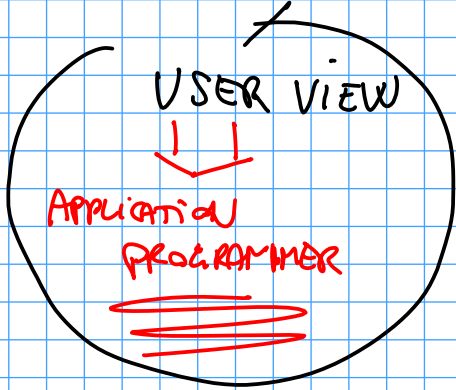


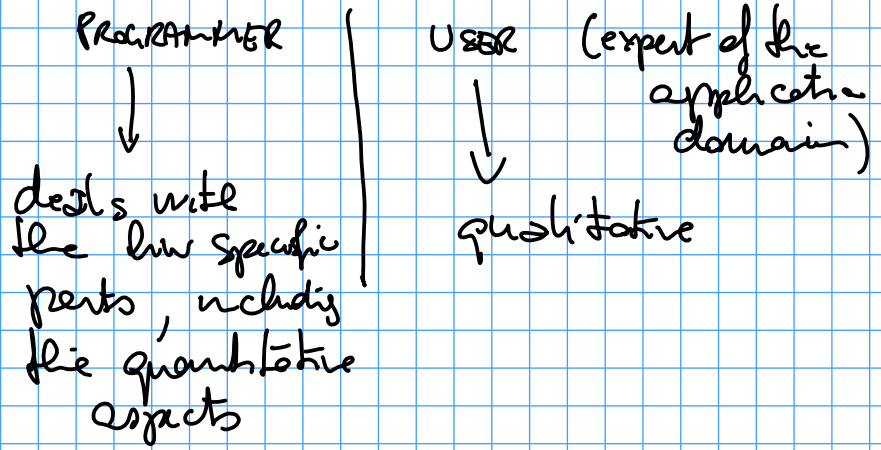
# Algorithmic skeleton frameworks



## MOTIVATIONS

History

MURRAY COLE 1988



```

if (C) { then }
else { Else }
    
```

### BEFORE

### AFTER

Seq prog lang  
(C, FORTRAN)

Library of parallel  
building blocks  
to instantiate

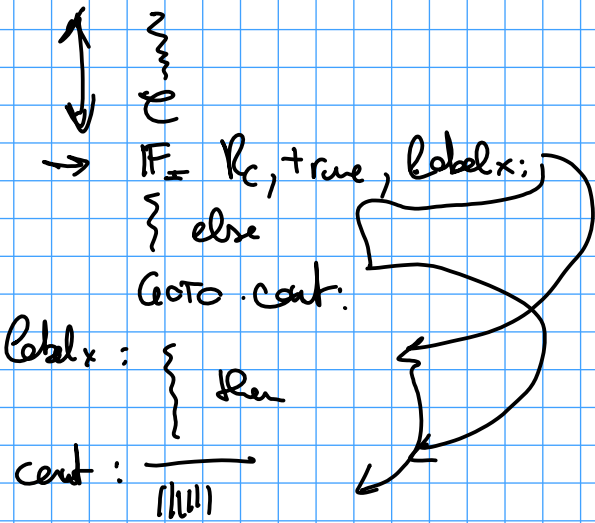
+ com libraries

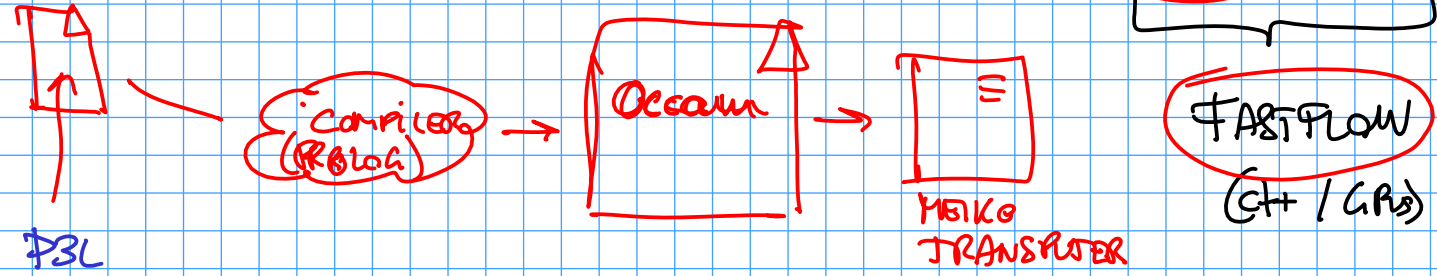
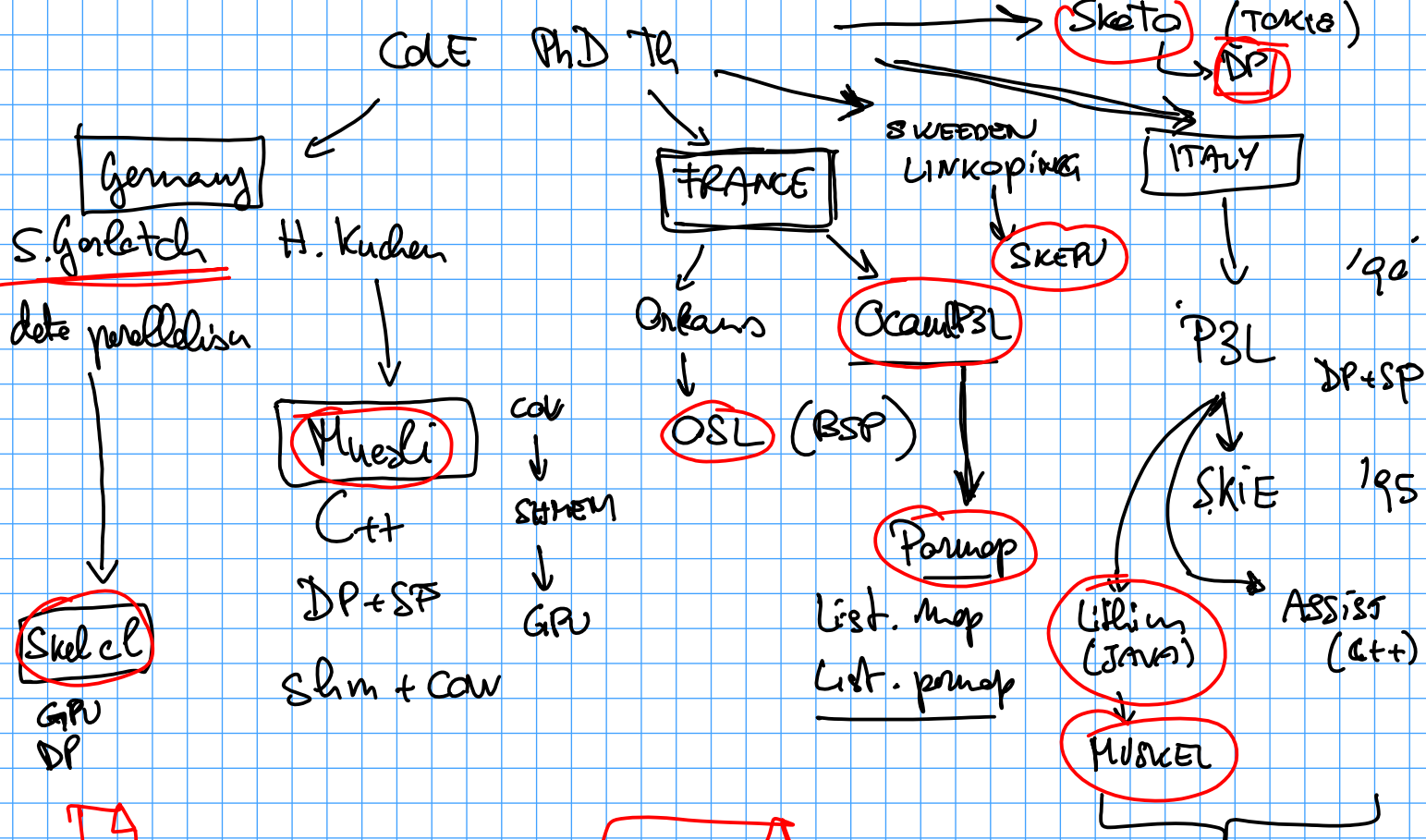
$P_1 (x!P_2) \{$

pipe  $(P_1, P_2, P_3)$

$[ P_2 (y?P_1) \dots (y!P_3) \}$

$\} (x?P_2) \}$





<skelton-kind> <name> in(<param>) out(<param>)  
 <body>  
 <end-clause>

```

    main
    pipe mainpipe in (float A[])
    out (float B[])
    stage1 in (A) . out (float C[])
    stage2 in (C) out (B)
  end pipe
  f2 in ( ) out ( )
  
```

```

    seq for in (float x)
    out (float y)
    $$$
    $ C } ... y = ... f(x) ... } $
  end seq
  
```

```

    form f2 in (float A[])
    at (float B[])
    mw: 10;
    Stage2 in (A) out (B)
  end form
  
```

# Ocam P3L

||| : pipeline

||| :  $(\alpha \rightarrow \beta) \rightarrow (\beta \rightarrow \gamma) \rightarrow (\alpha \rightarrow \gamma)$

let f x = ... ;;

let g x = ... ;;

(f ||| g) [1, 2, 3, 4]

[ g(f(1)), g(f(2)) ... ]

MUESLI (CH)

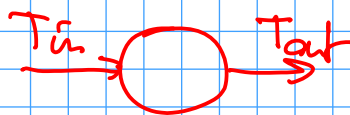
Atomic <T<sub>in</sub>, T<sub>out</sub>>

INITIAL <T>

DRAIN <T>

PIPE ( );

• compute ()



# Composition

LIB

skeletons

SK1

SK2

SK3

---

RISC view

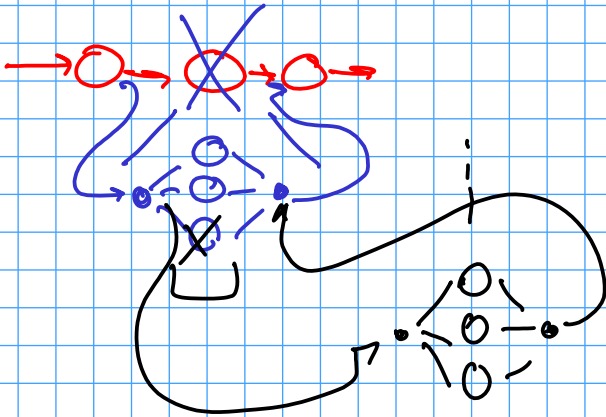
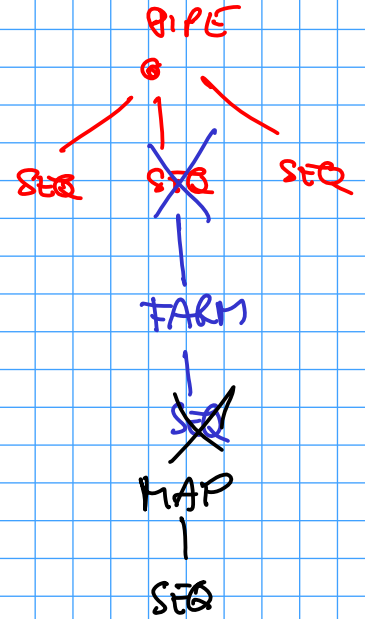
VAX DIGITAL

# State

BEHINDING  
(complex skeleton)  
(cisc view)



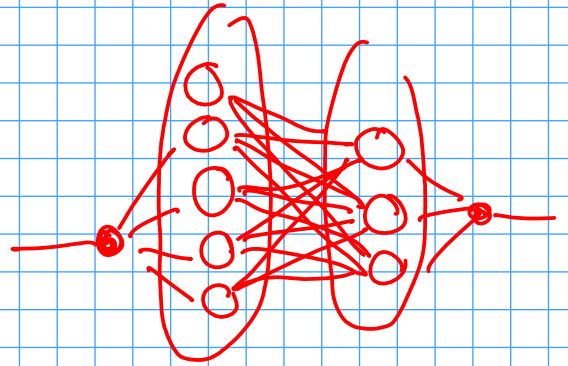
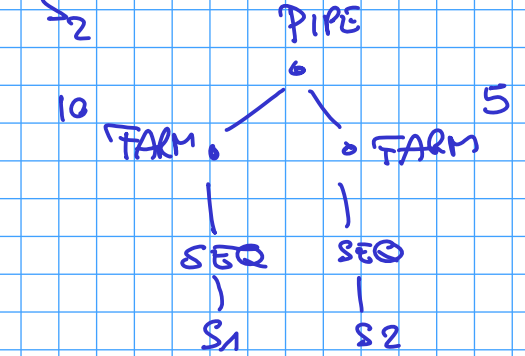
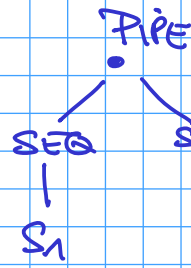
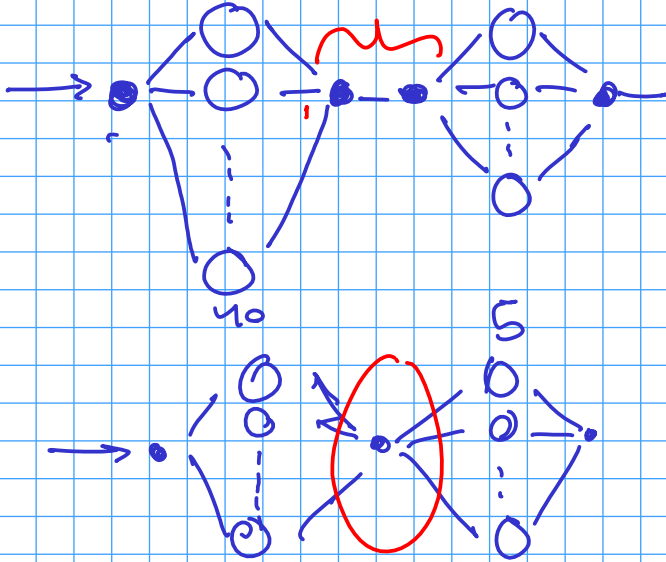
RISC view  
(small set of very skeletons  
+ meeting segment)



$\Phi_{PIPE}(S_1, S_2)$



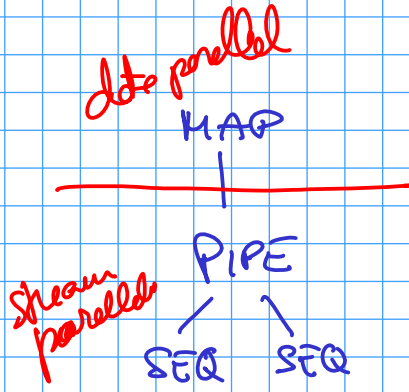
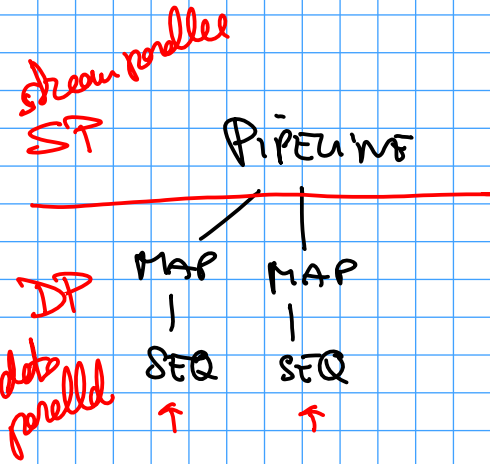
$\Phi_{PIPE}(\text{FARM}(S_1, 10), \text{FARM}(S_2, 5))$



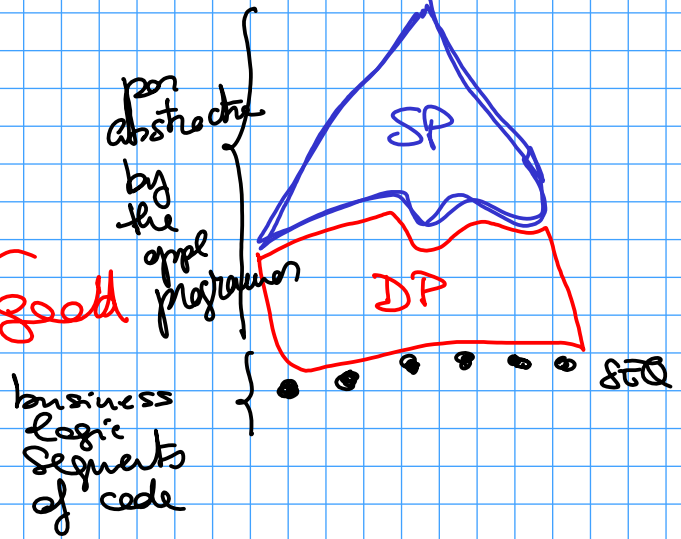
# MEANINGFUL COMPOSITIONS

## ↳ COMPOSITION PATTERNS

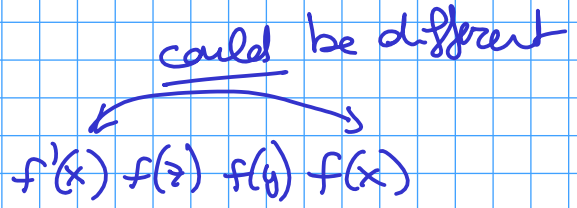
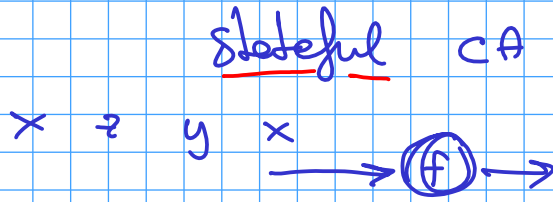
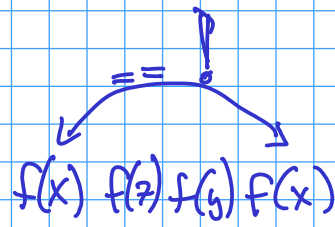
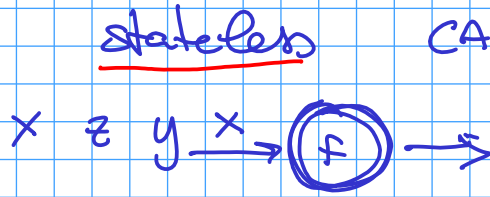
H. KUCHEN



Not so good



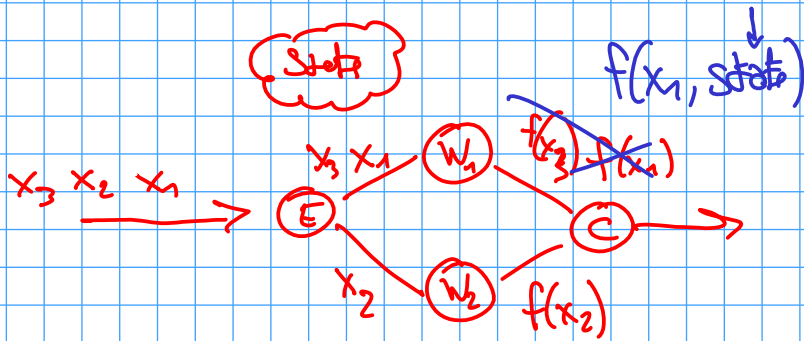
# STATE



$f$ : counts the inputs ( $n$ ) initially 0  
 outputs  $\left(\frac{x}{n}\right)$

1  $\frac{n+1}{1/1} \rightarrow 1$

#  $\frac{n+1}{1/2} \rightarrow 0.5$



read only state  
 ↳ coding  
 (1 synch at the very beginning)

read/writes state  
 ↳ continuous synchronization

State "kinds"

↳ Read only

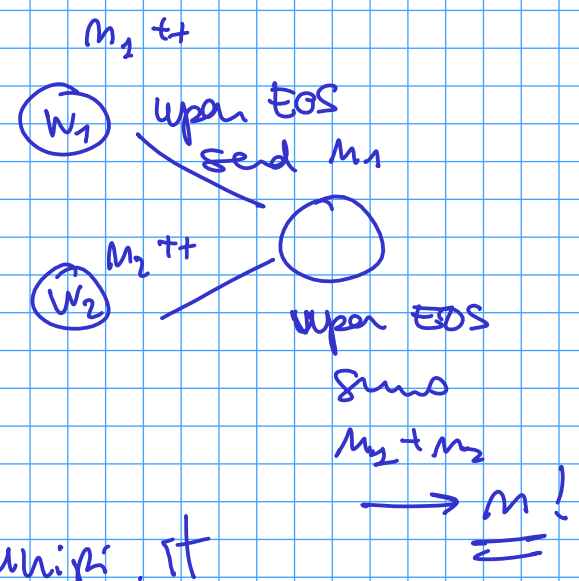
↳ Resource

↳ Structured  
"Reduce"  
Accumulates

easy

Worst case (!synchronize each access)

Spmlh.01@131.....



EMAIL to [marco.danelutto@unipi.it](mailto:marco.danelutto@unipi.it)

Subject : PHI SPIN ACCOUNT

Body : Name Family Name Nickname  
[MCSN/CS]