LAB REPORT -2

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Microbench:

We have created following microbenchmark which has two branches: one is always taken (till 100000 iterations), other produces a pattern of T,N,N,N,N,T* .

```
define total_iteration 100000
void  main () {
int i,j;
int a = 0;
  for (i = 1; i <= total_iteration; i++)   MPKI: 2-bit saturating = 10.546, 2-level = 0.645
        {

         if(i % 5 == 0)
                a = a+1;
          }
}
```

MPKI for provided benchmarks

Benchmark	2-bit saturating	2-level	open-ended
astar	24.639	11.903	5.000
bwaves	7.880	7.146	5.287
bzip2	8.167	8.651	7.553
gcc	21.075	14.824	7.016
gromacs	9.074	7.484	5.166
hmmer	13.567	14.872	11.861
mcf	24.387	13.494	10.279
soplex	7.108	6.819	5.158
Average	14.487	10.649	7.165

Open-ended Predictor

We have created a tournament/hybrid predictor with GaP and PaP. We are using a chooser of 4bits (8 GaP and 8 PaP) of 512 entries for selecting for accurate predictor. The PAp predictor has 12 bits of history with 512 entries, 8 prediction tables, 4096 entries per prediction table, and uses 3-bit saturating counters. We use MSB (XORed with Global history) and LSB (for Pap) of PC to select the history entry. Again, 3 bits of PC are used for prediction table of both predictors. Through history value we index the corresponding prediction table. Our GaP predictor uses the 12 bit GHR, 8 prediction tables, 512 entries per prediction table, and uses 4-bit saturating counters. MSB provides more consistent value for GaP history.

Size:
GaP = 12(GHR) + 512*8*4(Predictor) = 16396
PaP = 512*12(PHT) + 4096*3*8(Preditor) =104418
Chooser = 512*4 =2048
Total Open Ended= 122,862 bits = 15.35775 Kb

CACTI Results

Two level Predictor

Note that there are 8 predictor tables, indexed by 3bits of PC. The measurements are for each table.

	Config	Area	Access Latency	Leakage Power
BHT (2level-bpred-1.cfg)	Type: Cache, Size: 64, Block Size: 1	0.0256629 x 0.0149475 (mm)	0.235609 ns	0.0645814 mW
PHT (2level-bpred-2.cfg)	Type: Cache, Size: 128, Block Size: 2	0.246389 x 0.0219721 (mm)	0.260657(ns)	0.0882322 (mW)

Open-ended Predictor

Note that there are 8 predictor tables, indexed by 3 bits of PC. The measurements are for each table.

	Config (per structure)	Area (mm)	Access Latency	Leakage Power (mW)
2 Level - Global (open-ended-bpred-1.cfg)	Type:Cache, Size: 2050, Block Size: 2	0.0732622 x 0.0761301 (mm)	0.37653 (ns)	1.18975(mW)
2 Level - Private (open-ended-bpred-2.cfg)	Type: Cache, Size: 13053, Block Size: 2	0.110702 x 0.274546 (mm)	0.569851 (ns)	6.45728 (mW)
Selector (open-ended-bpred-3.cfg)	Type: Cache, Size: 256, Block Size: 1	0.0238567 x 0.509558 (mm)	0.309629 (ns)	0.197378 (mW)

Work Distribution

Open ended design logic was worked upon together.

Shreya: Implementation of 2-level local history predictor, GaP(open ended), CACTI configuration and worked upon the final efficiency improvement.

Ritam: Implementation of 2-bit saturating predictor, open-ended PAP and chooser. Created microbenchmark, carried out final output collection and verification.