



BPB UNIT



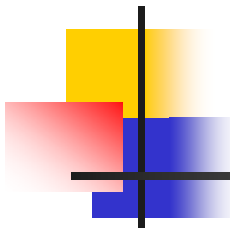
2 Bit Predictor

- Branch Prediction Buffer (BPB) is used for speculating the direction of branches being dispatched.
- BPB is 8 location deep buffer and is indexed by PC[4:2] of the instruction.
- Each location is a state machine represented by 2-bit saturating counter.
- In implementation, the 8 counters share the same NSL as only one BPB entry is updated at any instance of time.



Basic Operation

- During dispatch, Dis_BpbBranchPCBits are used to index the buffer to get the prediction from the state machine. If predicted taken , IFQ is flushed and new instructions are fetched from the computed branch target address
- BranchPCBits are carried along through the queues. When branch reaches the Cdb , the state machine of Bpb is updated as per the outcome of the branch. The BranchPCBits are used for indexing
- Selective flushing mechanism is used to flush the instructions (younger to the mis-predicted branch or Jr instruction) in back-end in case of mis-prediction.



Interaction with Dispatch (Prediction):

- During the 1st stage of dispatch, the BPB is accessed to get the prediction of branch instructions (Taken or not Taken).
- The dispatch stage provides the required signals to access the BPB:
 - Dis_BpbBranchPCBits: PC [4:2] bits of the branch instruction used as index to access BPB
 - Dis_BpbBranch: 1 bit signal to indicate if the instruction in the dispatch stage is branch or not.
- In response, BPB produces 1 bit signal “Bpb_BranchPrediction”. If it is 1 then branch is predicted taken and we need to flush IFQ and start fetching instructions from the branch target address. Otherwise, we continue fetching from the same path.



Interaction with Cdb (Update):

- When a branch instruction finishes its execution and is on the Cdb, the BPB must be updated according to the actual outcome of the branch regardless whether the branch is mis-predicted or not.
- All signals required to complete the update process is provided by the Cdb to the BPB and includes:
 - Dis_CdbUpdBranch: 1 bit signal to indicate if the instruction is actually a branch instruction or not.
 - Dis_CdbUpdBranchAddr: 3-bit signal used to index the BPB
 - Dis_CdbBranchOutcome: 1-bit signal that indicates whether the branch actual outcome is taken or not. If it is "0" then the branch is not taken, otherwise the branch is taken.

State diagram

"1" represents taken , "0" is not taken

