

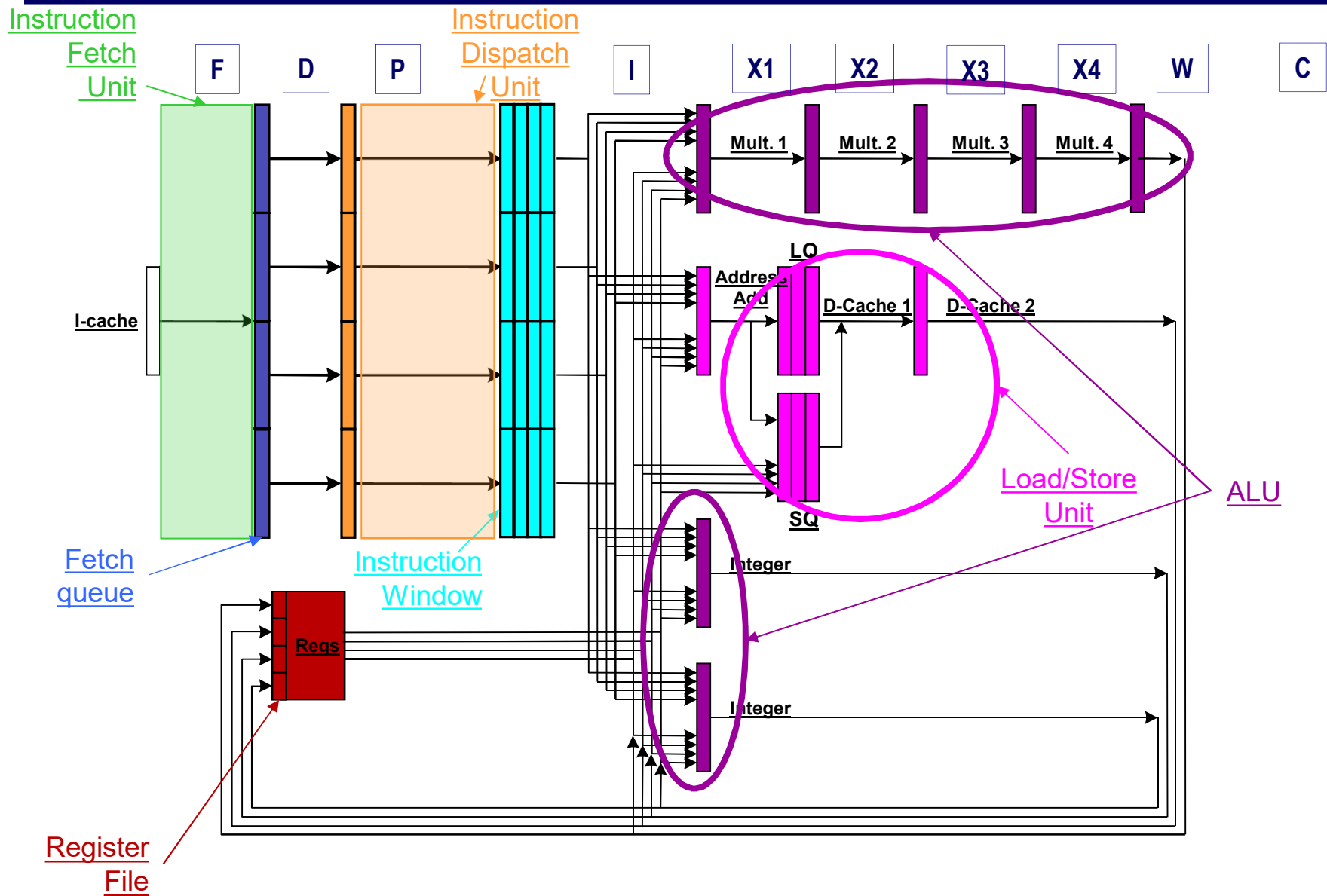
# FREESS

## The FREE Superscalar Simulator

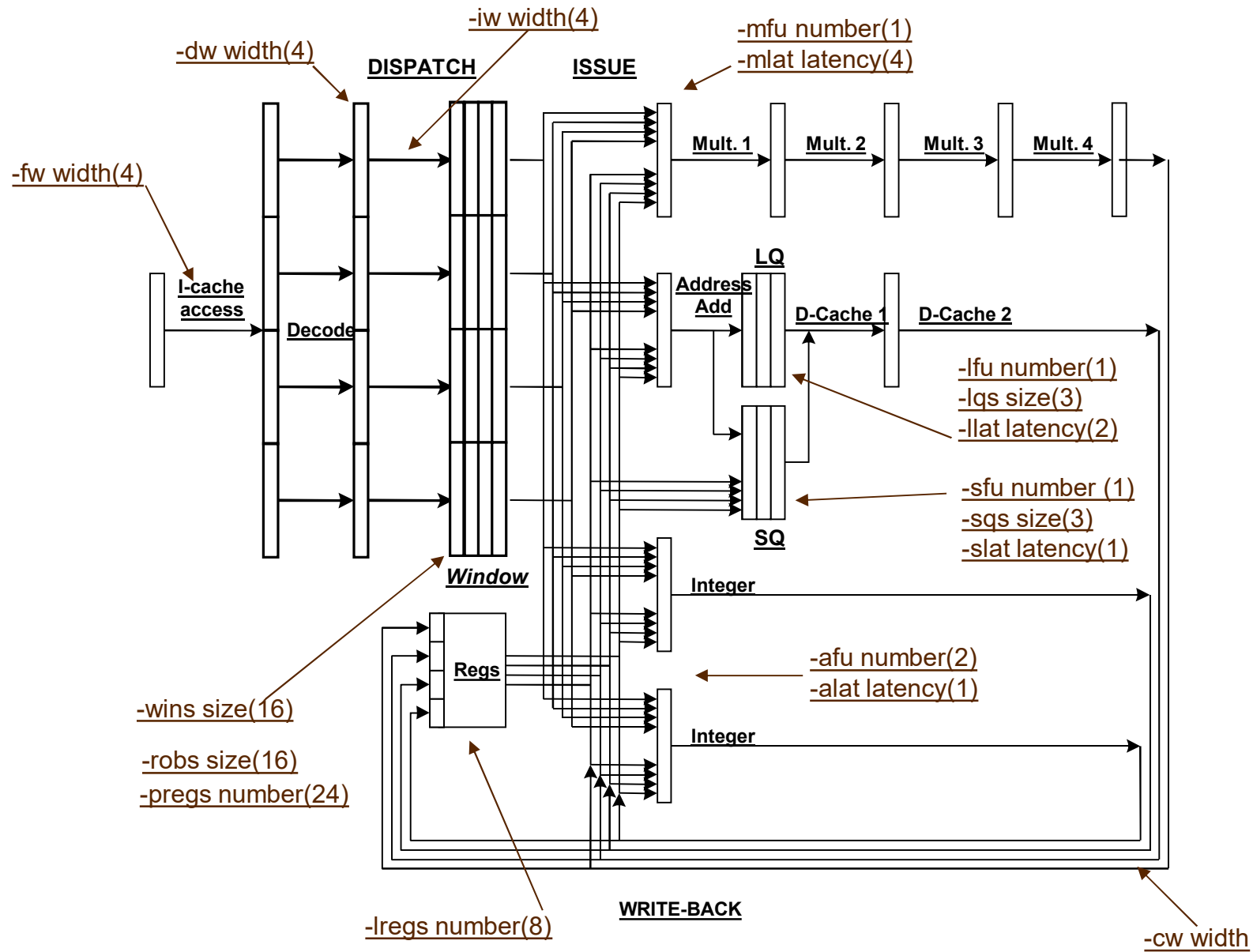
<http://www.dii.unisi.it/~giorgi/teaching/hpca2>

High Performance Computer Architecture

# Structure of Out-Of-Order Processor in FREESS



# FREESS Parameters



# Parameter Key

FREES parameters	UNIT	MEANING
-fw number	<inst/cycle>	Number of instruction that can be fetched in a cycle
-dw number	<insts/cycle>	Number of instruction that can be decoded in a cycle
-iw number	<insts/cycle>	Number of instruction that can be issued in a cycle
-cw number	<inst/cycle>	Number of instruction that can be committed in a cycle
-wins size	<insts>	Number of slots in the Instruction Window (IW)
-robs size	<inst>	Number of slots in the Re-Order Buffer (ROB)
-rreg number	<num>	Number of Logical Registers
-preg number	<num>	Number of Physical Registers
-lqs size	<insts>	Number of slots in the load queue (LSQ)
-lfu number	<num>	Number of load functional units
-llat latency	<cycle>	Number of cycles to perform a load operation
-sqs size	<insts>	Number of slots in the store queue (LSQ)
-sfu number	<num>	Number of store functional units
-slat latency	<cycle>	Number of cycles to perform a store operation
-afu number	<num>	Number of integer ALUs
-alat number	<cycle>	Number of cycles to perform an ALU operation
-mfu number	<num>	Number of integer Multipliers
-mlat number	<cycle>	Number of cycles to perform a integer Multiplication operation

# STEPS to launch a simple example

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- 1) START YOUR LINUX MACHINE (use UNISIPASS to login)
- 2) OPEN A TERMINAL (prompt should be .....\$ )
- 3) `mkdir FREESS; ls -la` (what do you see?)
- 4) `cd FREESS; ls -la` (what do you see?)
- 5) `wget http://www/~giorgi/teaching/hpca2/public/betatools/frees-0\_8.tgz; ls -l`
- 6) OPEN THE "TARBALL": `tar xf frees-0_8.tgz`
- 7) `cd freess0.8; ls -l`
- 8) `make` → IT WILL COMPILE THE SIMULATOR "fress"
- 9) `./fress` → IT WILL PRINT AN INITIAL MESSAGE
- 10) `./frees -help` → LOOK AT THE OPTIONS
- 11) `more prog150622` → the program!
- 12) `more run150622.sh` → the last line is how to launch frees
- 13) `./fress -exe prog150622 -wins 10 -pregs 18 -robs 99 -lqs 3 -sqs 3 -llat 1`

# Sample Output

```

=====
PHYSICAL REGS:  1  2  3  4  5  6  7  8
                *  *                *
qi:  0  0  1  1  1  1  1  0
vi:  00 04 00 04 00 00 00 00
=====

REG.FILE: Ri:   1    2    3    4    5    6    7    8
Pi:   2    8    -    1    -    -    -    -
Qi:   0    0    0    0    0    0    0    0
Vi:  00001000 00000000 00003000 00000000 00000000 00000000 00000003 00000000
=====

STAGES:          F  D  P  I  X  W  C  RENAMED-STR  INSTRUCTION-WINDOW  REORDER-BUFFER  A  M  L  S  B  F  X
TOTAL SLOTS:     4  4  8  4 12  4  4  8          8          10          4  1  1  0  1  4  1
BUSY SLOTS:     0  0  0  0  0  1  0  3          0          0          0  0  0  0  0  0  0
STALLS:         0  7  0  6  0  0  9  7          0          0          0  0  0  2  0  0  0
=====

PC  INSTRUCTION  F  D  P  I  X  W  C  Pi,Pj Pk P1  IW#  OPCD  Pi  Pj  Pk  I/P1  Cj  Ck  Cl  ROB#  PC  Ri  oPi  s  x  c  +-----+
000] LW  R2,0(R1)  0  1  2  3  4  5  6  P2,0(P1)  ----  LW  P2  P1  -  0  2  -  -  ----  000  R2  -  0  0  1  |LQ(0)          |
001] MUL R4,R2,R2  0  1  2  5  5 10 11  P3,P2,P2  ----  MUL  P3  P2  P2  -  5  5  -  ----  001  R4  -  0  0  1  |PC  OP Pi  EFAD Ci|
002] SW  R4,0(R1)  0  1  2  4  5 10 11  ,0(P1)<-P3  ----  SW  -  P3  P1  0  -  2  -  ----  002  -  -  1  0  1  |---- LW P2 1000 5|
003] ADDI R1,R1,4  0  1  2  3  3  4 11  P4,P1,4  ----  ADDI  P4  P1  -  4  2  -  -  ----  003  R1  P1  0  0  1  |---- LW P5 1004 7|
004] BNE R2,R0,-5  1  2  3  4  4  5 11  ,P2,P0,-5  ----  BNE  -  P2  P0  -5  -  3  -  ----  004  -  -  0  0  1  |---- LW P8 1008 9|
005] LW  R2,0(R1)  2  3  4  5  6  7 12  P5,0(P4)  ----  LW  P5  P4  -  0  4  -  -  ----  000  R2  P2  0  0  1  +-----+
006] MUL R4,R2,R2  2  3  4  7  7 12 13  P6,P5,P5  ----  MUL  P6  P5  P5  -  7  7  -  ----  001  R4  P3  0  0  1
007] SW  R4,0(R1)  2  3  4  6  7 12 13  ,0(P4)<-P6  ----  SW  -  P6  P4  0  -  4  -  ----  002  -  -  1  0  1  +-----+
008] ADDI R1,R1,4  2  3  4  5  5  6 13  P7,P4,4  ----  ADDI  P7  P4  -  4  4  -  -  ----  003  R1  P4  0  0  1  |SQ(0)          |
009] BNE R2,R0,-5  3  4  5  6  6  7 13  ,P5,P0,-5  ----  BNE  -  P5  P0  -5  -  5  -  ----  004  -  -  0  0  1  |PC  OP P1  EFAD C1|
010] LW  R2,0(R1)  4  5  6  7  8  9 14  P8,0(P7)  ----  LW  P8  P7  -  0  6  -  -  ----  000  R2  P5  0  0  1  |---- SW P3 1000 10|
011] MUL R4,R2,R2  4 11 12 13 13 18 19  P1,P8,P8  ----  MUL  P1  P8  P8  - 12 12  -  ----  001  R4  P6  0  0  1  |---- SW P6 1004 12|
012] SW  R4,0(R1)  4 11 12 13 14 18 19  ,0(P7)<-P1  ----  SW  -  P1  P7  0  - 12  -  ----  002  -  -  1  0  1  |---- SW P1 1000 18|
013] ADDI R1,R1,4  4 12 13 14 14 15 19  P2,P7,4  ----  ADDI  P2  P7  -  4 13  -  -  ----  003  R1  P7  0  0  1  +-----+
014] BNE R2,R0,-5  5 12 13 14 14 15 19  ,P8,P0,-5  ----  BNE  -  P8  P0  -5  - 13  -  ----  004  -  -  0  0  1
----- Press ENTER to continue (PC=6,IC=15,CK=19,CTOT=20,IPC=0.75)...

```