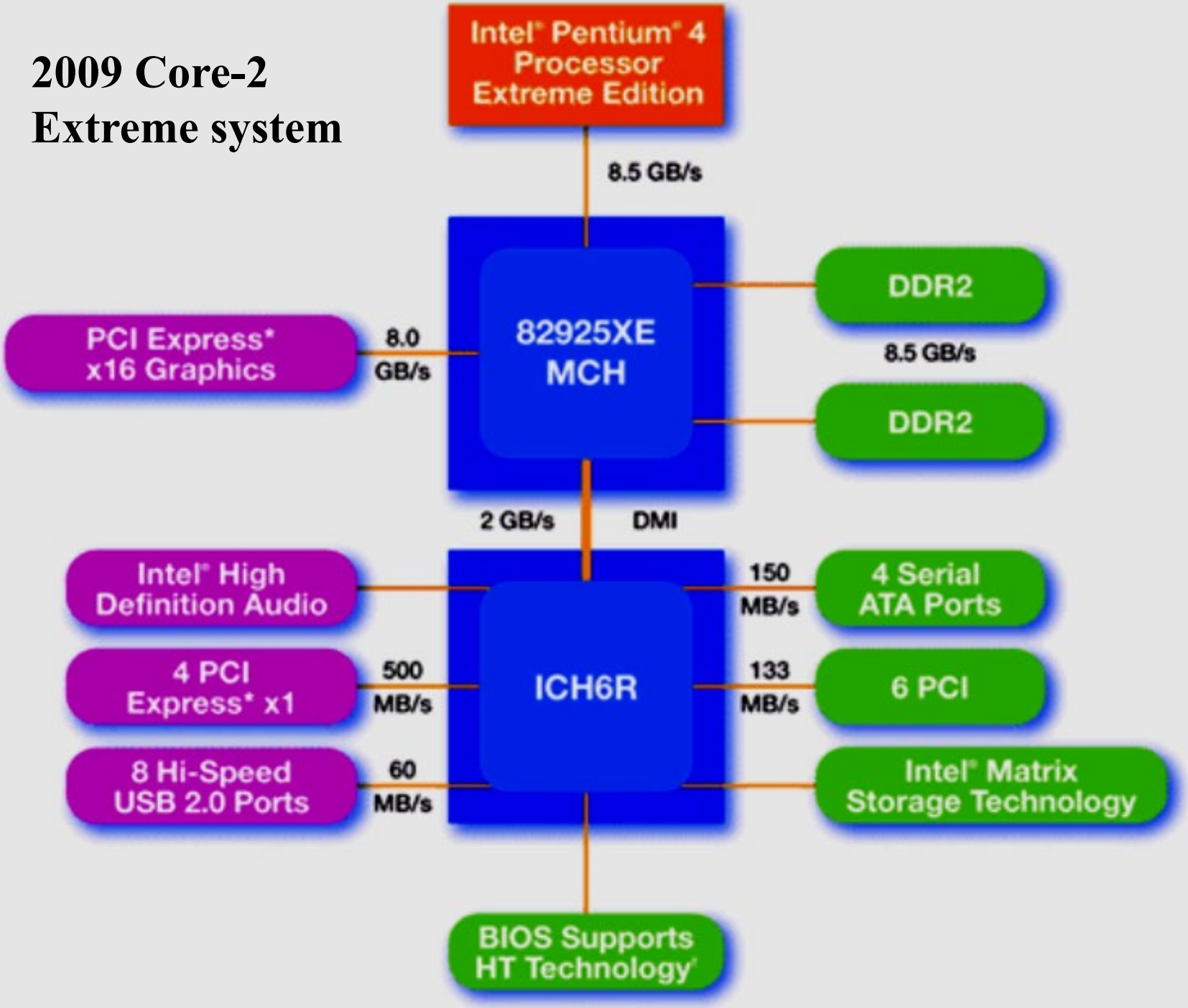
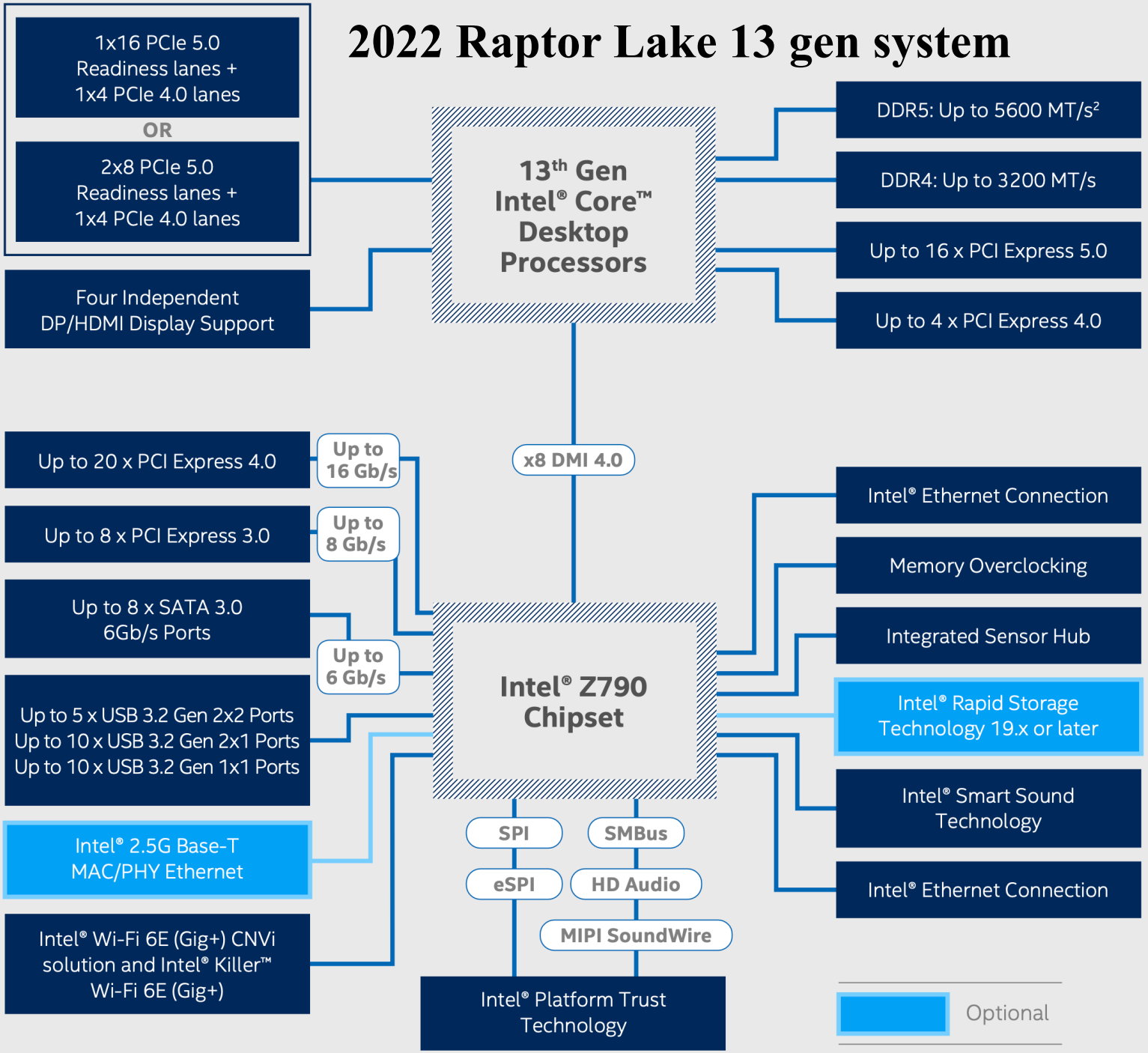
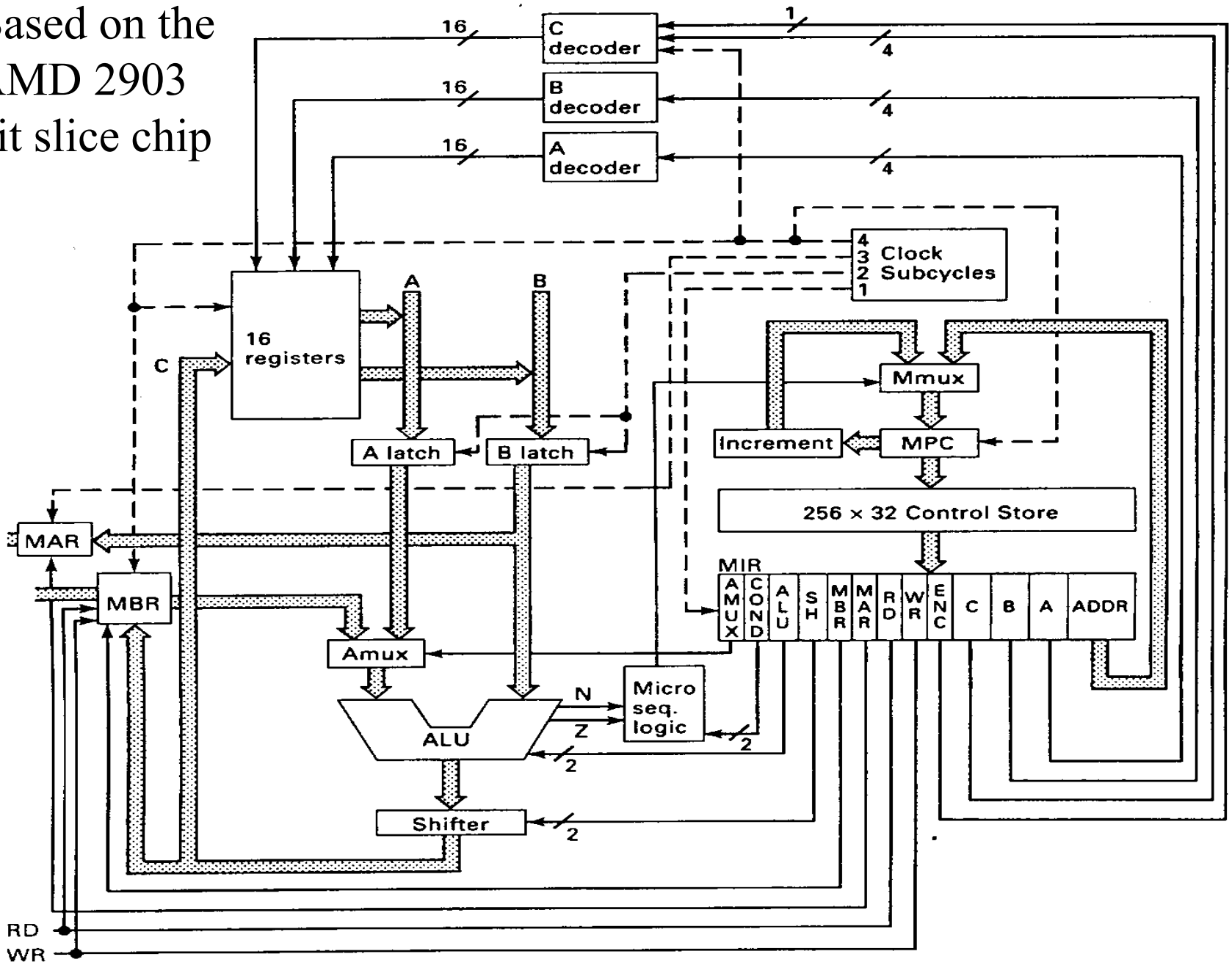
2009 Core-2 Extreme system

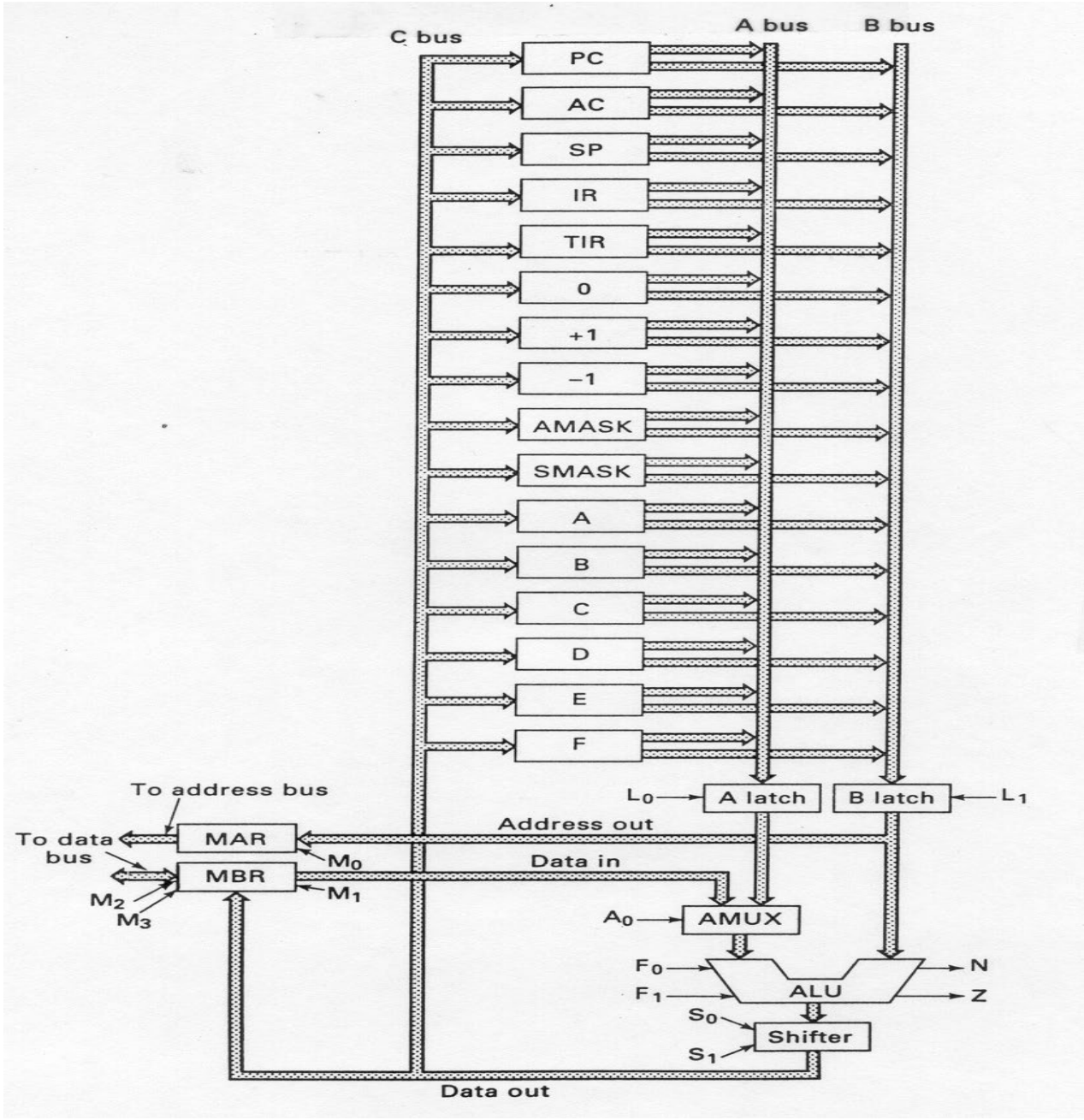


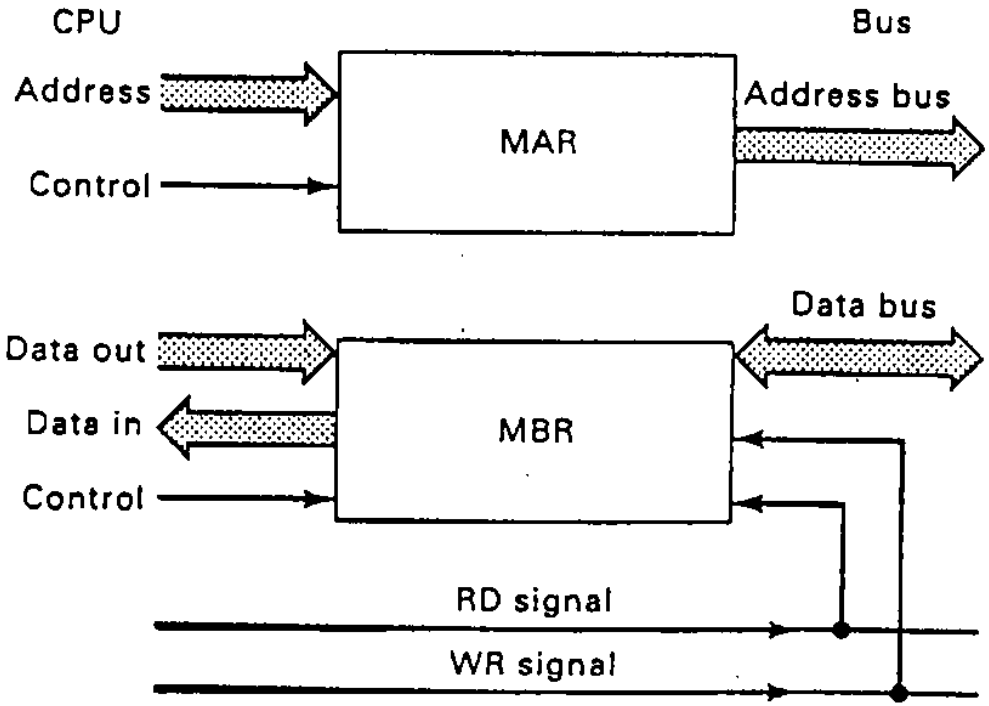
2022 Raptor Lake 13 gen system



Based on the AMD 2903 bit slice chip




C bus
A bus
B bus
PC
AC
SP
IR
TIR
0
+1
−1
AMASK
SMASK
A
B
C
D
E
F
To address bus
To data bus
MAR
MBR
M0
M1
M2
M3
L0
A latch
B latch
L1
Address out
Data in
A0
AMUX
F0
F1
ALU
N
Z
S0
S1
Shifter
Data out


CPU
Bus
Address
Address bus
MAR
Control
Data bus
Data out
Data in
MBR
Control
RD signal
WR signal

AMUX — controls left ALU input: 0 = A latch, 1 = MBR

ALU — ALU function: 0 = A + B, 1 = A AND B, 2 = A, 3 = $\overline{A}$

SH — shifter function: 0 = no shift, 1 = right, 2 = left

MBR — loads MBR from shifter: 0 = don't load MBR, 1 = load MBR

MAR — loads MAR from B latch: 0 = don't load MAR, 1 = load MAR

RD — requests memory read: 0 = no read, 1 = load MBR from memory

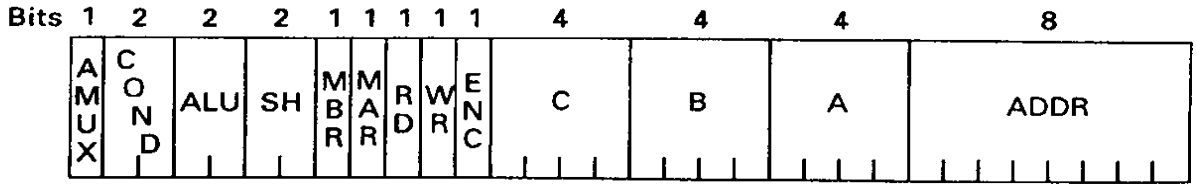
WR — requests memory write: 0 = no write, 1 = write MBR to memory

ENC — controls storing into scratchpad: 0 = don't store, 1 = store

C — selects register for storing into if ENC = 1: 0 = PC, 1 = AC, etc.

B — selects B bus source: 0 = PC, 1 = AC, etc.

A — selects A bus source: 0 = PC, 1 = AC, etc.



AMUX	COND	ALU	SH	MBR, MAR, RD, WR,
0 = A latch 1 = MBR	0 = No jump 1 = Jump if N = 1 2 = Jump if Z = 1 3 = Jump always	0 = A + B 1 = A AND B 2 = $\overline{A}$ 3 = $\overline{A}$	0 = No shift 1 = Shift right 1 bit 2 = Shift left 1 bit 3 = (not used)	0 = No 1 = Yes

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0:mar := pc; rd;                                    { main loop  }
1:pc := 1 + pc; rd;                                 { increment pc }
2:ir := mbr; if n then goto 28;                     { save, decode mbr }
3:tir := lshift(ir + ir); if n then goto 19;
4:tir := lshift(tir); if n then goto 11;            { 000x or 001x? }
5:alu := tir; if n then goto 9;                     { 0000 or 0001? }
6:mar := ir; rd;                                    { 0000 = LODD }
7:rd;
8:ac := mbr; goto 0;
9:mar := ir; mbr := ac; wr;                         { 0001 = STOD }
10:wr; goto 0;
11:alu := tir; if n then goto 15;                   { 0010 or 0011? }
12:mar := ir; rd;                                   { 0010 = ADDD }
13:rd;
14:ac := ac + mbr; goto 0;
15:mar := ir; rd;                                   { 0011 = SUBD }
16:ac := 1 + ac; rd;                                { Note: x - y = x + 1 + not y }
17:a := inv(mbr);
18:ac := a + ac; goto 0;
19:tir := lshift(tir); if n then goto 25;           { 010x or 011x? }
20:alu := tir; if n then goto 23;                   { 0100 or 0101? }
21:alu := ac; if n then goto 0;                     { 0100 = JPOS }
22:pc := band(ir, amask); goto 0;                   { perform the jump }
23:alu := ac; if z then goto 22;                    { 0101 = JZER }
24:goto 0;                                          { jump failed }
25:alu := tir; if n then goto 27;                   { 0110 or 0111? }
26:pc := band(ir, amask); goto 0;                   { 0110 = JUMP }
27:ac := band(ir, amask); goto 0;                   { 0111 = LOCO }
28:tir := lshift(ir + ir); if n then goto 40;       { 10xx or 11xx? }
29:tir := lshift(tir); if n then goto 35;           { 100x or 101x? }
30:alu := tir; if n then goto 33;                   { 1000 or 1001? }
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31:a := sp + ir;                                    { 1000 = LODL }
32:mar := a; rd; goto 7;
33:a := sp + ir;                                    { 1001 = STOL }
34:mar := a; mbr := ac; wr; goto 10;
35:alu := tir; if n then goto 38;                   { 1010 or 1011? }
36:a := sp + ir;                                    { 1010 = ADDL }
37:mar := a; rd; goto 13;
38:a := sp + ir;                                    { 1011 = SUBL }
39:mar := a; rd; goto 16;
40:tir := lshift(tir); if n then goto 46;           { 110x or 111x? }
41:alu := tir; if n then goto 44;                   { 1100 or 1101? }
42:alu := ac; if n then goto 22;                    { 1100 = JNEG }
43:goto 0;
44:alu := ac; if z then goto 0;                     { 1101 = JNZE }
45:pc := band(ir, amask); goto 0;
46:tir := lshift(tir); if n then goto 50;
47:sp := sp + (-1);                                 { 1110 = CALL }
48:mar := sp; mbr := pc; wr;
49:pc := band(ir, amask); wr; goto 0;
50:tir := lshift(tir); if n then goto 65;           { 1111, examine addr }
51:tir := lshift(tir); if n then goto 59;
52:alu := tir; if n then goto 56;
53:mar := ac; rd;                                   { 1111000 = PSHI }
54:sp := sp + (-1); rd;
55:mar := sp; wr; goto 10;
56:mar := sp; sp := sp + 1; rd;                     { 1111001 = POPI }
57:rd;
58:mar := ac; wr; goto 10;
59:alu := tir; if n then goto 62;
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60:sp := sp + (-1);                                  { 1111010 = PUSH }
61:mar := sp; mbr := ac; wr; goto 10;
62:mar := sp; sp := sp + 1; rd;                      { 1111011 = POP }
63:rd;
64:ac := mbr; goto 0;
65:tir := lshift(tir); if n then goto 73;
66:alu := tir; if n then goto 70;
67:mar := sp; sp := sp + 1; rd;                      { 1111100 = RETN }
68:rd;
69:pc := mbr; goto 0;
70:a := ac;                                          { 1111101 = SWAP }
71:ac := sp;
72:sp := a; goto 0;
73:alu := tir; if n then goto 76;
74:a := band(ir, smask);                             { 1111110 = INSP }
75:sp := sp + a; goto 0;
76:tir := tir + tir; if n then goto 80;
77:a := band(ir, smask);                             { 11111110 = DESP }
78:a := inv(a);
79:a := a + 1; goto 75;
80:rd; wr;                                           { 11111111 = HALT }
```