



Reservation Station



Reservation Station

- 保留站 - 进行Renaming操作

Reservation stations								
Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
Load1	No							
Load2	No							
Add1	No							
Add2	No							
Add3	No							
Mult1	No	fmul.d	Mem[44 + Regs[x3]]	Regs[f4]			#3	
Mult2	Yes	fdiv.d		Mem[32 + Regs[x2]]	#3		#5	

- Busy - 当前 station 是否被使用
- Op - 操作类型
- Vj, Vk - source 的 Value
- Qj, Qk - source 的新编号

如果存在依赖关系并且依赖的数据未得到, 则 Qj/Qk 非 0; 若两者都为 0, 则说明该指令 ready

- Dest - 目的寄存器
- A - 立即数



Reservation Station

Reservation stations										
Name	Busy	Op	Vj	Vk			Qj	Qk	Dest	A
Load1	No									
Load2	No									
Add1	No									
Add2	No									
Add3	No									
Mult1	No	fmul.d	Mem[44 + Regs[x3]]	Regs[f4]					#3	
Mult2	Yes	fdiv.d		Mem[32 + Regs[x2]]			#3		#5	
FP register status										
Field	f0	f1	f2	f3	f4	f5	f6	f7	f8	f10
Reorder #	3						6		4	5
Busy	Yes	No	No	No	No	No	Yes	...	Yes	Yes

- Value - 寄存器中的值
- Reorder (Qj) - 寄存器的新编号（意义：当前这个时刻该寄存器的值应该是哪条指令的结果）
- Busy - 是否处于被 Renaming 的状态（可以用 Qj 是否为 0 替代）



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No							
RS2	No							

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	0	0	0		0	0



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	Yes	ADD	4000	396			R1	
RS2	No							

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	RS1	0	0		0	0



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	Yes	ADD	4000	396			R1	
RS2	No							

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	RS1	0	0		0	0



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No	ADD	4000	396			R1	
RS2	No							

→ ALU

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	RS1	0	0		0	0



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No	ADD	4000	396			R1	
RS2	Yes	ADD		R[R6]	RS1		R7	

→ ALU

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	RS1	0	0		0	RS2



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No	ADD	4000	396			R1	
RS2	Yes	ADD		R[R6]	RS1		R7	

→ DONE

Field	R1	R2	R3	...	R6	R7
Value	0	4000	396		1	0
Qj	RS1	0	0		0	RS2



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No	ADD	4000	396			R1	
RS2	No	ADD	4396	1	0		R7	

→ ALU

Field	R1	R2	R3	...	R6	R7
Value	4396	4000	396		1	0
Qj	0	0	0		0	RS2



Reservation Station

- ADD R1, R2, R3
- ADD R7, R1, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	A
RS1	No	ADD	4000	396			R1	
RS2	No	ADD	4396	1	0		R7	

Field	R1	R2	R3	...	R6	R7
Value	4396	4000	396		1	4397
Qj	0	0	0		0	0



Reorder Buffer



Reorder Buffer

- 重排序缓冲区 - 允许指令乱序执行，但必须顺序提交

Reorder buffer						
Entry	Busy	Instruction		State	Destination	Value
1	No	f1d	f6,32(x2)	Commit	f6	Mem[32 + Regs[x2]]
2	No	f1d	f2,44(x3)	Commit	f2	Mem[44 + Regs[x3]]
3	Yes	fmul.d	f0,f2,f4	Write result	f0	#2 × Regs[f4]
4	Yes	fsub.d	f8,f2,f6	Write result	f8	#2 − #1
5	Yes	fdiv.d	f0,f0,f6	Execute	f0	
6	Yes	fadd.d	f6,f8,f2	Write result	f6	#4 + #2



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No							
RS2	No							
RS3	No							

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	666		233
Reorder			

Entry	Busy	Instruction	Ready	Dest	Value
1					
2					
3					



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	Yes	DIV	R[R2]	R[R3]			1	
RS2	No							
RS3	No							

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	666		233
Reorder	1		

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	No	R1	
2					
3					



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ		R[R4]	1		2	0
RS3	No							

Op	rs1	rs2	Reorder
DIV	R[R2]	R[R3]	1

Field	R1	...	R7
Value	666		233
Reorder	1		

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	No	R1	
2	Yes	L2	No		
3					



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ		R[R4]	1		2	0
RS3	Yes	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder
DIV	R[R2]	R[R3]	1

Field	R1	...	R7
Value	666		233
Reorder	1		3

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	No	R1	
2	Yes	L2	No		
3	Yes	L3	No	R7	



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ		R[R4]	1		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder
DIV	R[R2]	R[R3]	1
ADD	R[R5]	R[R6]	3

Field	R1	...	R7
Value	666		233
Reorder	1		3

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	No	R1	
2	Yes	L2	No		
3	Yes	L3	No	R7	



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ		R[R4]	1		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder
DIV	R[R2]	R[R3]	1

Field	R1	...	R7
Value	666		233
Reorder	1		3

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	No	R1	
2	Yes	L2	No		
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ		R[R4]	1		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	666		233
Reorder	1		3

Entry	Busy	Instruction	Ready	Dest	Value
1	Yes	L1	Yes	R1	6666
2	Yes	L2	No		
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	Yes	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		233
Reorder	0		3

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	Yes	L2	No		
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder
BEQ	6666	R[R4]	2

Field	R1	...	R7
Value	6666		233
Reorder	0		3

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	Yes	L2	No		
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		233
Reorder	0		3

- 如果需要跳转

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	Yes	L2	Yes		1
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		233
Reorder	0		0

- 如果需要跳转

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	No	L2	Yes		1
3	No	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		233
Reorder	0		3

- 如果不需要跳转

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	Yes	L2	Yes		0
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		233
Reorder	0		3

- 不需要跳转

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	No	L2	Yes		0
3	Yes	L3	Yes	R7	2333



Reorder Buffer

- L1: DIV R1, R2, R3
- L2: BEQ R1, R4, 0
- L3: ADD R7, R5, R6

Name	Busy	Op	Vj	Vk	Qj	Qk	Reorder	A
RS1	No	DIV	R[R2]	R[R3]			1	
RS2	No	BEQ	6666	R[R4]	0		2	0
RS3	No	ADD	R[R5]	R[R6]			3	

Op	rs1	rs2	Reorder

Field	R1	...	R7
Value	6666		2333
Reorder	0		0

- 如果不需要跳转

Entry	Busy	Instruction	Ready	Dest	Value
1	No	L1	Yes	R1	6666
2	No	L2	Yes		0
3	No	L3	Yes	R7	2333