x₂ ... x_n

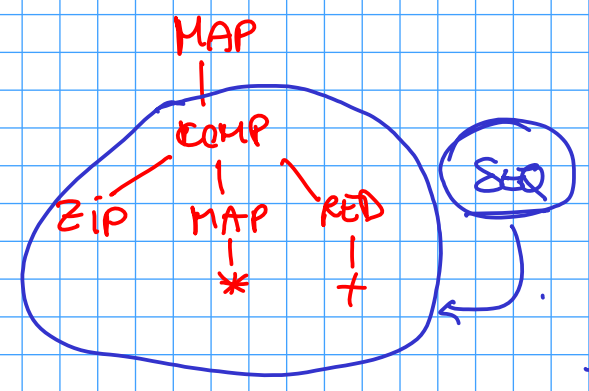
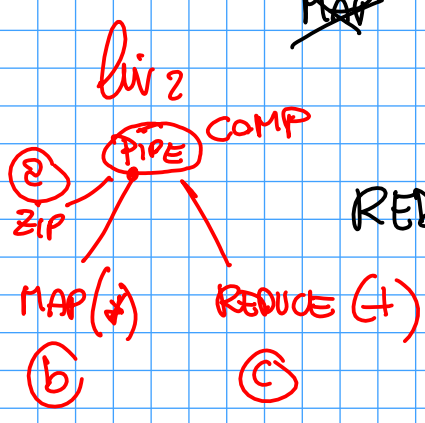
y₁ y₂ ... y_m

ZIP

MAP * : <x₁, y₁> <x₂, y₂> ... <x_n, y_n>

REDUCE + : x₁*y₁, x₂*y₂, ... x_n*y_n

x₁*y₁ + x₂*y₂ + ... + x_n*y_n



MM con grana Righe x colonne

MM con grana * +

SEMANTICA PARALLELA

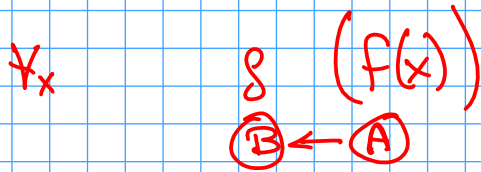
Sistemi di risultato

INFORMALE

seni parallelo del PIPE(f,s)

f in attività concorrente A

g in attività concorrente B



$$\frac{\text{pipe}(f,s) : []}{[]}$$

$$\frac{\text{pipe}(f,s) : x :: rx}{}$$

$$\frac{g(F(x)) \text{ PE}_1 \text{ PE}_2}{\text{PE}_2 \text{ PE}_1} :: (\text{pipe}(f,s) rx) \text{ PE}_1 \text{ PE}_2$$