Efficient Instruction Scheduling Using Finite State Automata

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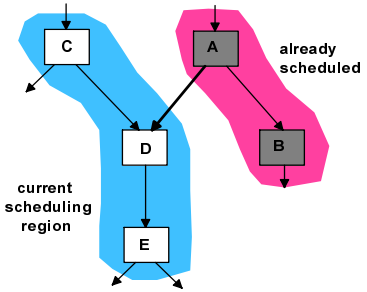
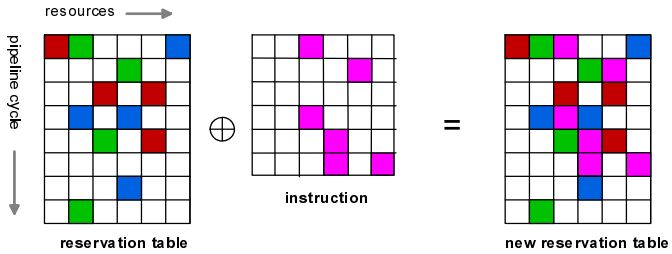
Problem

- Need to avoid introducing structural hazards.
- Need to deal with splits and joins: resources can be in use past a basic block boundary.
- Dealing with already scheduled blocks.



Avoiding Structural Hazards

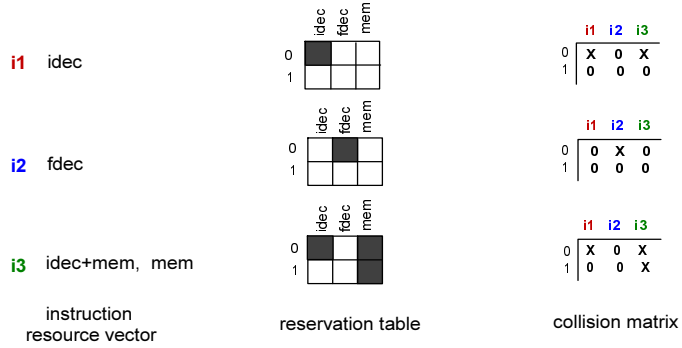
- An instruction may require different hardware resources in different pipeline cycles.
- Need to model the pipeline during instruction scheduling.



- Traditional method uses a **resource reservation table**.
- If no instruction fits, reservation table is shifted to "advance the pipeline clock".

Finite State Machine Model of Pipeline

- FSM states are :
  - resource reservation tables -- Muller.
  - collision matrices -- Proebsting & Fraser.
- Scheduling an instruction causes an FSM state transition.



- Collision matrix method produces a *minimal* finite state machine directly.