转发型冲突

1. 需求者：
   1. D:beq, jr, jalr
   2. E:calr, cali, ld, st
   3. M:sw
2. 供给者
   1. EM:calr, cali, jal, jalr
   2. MW: ld+(calr, cali, jal, jalr)



EM:calr/cali/jal/jalr

MW:calr/cali/jal/jalr /jalr

MW:ld

D:branch-rs

D:branch-rt

D:jr-rs

D:jalr-rs

E:calr-rs

E:calr-rt

E:cali-rs

E:ld-rs

E:st-rs

M:st-rt

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|  | 位置 | 前序指令 | 冲突寄存器 | 实例代码 |
| 1 | D-M | nop, addu | Rs | addu $1, $2, $3  nop  beq $1,$2, label |
| 2 | D-M | nop, sll | Rt | sll $1, $2, 5  nop  beq $2, $1, label |
| 3 | D-M | nop, ori | Rs | ori $1, $1, 5  nop  jr $1 |
| 4 | D-M | nop, jal | Rt | jal label  nop  beq $ra $1 label |
| 5 | D-M | nop, jal | Rs | jal label  nop  jr $ra |
|  | D-M | nop, jalr | Rs | jalr $ra $1  nop  beq $ra $1 label |
|  | D-M | nop, jalr | Rs | jalr $ra $1  nop |
| 6 | D-W | nop, nop, lw | Rt | lw $1, 0($0)  nop  nop  beq $1 $2 label |
| 7 | D-W | nop, nop, subu | Rs | subu $1, $2, $3  nop  nop  jr $1 |
| 8 | D-W | nop, nop, lui | Rt | lui $1, 100  nop  nop  beq $2, $1, label |
| 9 | D-W | nop, nop, jal | Rs | jal label  nop  nop  jr $ra |
| 10 | E-M | subu | Rs | subu $1, $2, $3  addu $2, $1, $2 |
| 11 | E-M | lui | Rs | lui $1, 100  addu $2, $1, $1 |
| 12 | E-M | sll | Rt | sll $1,$1,5  ori $1, $1, 1 |
| 13 | E-M | jal | Rs | jal label  lw $1, -4($31) |
| 14 | E-M | jal | Rs | jal label  sw $1, 4($31) |
| 15 | E-M | ori | Rs | ori $1, 100  lw $2, 100($1) |
| 16 | E-W | nop, lw | Rs | lw $1, 0($0)  nop  sw $2, 0($1) |
| 17 | E-W | nop. lw | Rt | lw $1, 0($0)  nop  subu $2,$1,$1 |
| 18 | E-W | nop, lw | RS | lw $1, 80($0)  nop  ori $1,$1,0xf000 |
| 19 | E-W | nop, lw | Rs | lw $1, 200($0)  nop  lw $2, 0($1) |
| 20 | E-W | nop, ori | Rt | ori $1 $2 4  nop  addu $1 $0 $1 |
| 21 | E-W | nop, jal | Rs | jal label  nop  sw $1 0($31) |
| 22 | E-W | nop, subu | Rs | subu $2,$1,$1  nop  lw $3,0($2) |
| 23 | M-W | lw | Rt | lw $1 0($0)  sw $1 4($0) |
| 24 | M-W | lui | Rt | lui $1 100  sw $1 0($0) |
| 25 | M-W | jal | Rt | jal label  sw $31 100($0) |
| 26 | M-W | subu | Rt | subu $1,$0,$1  sw $1, 100($0) |
| 27 | 无冲突 |  |  | lw $0, 0($0)  nop  addu $1,$0,$1 |
| 28 | 无冲突 |  |  | lui $0 100  sw $0 0($1) |

暂停型冲突

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| 编号 | 位置 | 前序指令 | 冲突寄存器 | 实例代码 |
| 1 | F-D | ld | Rs | lw $1, 0($2)  subu $2, $1, $2 |
| 2 | F-D | ld | Rt | lw $1, 0($3)  ori $2, $1, 1 |
| 3 | F-D | ld | Rs | lw $1, 0($2)  lw $2, 0($1) |
| 4 | F-D | ld | Rt | lw $1, 0($2)  sw $2, 0($1) |
| 5 | F-D | ld | None | lw $1, 0($2)  sw $1, 0($0) |
| 6 | F-D | ld | Rt | lw $1, 0($0)  beq $2,$1,label |
| 7 | F-D | ld | Rs | lw $1, 0($0)  jr $1 |
|  | F-D | ld | Rs | lw $1,0($0)  jalr $ra $1 |
| 8 | F-D | calr | Rs | addu $1,$2,$3  beq $1,$2,label |
| 9 | F-D | cali | Rt | ori $1,$0,100  beq $2,$1,label |
| 10 | F-D | calr | Rs | addu $1,$2,$3  jr $1 |
| 11 | F-D | cali | Rs | lui $1,0xf  jr $1 |
|  | F-D | calr | Rs | subu $1 $2 $3  jalr $ra $1 |
|  | F-D | cali | Rs | xori $1 $0 0  jalr $ra $1 |
| 12 | F-E | nop, ld | Rs | lw $1 0($1)  nop  beq $1,$2,label |
| 13 | F-E | nop, ld | Rs | lw $1 0($1)  nop  jr $1 |
|  | F-E | nop, ld | Rs | lw $1 0($1)  nop  jalr $1 |