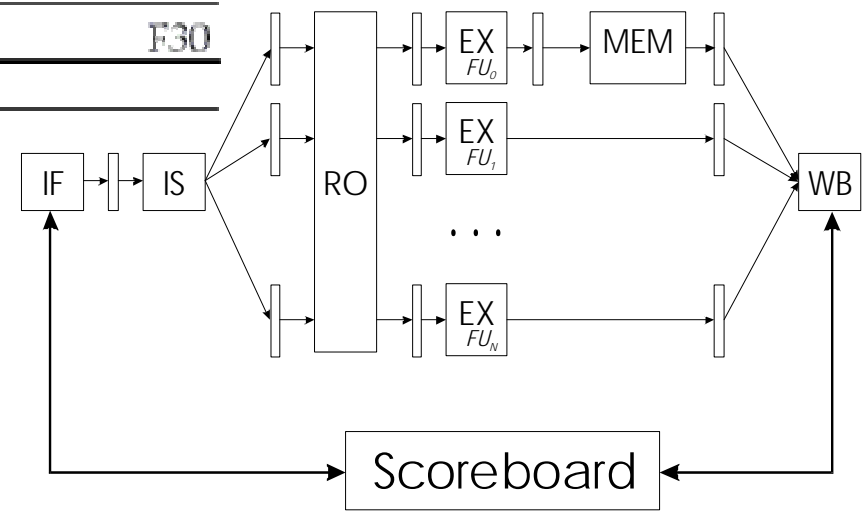


Scoreboarding

		Instruction Status			
Instruction	Issue	Read operands	Exec complete	Write result	
LD F6, 34(R2)	X	X	X	X	
LD F2, 45(R3)	X	X	X	X	
MULTD F0, F2, F4	X				
SUBD F8, F6, F2	X				
DIVD F10, F0, F6	X				
ADD F6, F8, F2					

		Functional Unit Status							
Name	Busy	Op	F _i	F _j	F _k	Q _j	Q _k	R _j	R _k
Integer	Yes	Load	F2	R3				No	
Mult1	Yes	Mult	F0	F2	F4	Int		No	Yes
Mult2	No								
Add	Yes	Sub	F8	F6	F2	Int		Yes	No
Divide	Yes	Div	F10	F0	F6	Mult1		No	Yes

		Register Result Status							
FU	F0	F2	F4	F6	F8	F10	F12	F30	
	Mult1	Int			Sub	Div			



Zależności danych

RAW

Read After Write

Write
 $y0 = a$
↘
 $y1 = y0$
Read

WAR

Write After Read

$y0 = y1$ Read
↙
 $y1 = 1$
Write

WAW

Write After Write

Write
 $y0 = 0$
↓
 $y0 = b$
Write

Scoreboarding

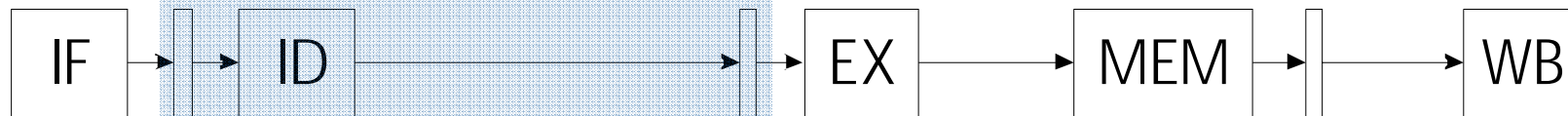
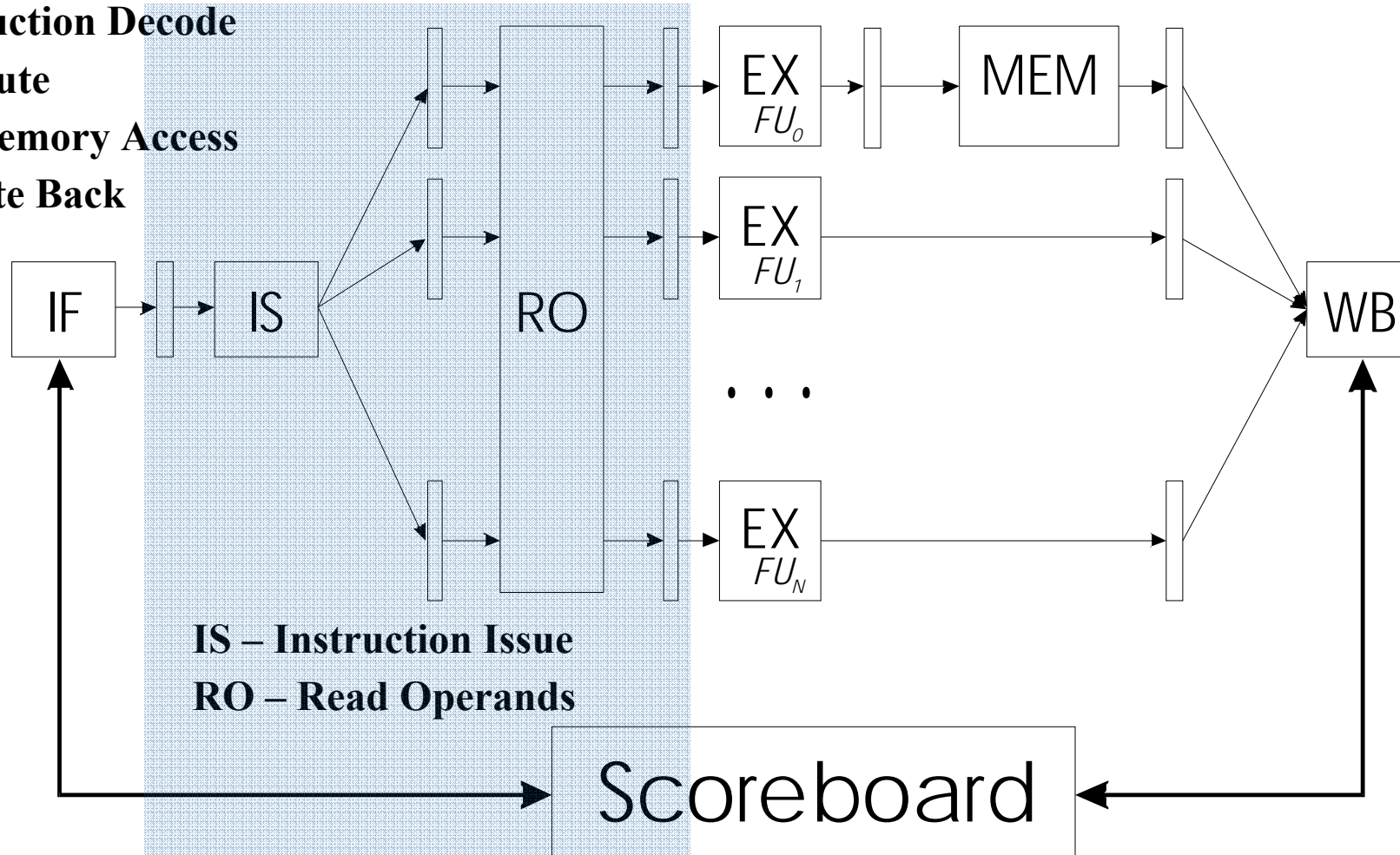
IF – Instruction Fetch

ID – Instruction Decode

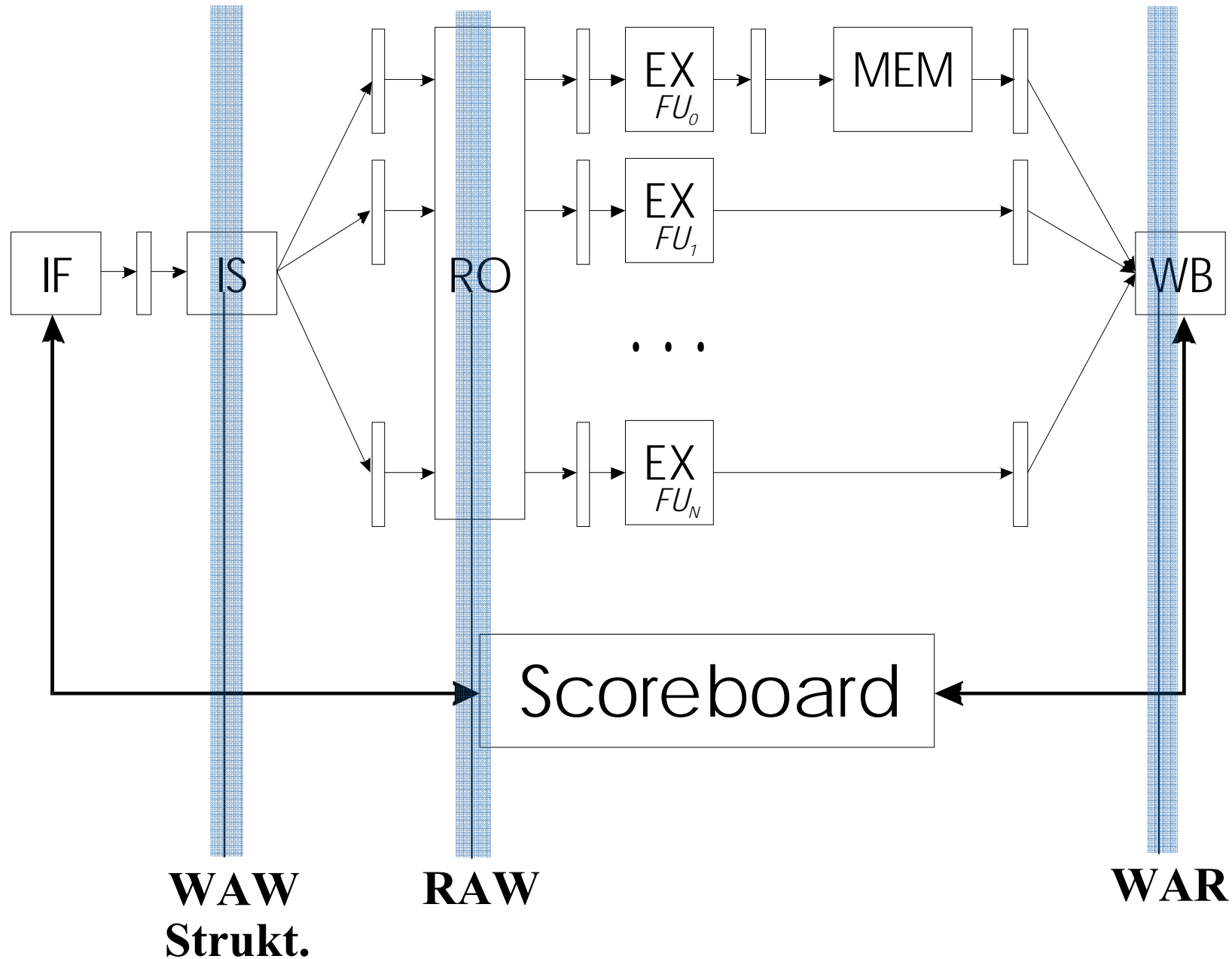
EX – Execute

MEM – Memory Access

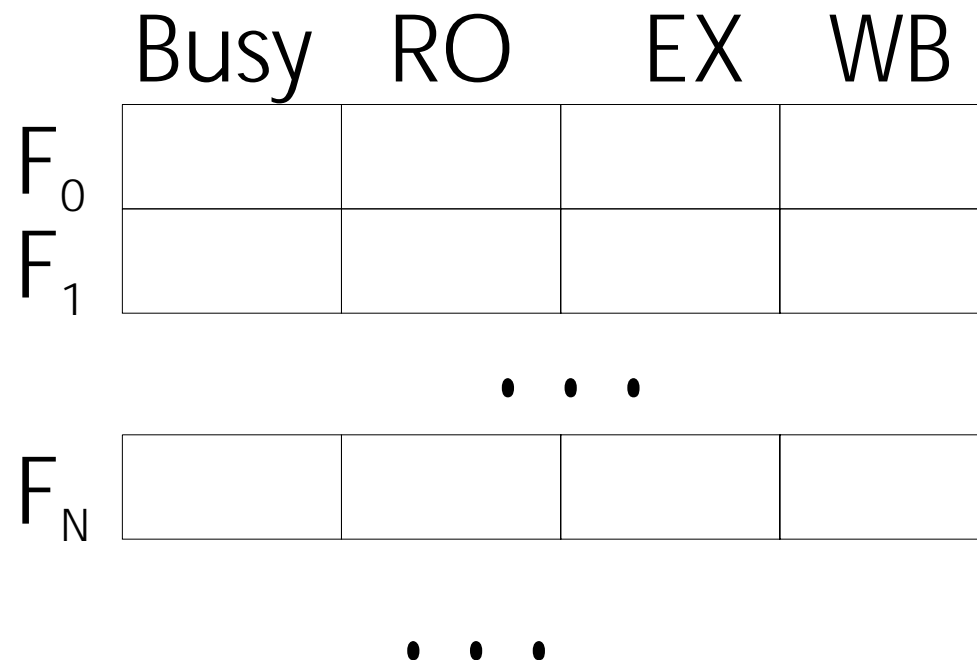
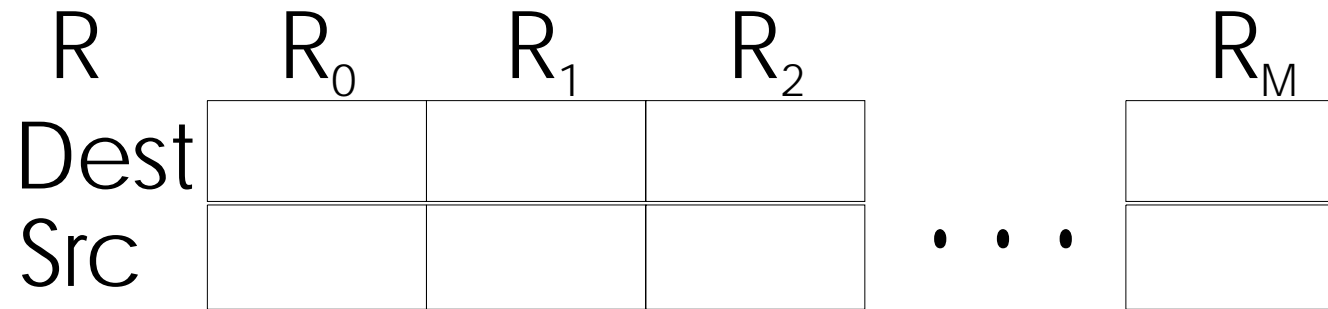
WB – Write Back



Zależności w scoreboarding



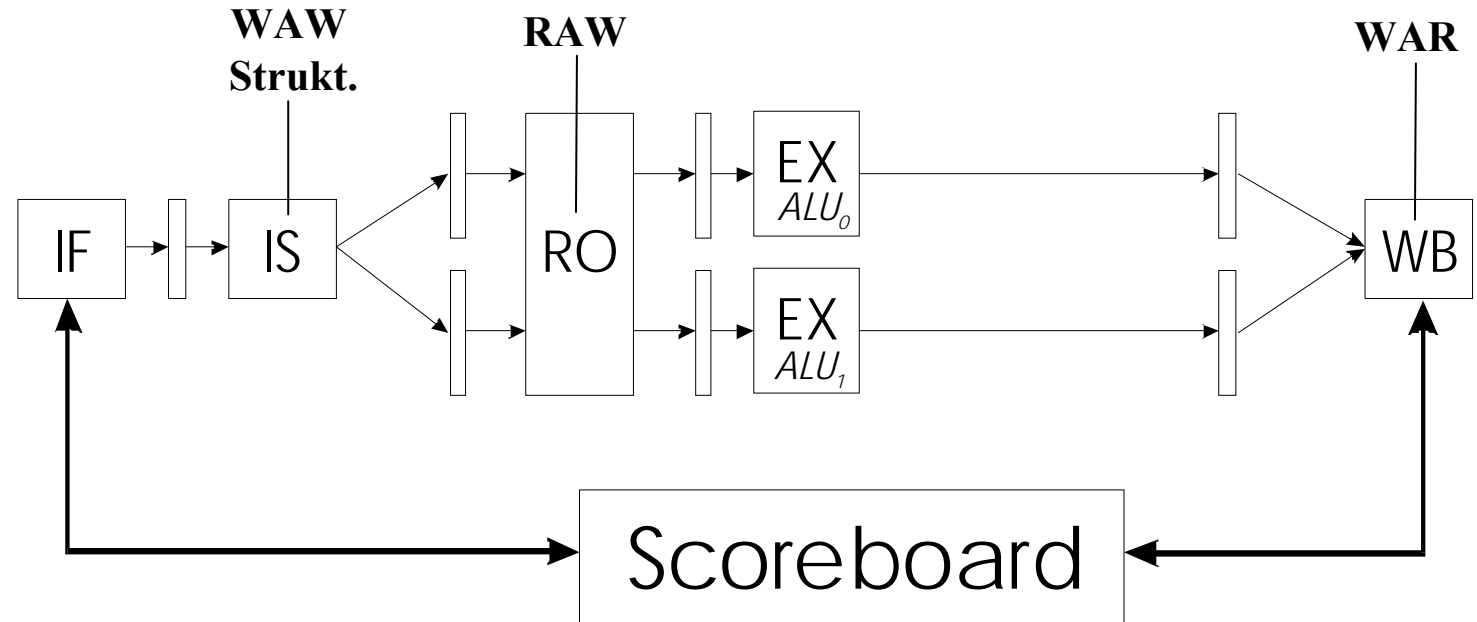
Struktury w scoreboarding



Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	0	0	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	0	0	0	0

Przykład

Program

(1) $y_0 = a + b$

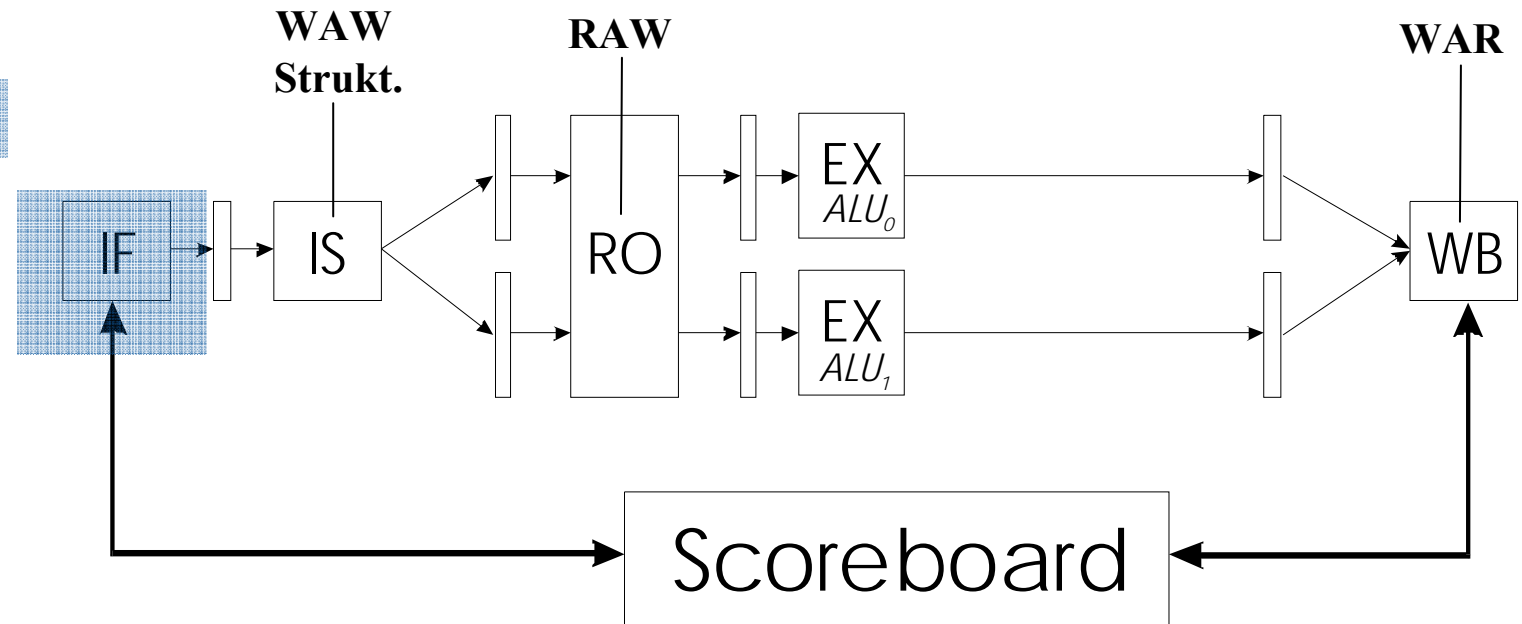
(2) $y_1 = y_0 + c$

(3) $y_2 = y_3$

(4) $y_1 = y_0 * s$

(5) $y_0 = a$

(6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	0	0	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	0	0	0	0

Przykład

Program

(1) $y_0 = a + b$

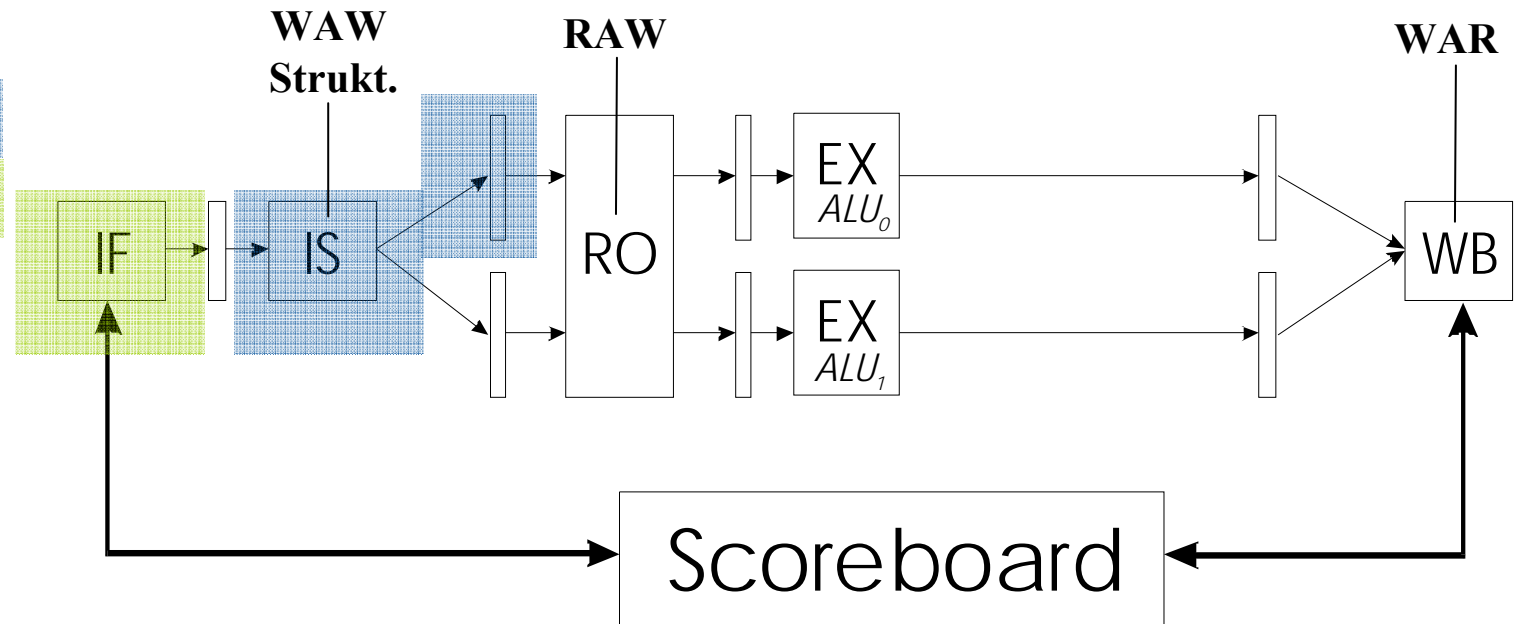
(2) $y_1 = y_0 + c$

(3) $y_2 = y_3$

(4) $y_1 = y_0 * s$

(5) $y_0 = a$

(6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	1	0	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	0	0	0
ALU ₁	0	0	0	0

Przykład

Program

(1) $y_0 = a + b$

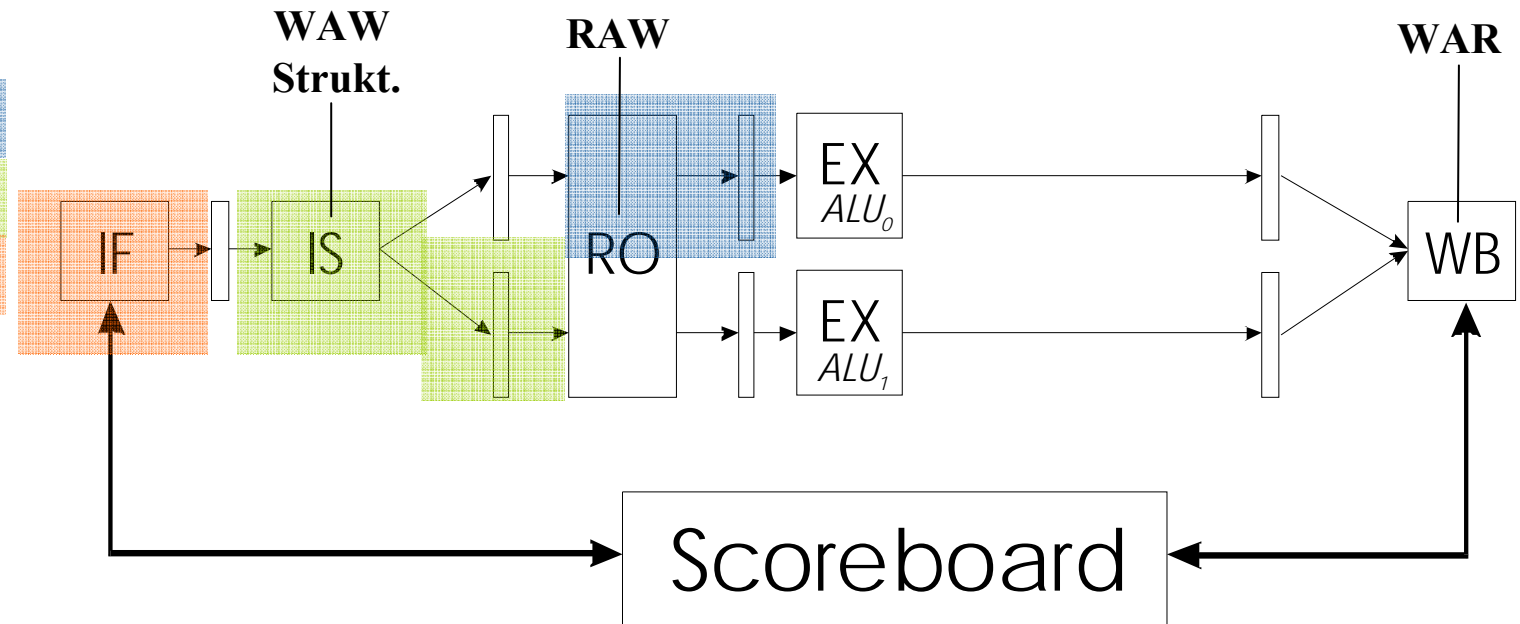
(2) $y_1 = y_0 + c$

(3) $y_2 = y_3$

(4) $y_1 = y_0 * s$

(5) $y_0 = a$

(6) $y_3 = b$



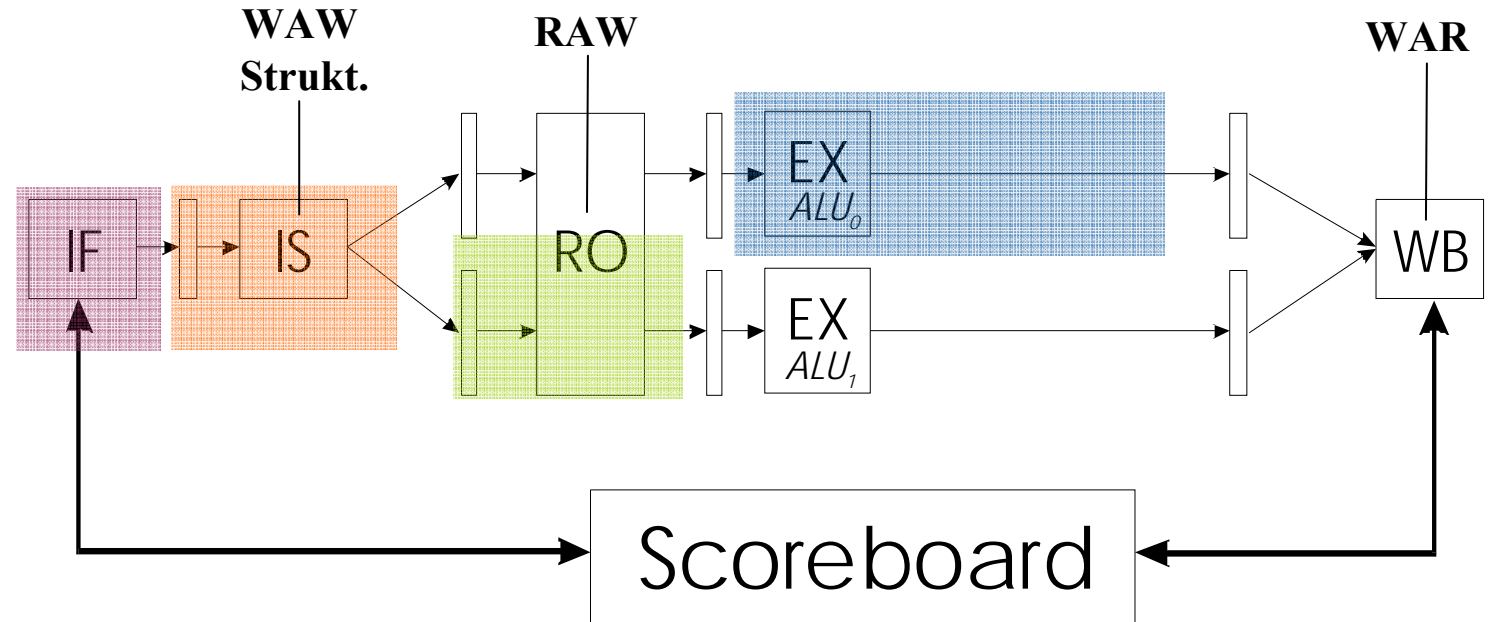
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	0	0
ALU ₁	1	0	0	0

Przykład

Program

(1) $y_0 = a + b$
 (2) $y_1 = y_0 + c$
 (3) $y_2 = y_3$
 (4) $y_1 = y_0 * s$
 (5) $y_0 = a$
 (6) $y_3 = b$



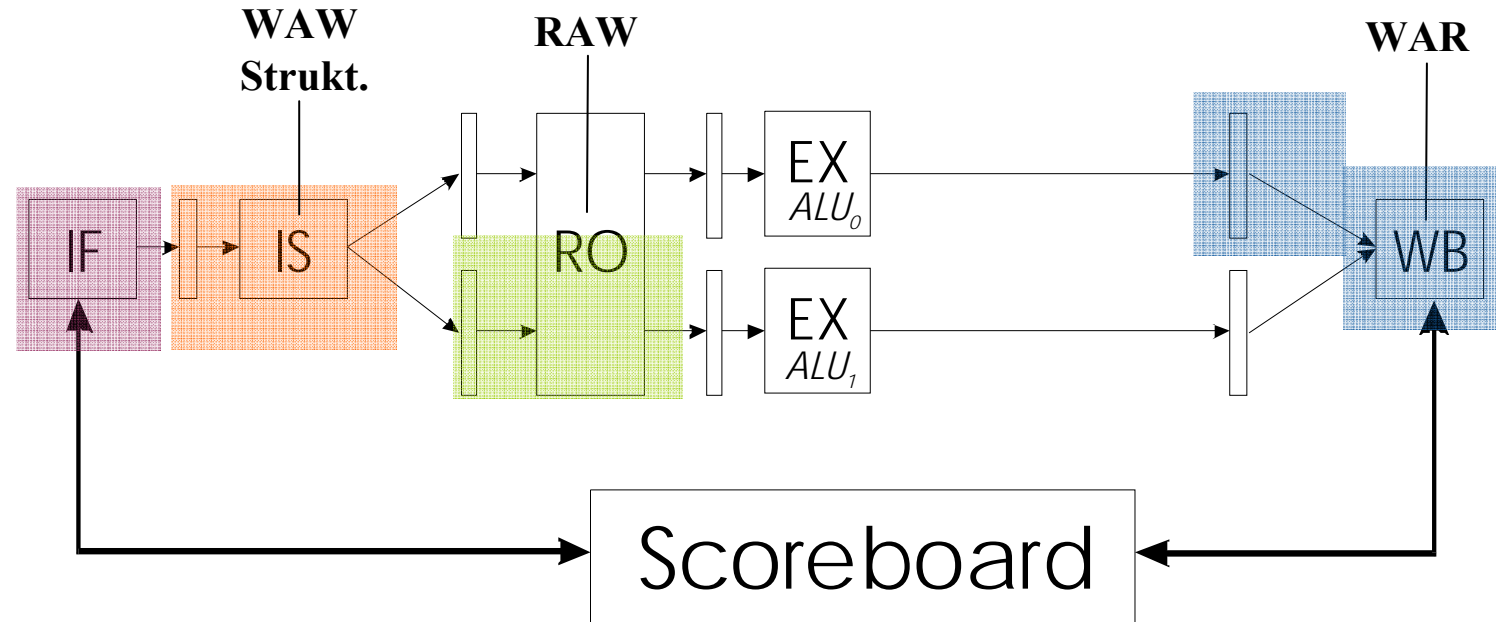
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	0	0	0

Przykład

Program

(1) $y_0 = a + b$
 (2) $y_1 = y_0 + c$
 (3) $y_2 = y_3$
 (4) $y_1 = y_0 * s$
 (5) $y_0 = a$
 (6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	1
ALU ₁	1	0	0	0

Przykład

Program

(1) $y_0 = a + b$

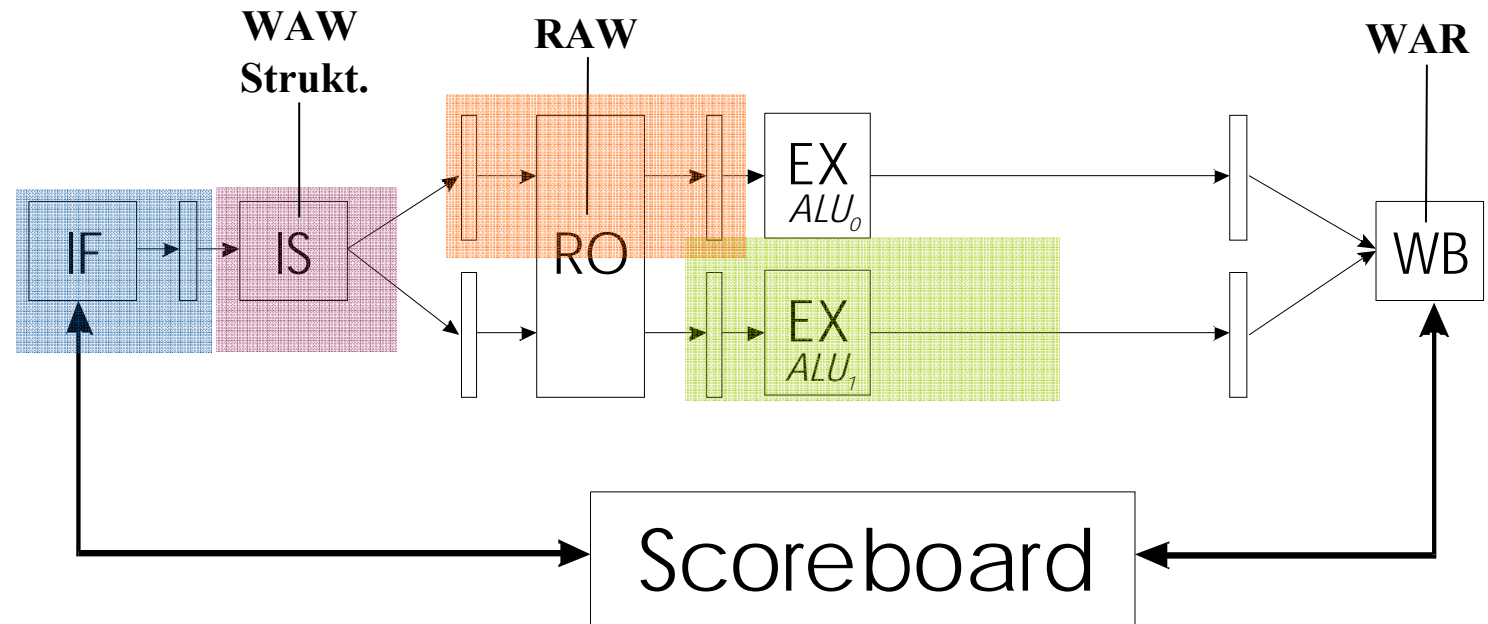
(2) $y_1 = y_0 + c$

(3) $y_2 = y_3$

(4) $y_1 = y_0 * s$

(5) $y_0 = a$

(6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	0	1	1	0
Src	1	0	0	1

	Busy	RO	EX	WB
ALU ₀	1	1	0	0
ALU ₁	1	1	0	0

Przykład

Program

(1) $y_0 = a + b$

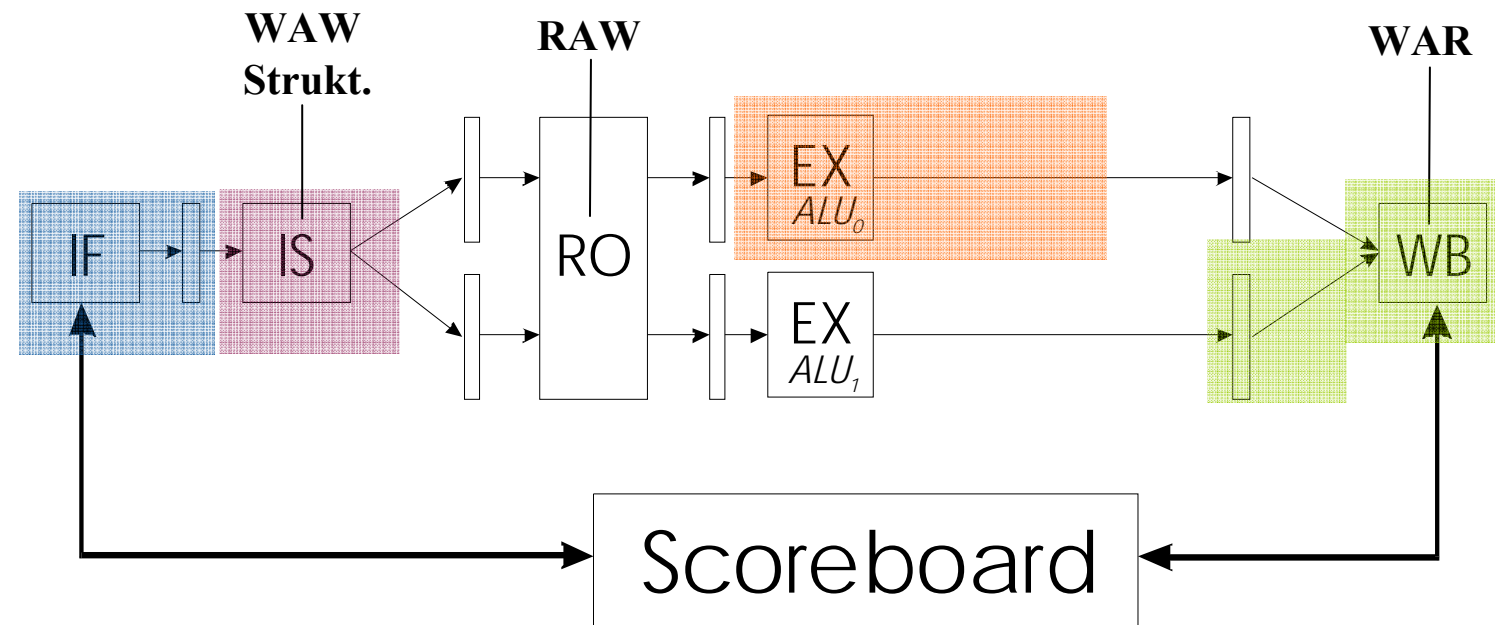
(2) $y_1 = y_0 + c$

(3) $y_2 = y_3$

(4) $y_1 = y_0 * s$

(5) $y_0 = a$

(6) $y_3 = b$



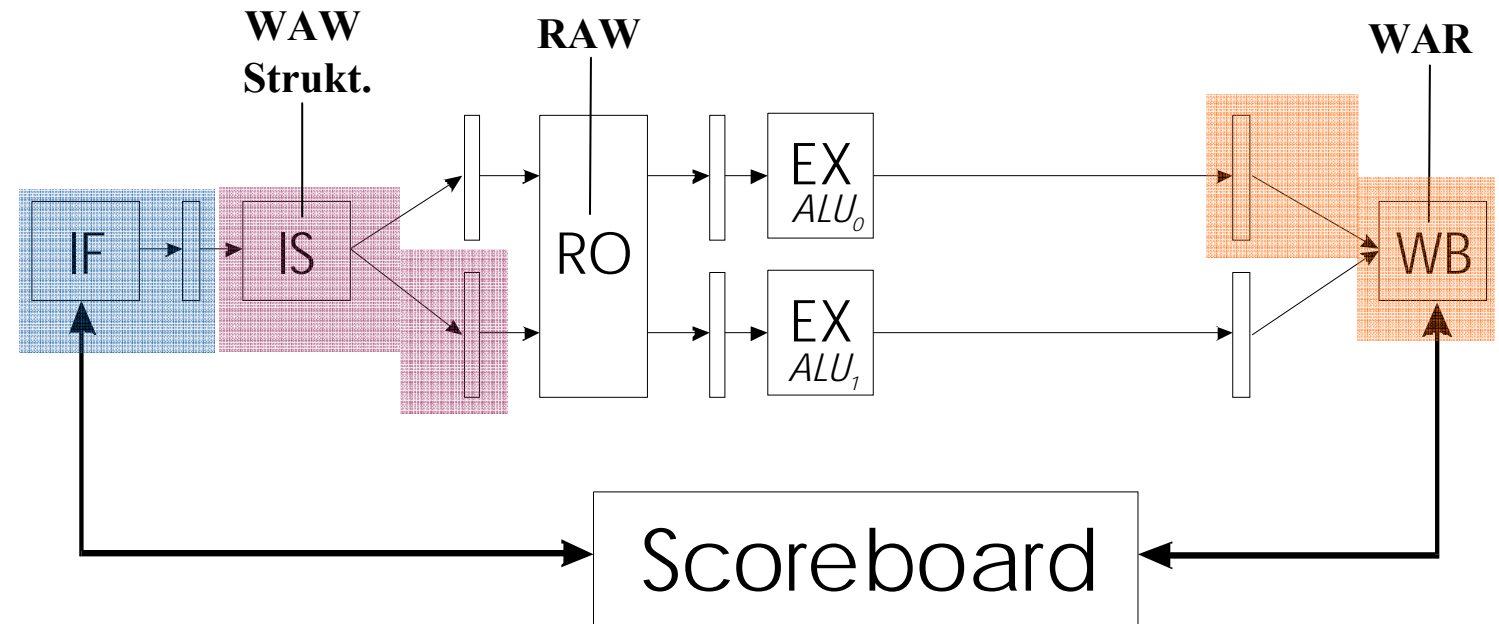
R	y_0	y_1	y_2	y_3
Dest	0	1	1	0
Src	1	0	0	1

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	1

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



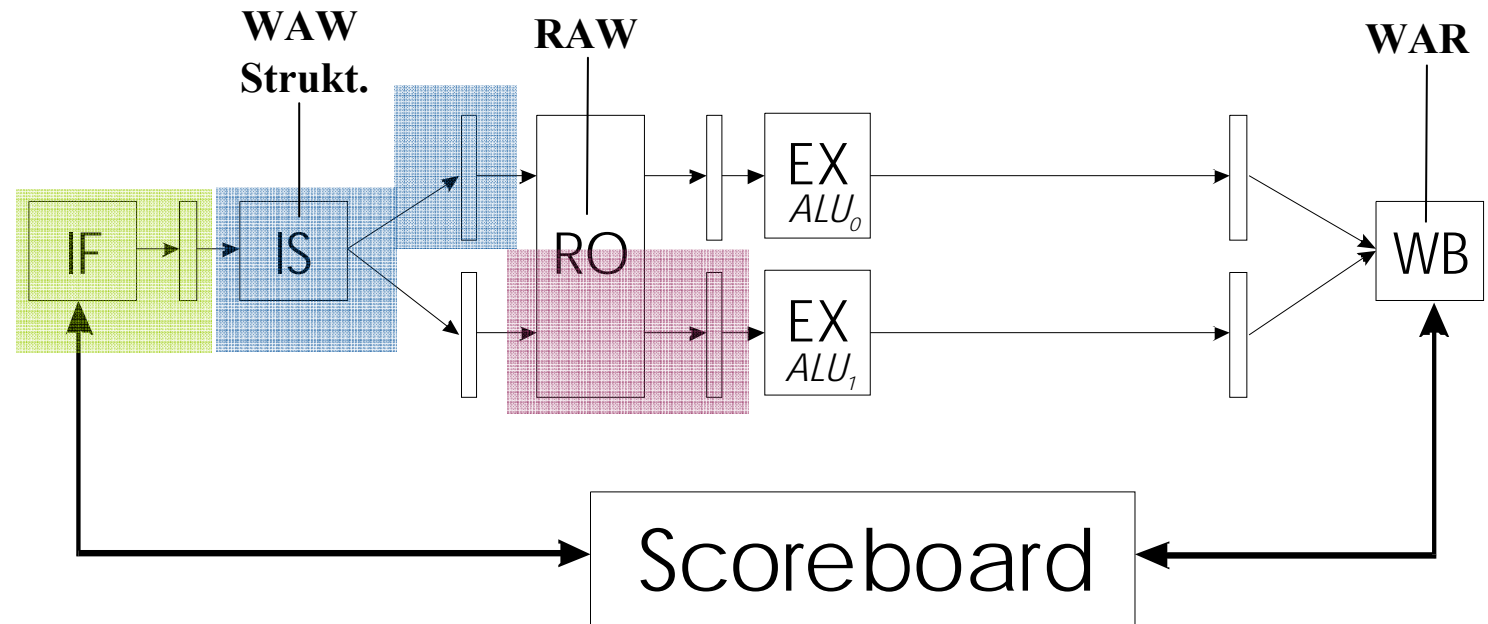
R	y_0	y_1	y_2	y_3
Dest	0	1	1	0
Src	1	0	0	1

	Busy	RO	EX	WB
ALU ₀	1	1	1	1
ALU ₁	1	0	0	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



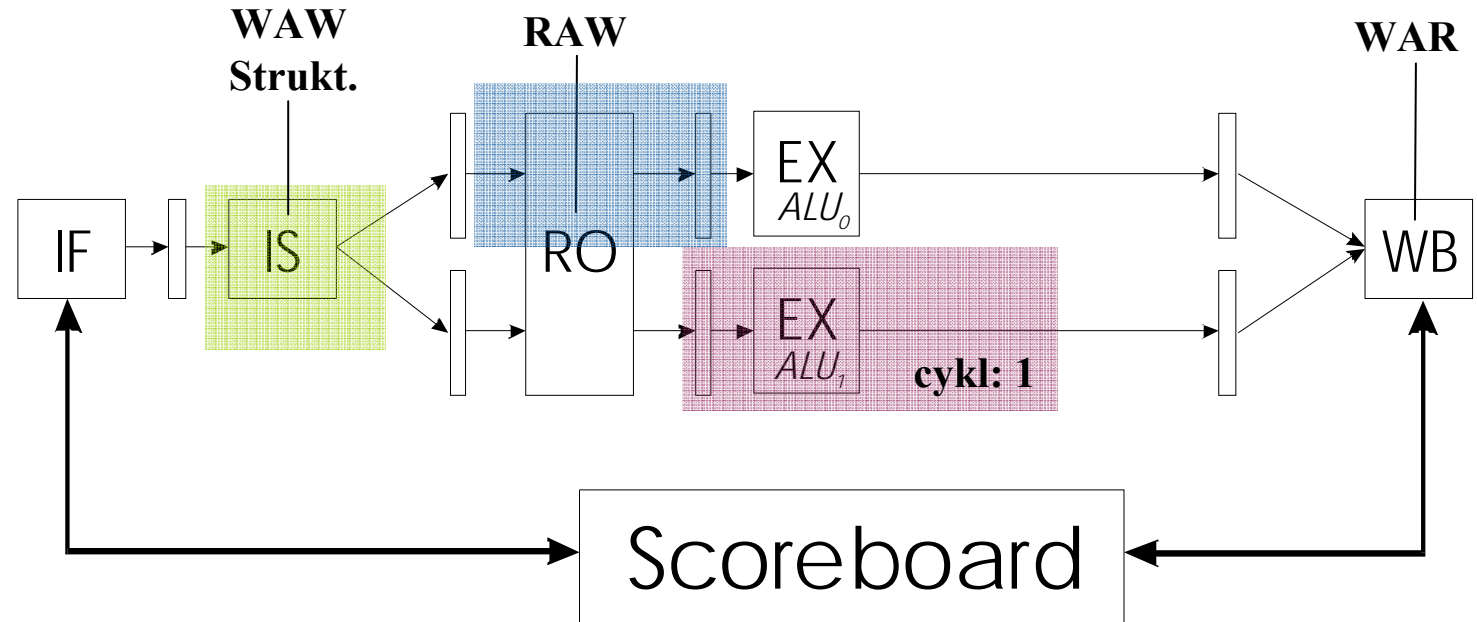
R	y_0	y_1	y_2	y_3
Dest	0	1	1	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	0	0	0
ALU ₁	1	1	0	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



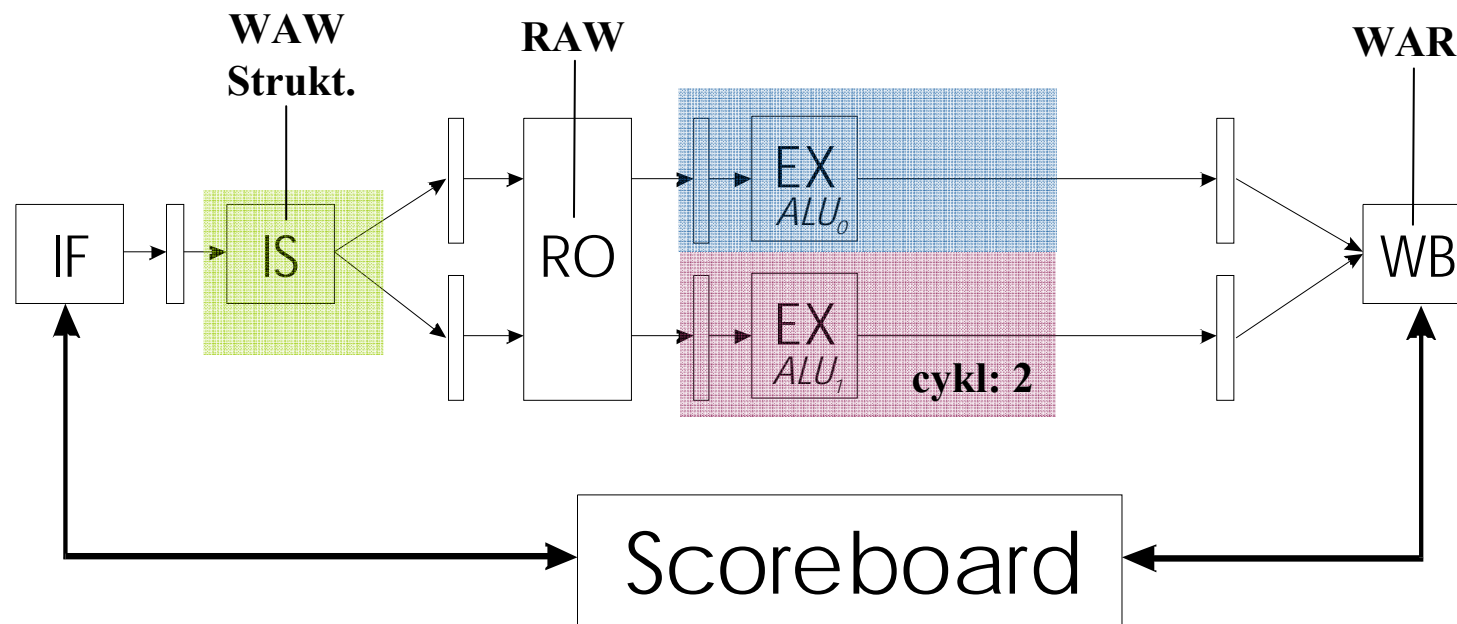
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU_0	1	1	0	0
ALU_1	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



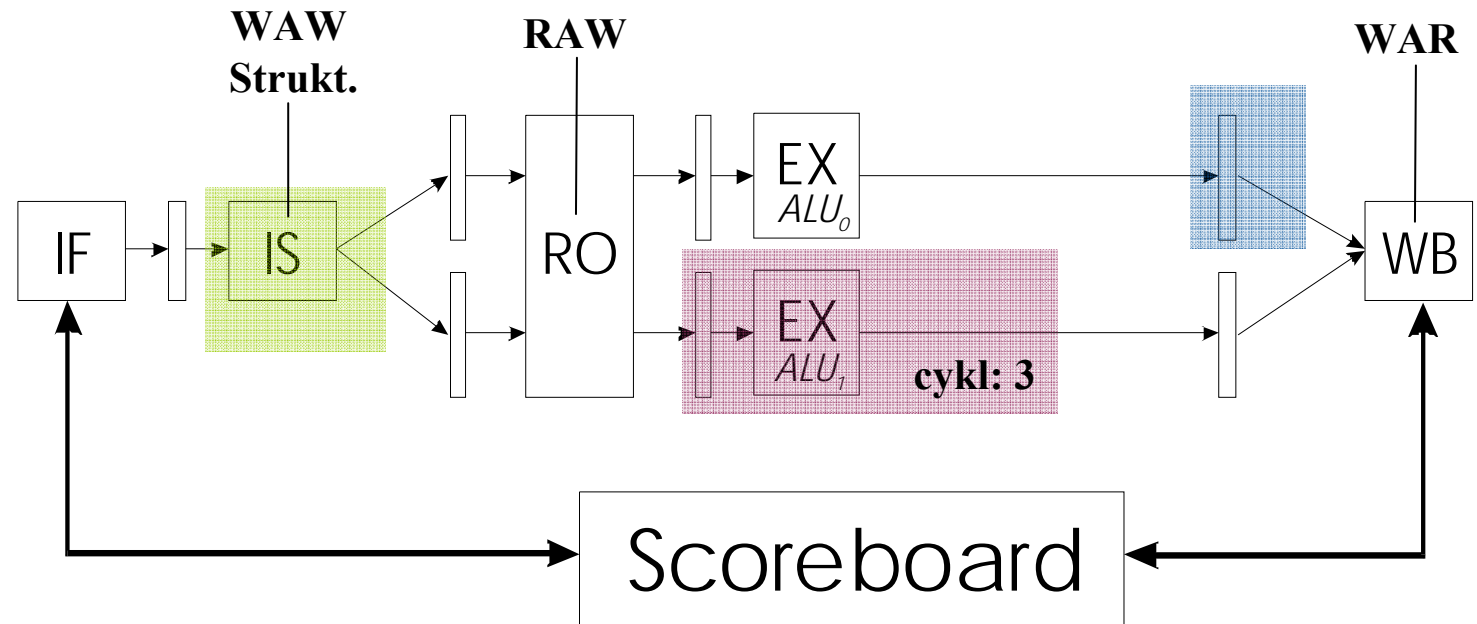
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



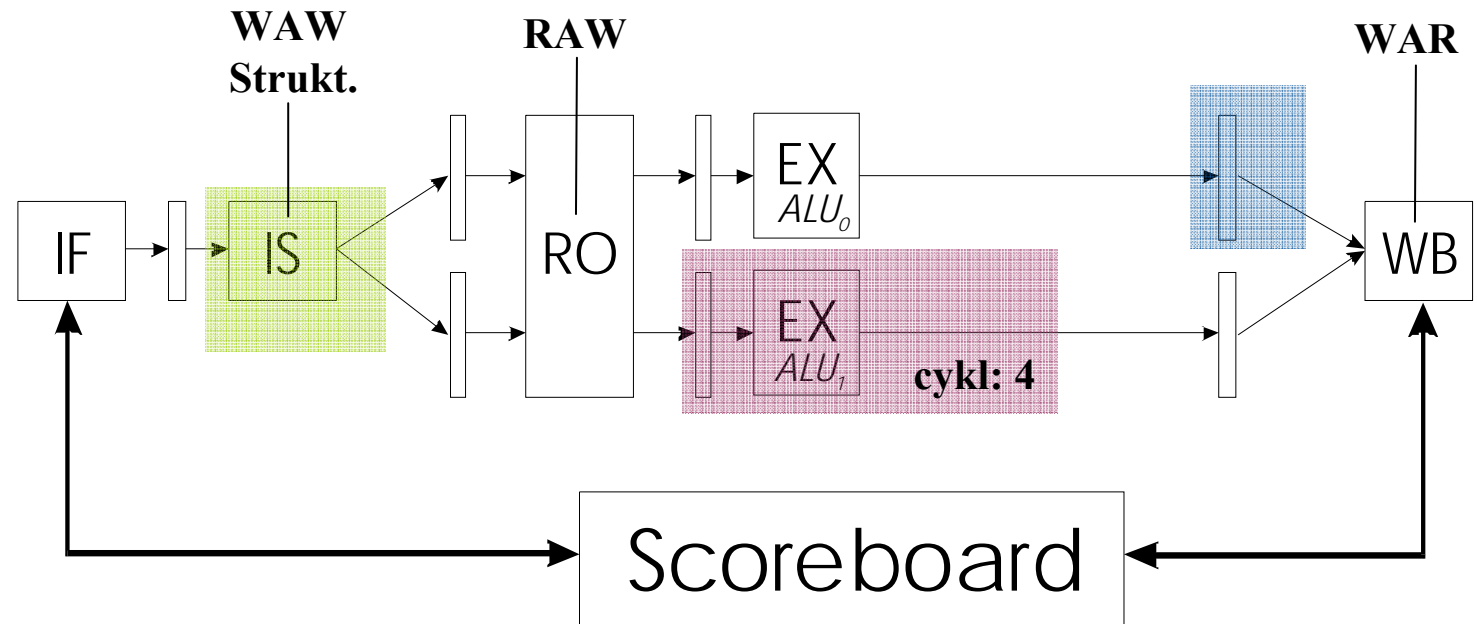
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



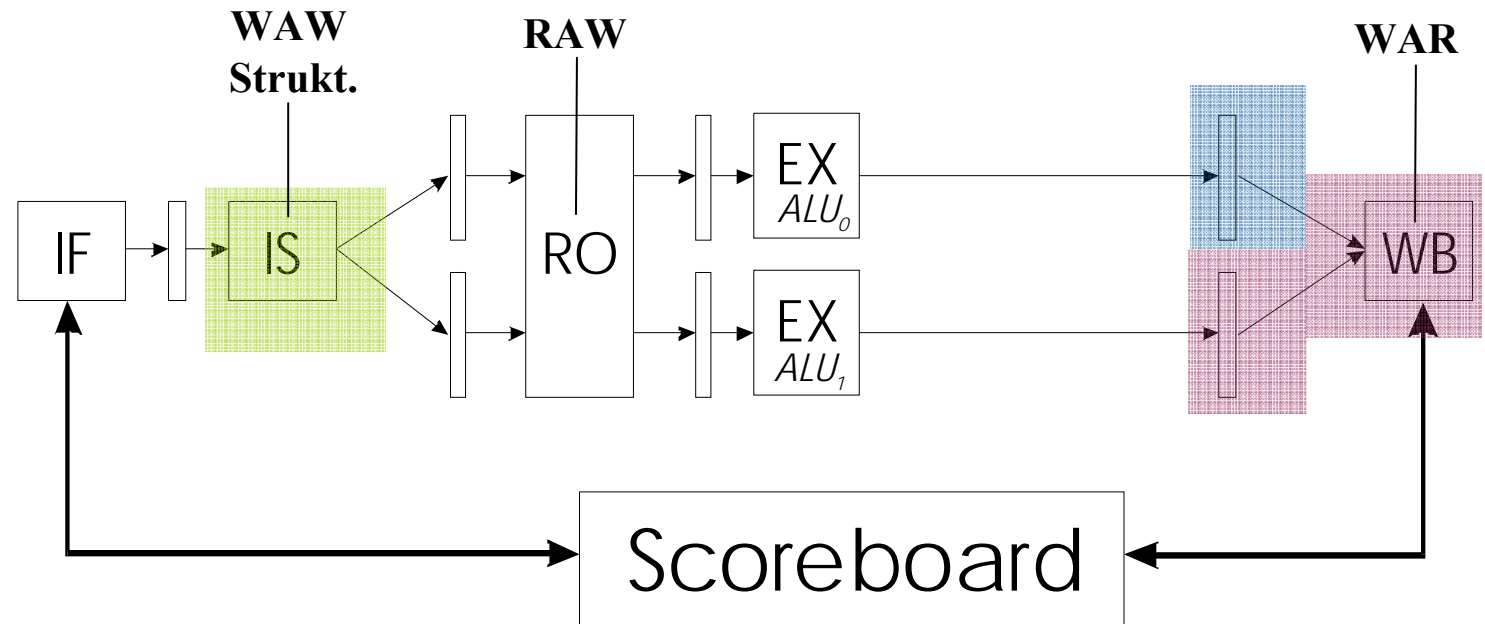
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



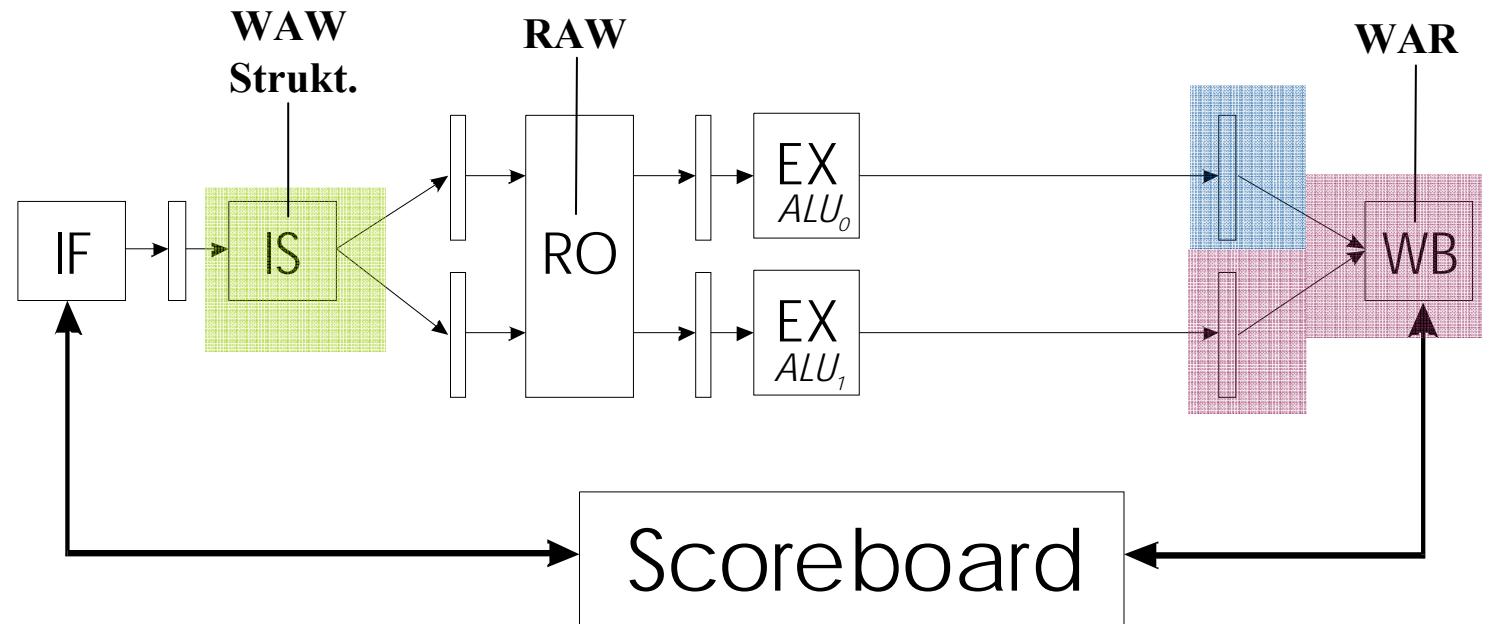
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



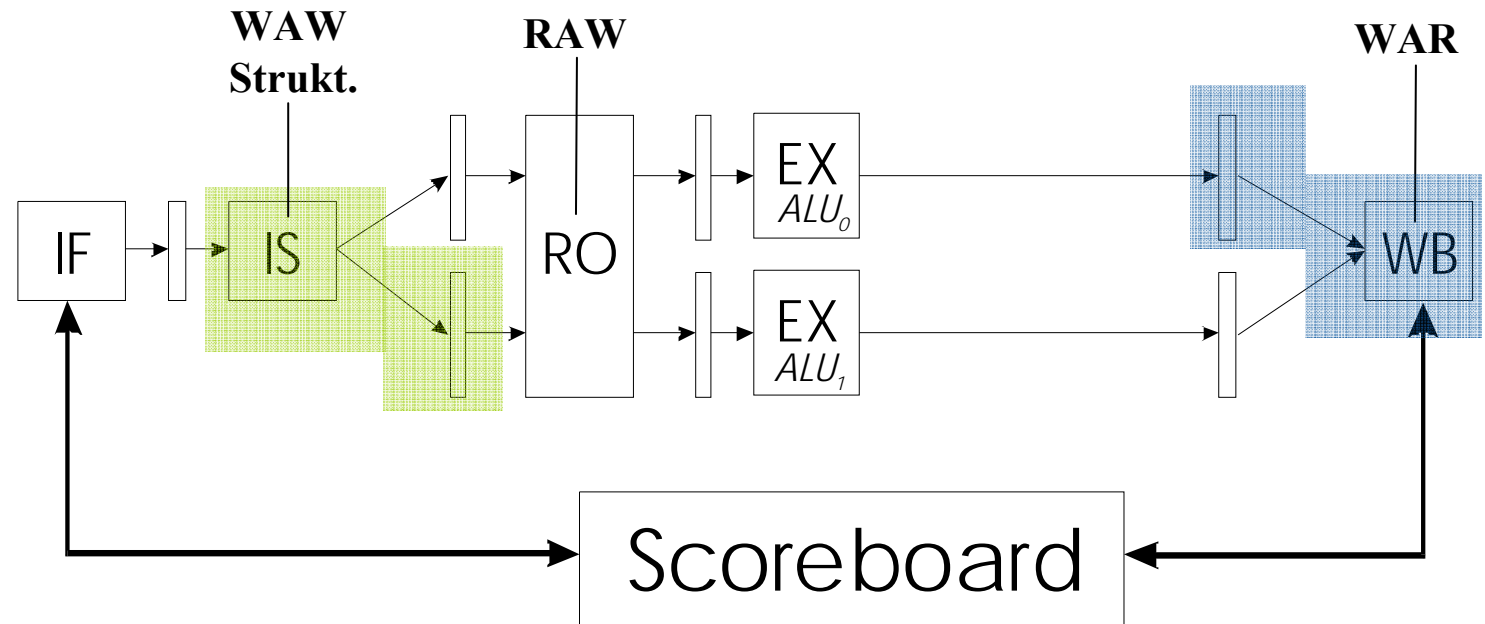
R	y_0	y_1	y_2	y_3
Dest	1	1	0	0
Src	1	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	0
ALU ₁	1	1	1	1

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



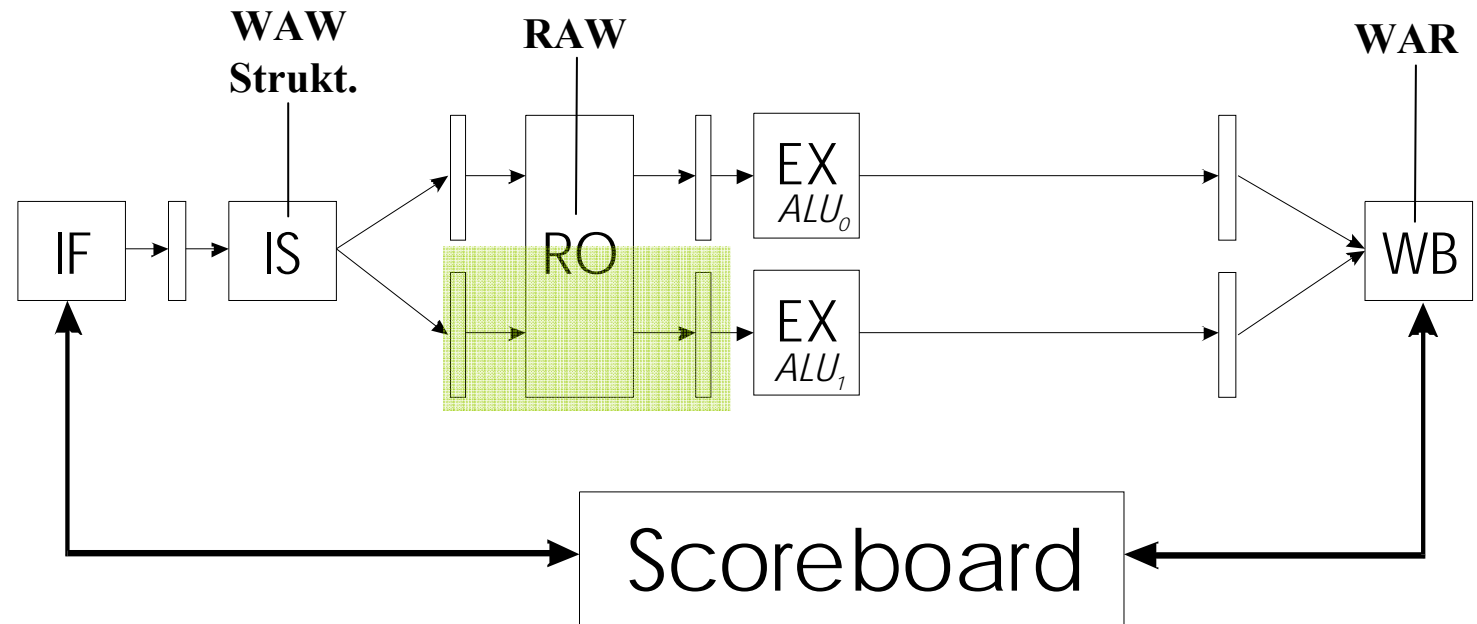
R	y_0	y_1	y_2	y_3
Dest	1	0	0	1
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	1	1	1	1
ALU ₁	1	0	0	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



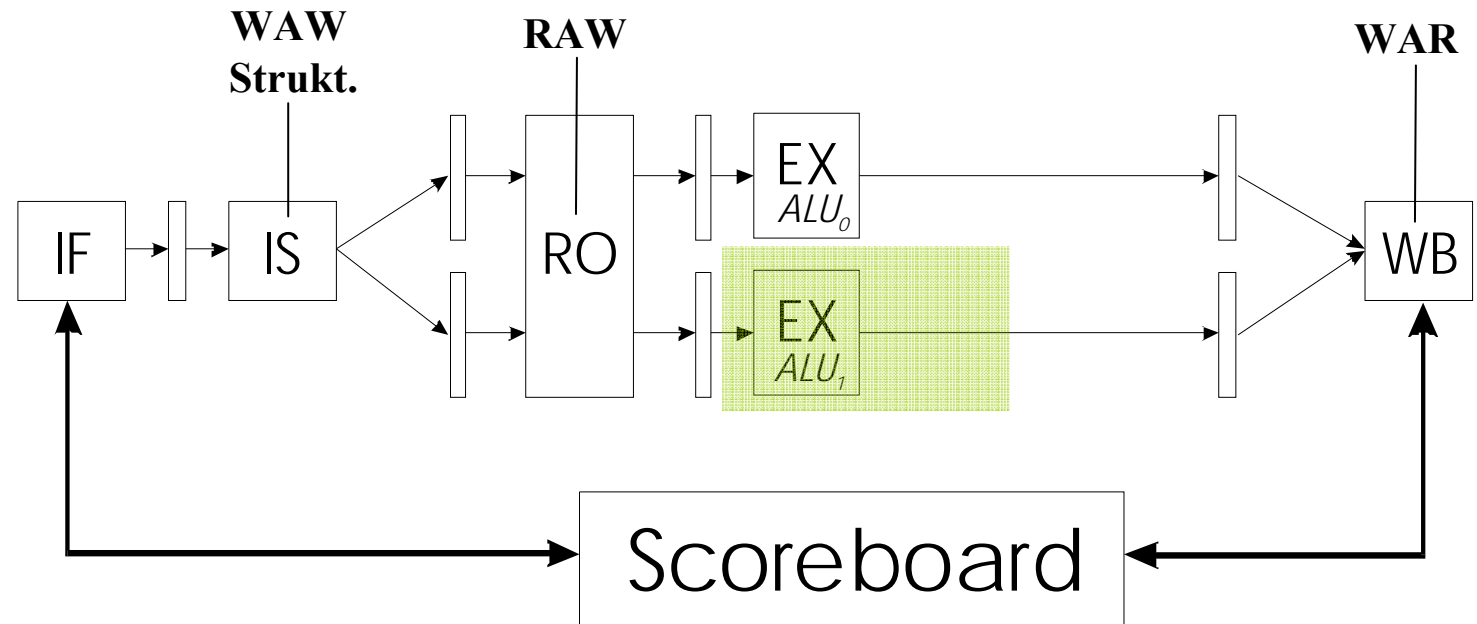
R	y_0	y_1	y_2	y_3
Dest	0	0	0	1
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	1	1	0	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



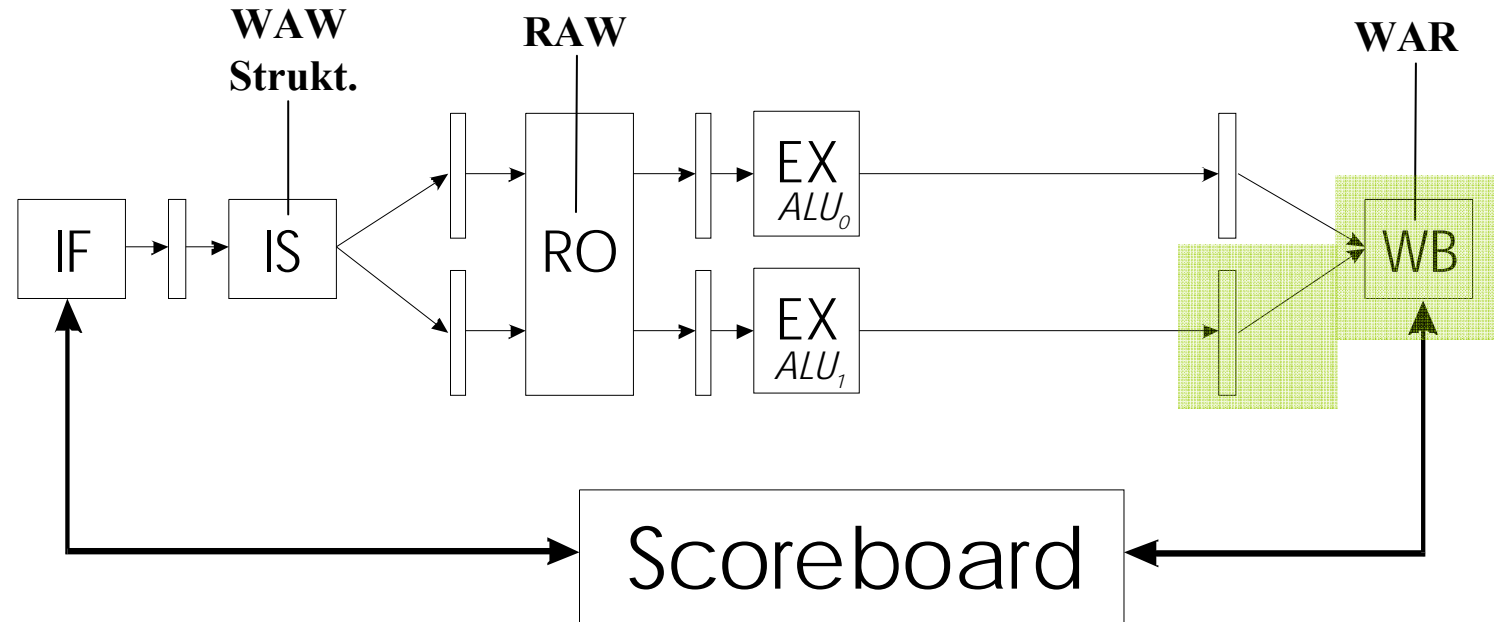
R	y_0	y_1	y_2	y_3
Dest	0	0	0	1
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	1	1	1	0

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



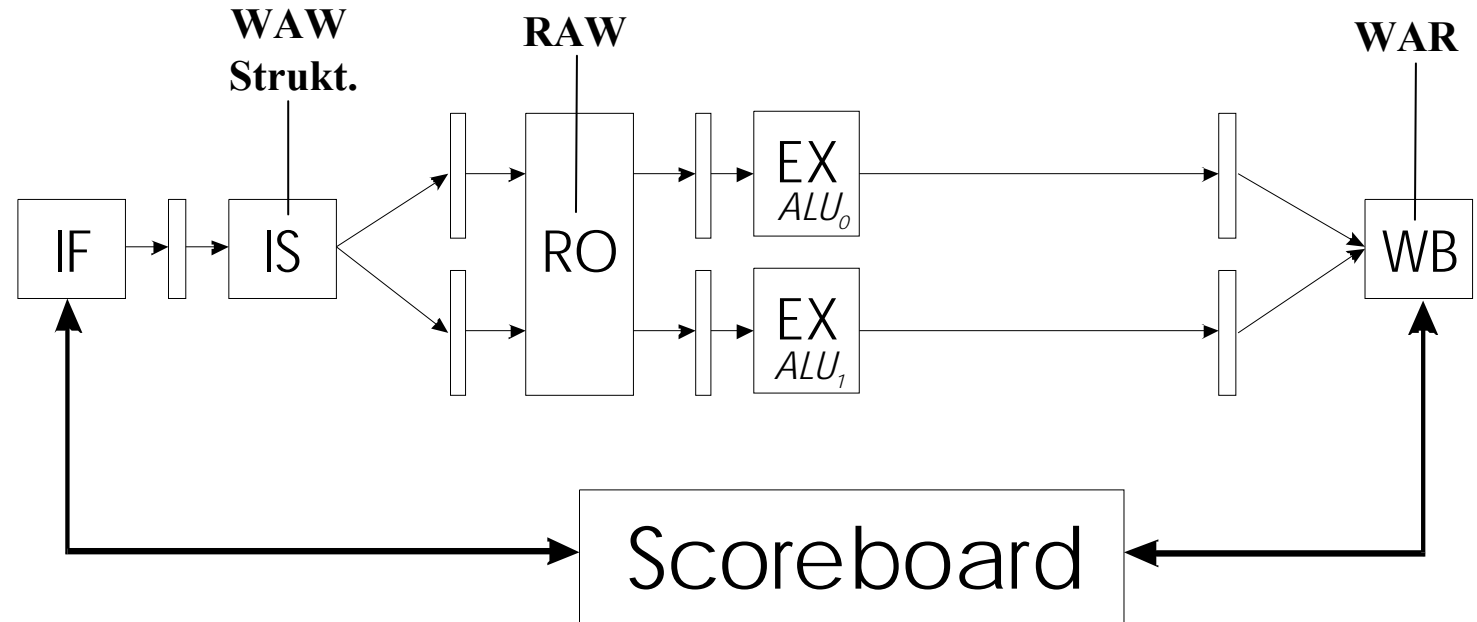
R	y_0	y_1	y_2	y_3
Dest	0	0	0	1
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	1	1	1	1

Przykład

Program

- (1) $y_0 = a + b$
- (2) $y_1 = y_0 + c$
- (3) $y_2 = y_3$
- (4) $y_1 = y_0 * s$
- (5) $y_0 = a$
- (6) $y_3 = b$



R	y_0	y_1	y_2	y_3
Dest	0	0	0	0
Src	0	0	0	0

	Busy	RO	EX	WB
ALU ₀	0	0	0	0
ALU ₁	0	0	0	0

DZIĘKUJE

