

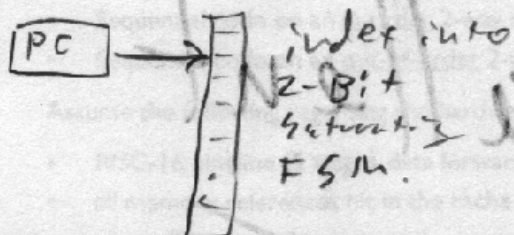
4. Discuss **BRANCH PREDICTION**: Why is it important? How does it work? What are the most important issues? Include thoughts on **aliasing** and **correlation**.

- When a branch is predicted incorrectly, Instruction Processed by the pipeline before the direction and target are known (i.e. before EX) must be flushed, thus decreasing performance.

- If more sophisticated branch prediction were used, the direction/target can be guessed more accurately.

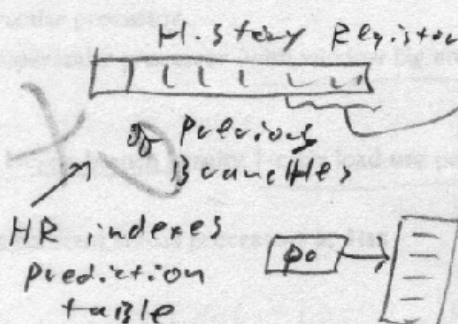
- Two methods have been explored

adaptive prediction:



- PC indexes FSM table

training

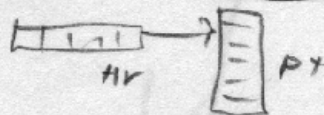


1 bit statically generated directions

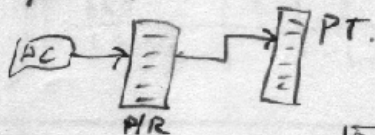
table of targets

Hybrid systems (both methods)

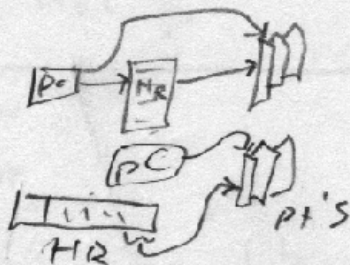
GAB: Global HR, Global Prediction table



PAB: Private HRs, Global Prediction table:



PAP: Private HR, private PT

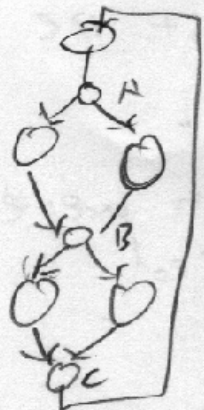


GAP: Global HR, private PT:

Of all the methods,

GAP was originally considered bad because of potential aliasing problems (strongly biased HR data pointing to the same PT)

- It was eventually found that GAP was a good approach, because global patterns of branch history exhibit strong correlations on the behavior of the algorithm being executed.
- Alarms are beneficial because of branch correlation.



A	B	C
1	1	0
1	0	1
0	0	1

predicted, previous related branches show behaviors for predicting branch 'C'

excellent