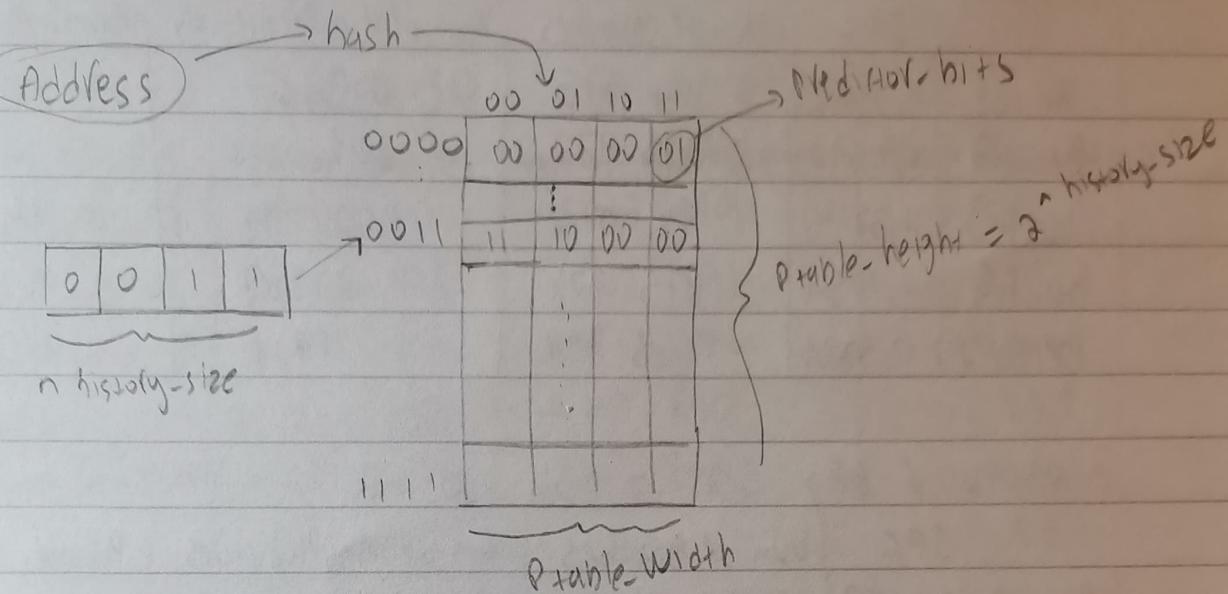


# Gap Predictor:

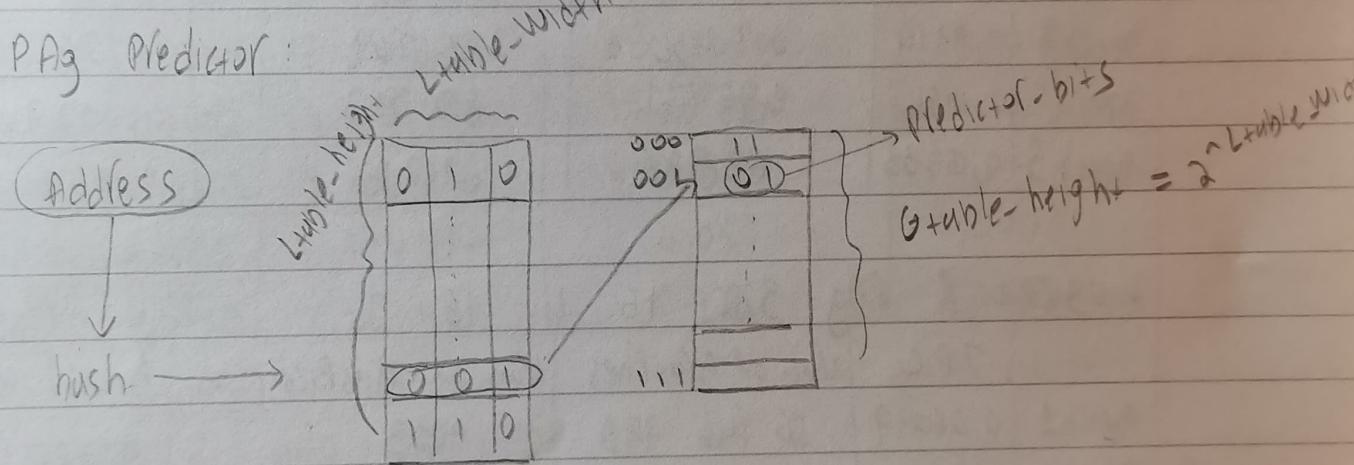
HpsSos ATOSzobu

csd4437

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# Flag Predictor:



⇒ Results: 10 million Instructions

## • 03 CPU & Static 512

	IPC	Num of Branches	Num of Miss Predictions	Branch Miss Ratio
Bench1	0,06078	9 870 350	6 556 963	0,664
Bench2	0,7622	3 052 206	670 396	0,219
Bench3	0,6470	1 172 115	547 542	0,467
Bench4	0,1047	2 618 267	869 371	0,332
Bench5	0,5292	208 935	64 877	0,310

• O3 CPU & Local 512 512 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6 144 576	803	0,00013
Bench2	1,0890	2 376 177	249 611	0,10
Bench3	1,3214	739 028	100 194	0,14
Bench4	0,1054	875 301	1 262	0,0014
Bench5	0,5283	68 390	724	0,010

• O3 CPU & GAP 512 5 32 8 2 → Nano ~~512~~

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6 144 844	1083	0,00017
Bench2	0,9152	2 593 954	362 559	0,14
Bench3	0,9914	801 430	210 769	0,26
Bench4	0,1054	876 451	2 363	0,0027
Bench5	0,5283	68 926	1 226	0,017

• O3 CPU & PAg 512 16 4 16 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6 144 932	983	0,00016
Bench2	0,8723	2 708 408	487 564	0,18
Bench3	1,1931	798 768	152 439	0,19
Bench4	0,1054	875 359	1 209	0,0014
Bench5	0,5283	68 762	1 043	0,015

O3 CPU	Static		Local		GAP		PAg	
	IPC	BMR	IPC	BMR	IPC	BMR	IPC	BMR
Bench1	0,0608	0,664	0,6099	0,00013	0,06099	0,00017	0,06099	0,00016
Bench2	0,7622	0,219	1,089	0,10	0,9152	0,14	0,8723	0,18
Bench3	0,6470	0,467	1,3214	0,14	0,9914	0,26	1,1931	0,19
Bench4	0,1047	0,332	0,1054	0,0014	0,1054	0,0027	0,1054	0,0014
Bench5	0,5292	0,310	0,5283	0,010	0,5286	0,017	0,5283	0,015

⇒ Results: 50 millions Instructions (same predictor configurations)

- O3CPU & Static 512

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1157	32 131 811	16 042 699	0,56
Bench2	0,9966	17 376 926	3 702 391	0,213
Bench3	0,16633	5 091 017	2 534 274	0,497
Bench4	0,0642	20 010 630	6 719 650	0,335
Bench5	0,5254	1 021 817	317 972	0,311

- O3CPU & Local 512 512 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1235	17 300 237	38 067	0,0049
Bench2	1,2422	13 459 833	1 384 973	0,10
Bench3	1,4065	3 184 256	460 858	0,14
Bench4	0,0642	6 726 177	4 051	0,0006
Bench5	0,5243	321 491	724	0,0022

- O3CPU & GAP 512 5 32 8 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1181	21 391 671	743 918	0,034
Bench2	0,9832	15 220 354	2 340 445	0,153
Bench3	1,041	3 402 833	982 327	0,288
Bench4	0,0642	6 730 336	7 771	0,0011
Bench5	0,5243	322 032	1 226	0,0038

- O3CPU & PAg 512 16 4 16 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1215	19 128 027	374 616	0,019
Bench2	0,90	15 358 136	2 348 475	0,135
Bench3	1,2676	3 444 043	706 569	0,205
Bench4	0,0642	6 727 301	5 948	0,0008
Bench5	0,5243	321 864	1 048	0,0032

	Static	Local	6AP	PAG		
	IPC	BMR	IPC	BMR	IPC	BMR
Bench1	0,1157	0,56	0,1235	0,0049	0,1181	0,034
Bench2	0,7966	0,213	1,2622	0,10	0,9330	0,153
Bench3	0,6083	0,497	1,4065	0,16	1,041	0,238
Bench4	0,0642	0,335	0,0642	0,0006	0,0642	0,0011
Bench5	0,5254	0,311	0,5243	0,0022	0,5248	0,0038
					0,5243	0,0032

⇒ Results: 10 million Instructions with bigger BTB ( $512 \rightarrow 1024$ ) and same Predictor size and Predictor bits

#### • 03CPU & Static 1024

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,6073	9 870 361	6 556 970	0,66
Bench2	0,7622	3 052 480	670 417	0,219
Bench3	0,6471	1 172 317	547 569	0,467
Bench4	0,1047	2 618 267	869 373	0,4
Bench5	0,5292	203 934	64 878	0,31

#### • 03CPU & Local 1024 512 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6 144 560	797	0,00013
Bench2	1,1031	2 348 977	216 159	0,092
Bench3	1,35	738 602	95 794	0,129
Bench4	0,1054	875 312	1 269	0,0014
Bench5	0,5288	68 383	301	0,01

#### • 03CPU & 6AP 1024 5 32 8 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6 144 845	1106	0,00018
Bench2	0,9412	2 571 508	337 148	0,13
Bench3	1,0063	801 468	207 941	0,26
Bench4	0,1056	876 433	2 370	0,0027
Bench5	0,5288	68 917	1 219	0,017

• O3CPU & PAg 1024 16 4 16 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,06099	6144 906	943	0,00015
Bench2	0,8758	2710 215	482 837	0,178
Bench3	1,2068	799 750	149 554	0,187
Bench4	0,1054	875 363	1 214	0,0014
Bench5	0,5233	68 751	1035	0,015

\* I forget the table with the results

→ Results: 50 million Instructions with BTB 1024 and same predictor size and predictor bits

• O3CPU & static 1024

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1157	32 131 303	18 044 279	0,561
Bench2	0,7963	17 413 637	3 303 772	0,212
Bench3	0,6633	5 091 393	2 534 267	0,497
Bench4	0,064	20 010 656	6 719 652	0,335
Bench5	0,5254	1 021 811	317 970	0,311

• O3CPU & Local 1024 512 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1235	17 799 643	87 690	0,0049
Bench2	1,2651	13 335 746	1 235 163	0,092
Bench3	1,4369	3 185 114	443 993	0,139
Bench4	0,064	6 725 970	3 813	0,00056
Bench5	0,52	321 486	701	0,0021

• O3CPU & GAP 1024 5 32 8 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1132	20 623 049	1 107 216	0,053
Bench2	0,9876	15 233 227	2 734 408	0,153
Bench3	1,058	3 421 952	967 929	0,204
Bench4	0,064	6 730 149	7 559	0,0011
Bench5	0,5248	322 021	1 219	0,0037

- O3CPU & PAg 1024 16 4 16 2

	IPC	Num of Branches	Num of Miss Predictions	Branch Miss Ratio
Bench1	0,1215	19 135 605	377 163	0,019
Bench2	1,1054	15 377 566	2 845 274	0,185
Bench3	1,27799	3 446 496	696 760	0,20
Bench4	0,064	6 727 195	5 703	0,00034
Bench5	0,5243	321 857	1035	0,0032

O3CPU	Static		Local		Gap		PAg	
	IPC	BMR	IPC	BMR	IPC	BMR	IPC	BMR
Bench1	0,1157	0,561	0,1235	0,0049	0,1130	0,053	0,1215	0,019
Bench2	0,7963	0,212	1,2651	0,097	0,9376	0,153	1,1054	0,185
Bench3	0,6633	0,497	1,4369	0,139	1,058	0,284	1,27799	0,20
Bench4	0,064	0,335	0,064	0,00056	0,064	0,0011	0,064	0,00034
Bench5	0,5243	0,311	0,52	0,0021	0,5243	0,0037	0,5243	0,0032

⇒ Results: 50 millions Instructions + 1024 BTB + bigger prediction size, same prediction bits

- O3CPU & Static 1024 → Already exist

- O3CPU & Local 1024 1024 2

	IPC	Number of Branches	Number of Miss Predictions	Branch Miss Ratio
Bench1	0,1235	17 799 764	87 534	0,0049
Bench2	1,3560	13 010 473	939 755	0,076
Bench3	1,4327	3 184 962	447 895	0,14
Bench4	0,064	6 725 942	3 801	0,00056
Bench5	0,5243	321 506	722	0,0022

• O3CPU & GAp 1024 6 64 16 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1187	20 458 363	1 751 306	0,085
Bench2	0,8512	16 195 155	2 978 641	0,123
Bench3	1,12	3 555 918	913 591	0,257
Bench4	0,064	6 733 379	10 780	0,0016
Bench5	0,5248	32 1945	1 203	0,0037

• O3CPU & PAg 1024 32 5 32 2

	IPC	Num of Branches	Num of MissPredictions	Branch Miss Ratio
Bench1	0,1236	17 777 333	75 697	0,0042
Bench2	0,9779	14 626 123	2 320 358	0,158
Bench3	1,3657	3 293 733	556 419	0,168
Bench4	0,064	6 727 559	5 646	0,00084
Bench5	0,5248	32 1595	804	0,0025

O3CPU	Static		Local		GAp		PAg	
	IPC	BMR	IPC	BMR	IPC	BMR	IPC	BMR
Bench1	0,1157	0,561	0,1235	0,0049	0,1187	0,085	0,1236	0,0042
Bench2	0,7963	0,212	1,3560	0,076	0,8512	0,123	0,9779	0,158
Bench3	0,6033	0,499	1,4327	0,16	1,12	0,257	1,3657	0,163
Bench4	0,064	0,335	0,064	0,00056	0,064	0,0016	0,064	0,00084
Bench5	0,5254	0,311	0,5243	0,0022	0,5248	0,0037	0,5248	0,0025

→ Results: 50 million Instruction + 1024 BTB + even bigger predictor size, same Predictor bits

- O3CPU & Static 1024 → Already exist

- O3CPU & Local 1024 2048 2

	IPC	Num of Branches	Num of Miss Predictions	Branch Miss Ratio
Bench1	0,1235	17 799 721	87 536	0,0049
Bench2	1,4602	12 831 553	679 381	0,052
Bench3	1,4326	3 134 361	448 650	0,14
Bench4	0,064	6 725 933	3 795	0,00056
Bench5	0,5248	321 520	749	0,0023

- O3CPU & BAP 1024 6 64 32 2

	IPC	Num of Branches	Num of Miss Predictions	Branch Miss Ratio
Bench1	0,1197	19 972 557	712 971	0,035
Bench2	0,2054	16 407 961	2 774 902	0,169
Bench3	1,1029	3 438 401	940 282	0,293
Bench4	0,064	6 736 265	12 100	0,00177
Bench5	0,5248	322 087	1 301	0,0040

- O3CPU & PAg 1024 64 5 32 2

	IPC	Num of Branches	Num of Miss Predictions	Branch Miss Ratio
Bench1	0,1236	17 774 422	75 214	0,0042
Bench2	1,022	14 930 534	1 966 559	0,13
Bench3	1,4192	3 133 104	493 336	0,154
Bench4	0,064	6 726 469	4 627	0,00068
Bench5	0,5248	321 557	738	0,0024

(4)

onCPU	S+2+IC		Local		GAP		PA <sub>2</sub>	
	IPC	BMR	IPC	BMR	IPC	BMR	IPC	BMR
Bench1	0,1157	0,561	0,1735	0,0049	0,1197	0,035	1,1236	0,0043
Bench2	0,7763	0,212	1,4602	0,052	0,9054	0,169	1,0220	0,131
Bench3	0,6633	0,492	1,4326	0,14	1,1029	0,273	1,4192	0,154
Bench4	0,064	0,335	0,064	0,0026	0,064	0,00179	0,064	0,02068
Bench5	0,5254	0,311	0,5248	0,0023	0,5243	0,0040	0,5248	0,0024

## Final Results:

1) Me BTB size degenwu kai ke "optimal" (1480 predictor size) n augnun twu fenzjwuw qmto 10 millions se 50 millions fixe ns egns etititjwuwels:

Bench1: - Augnunre to IPC noo Static, GAP kai PA<sub>2</sub> cum

cum no local kewonke

- Augnunre to BMR noo Local, GAP kai PA<sub>2</sub> cum

noo Static kewonke

Bench2: - Augnunre to IPC se 0.005

- Augnunre to BMR noo GAP cum noo Static

kewonke. twu local kai PA<sub>2</sub> kewonk uudepol

Bench3: - Augnunre to IPC se 0.005

- Augnunre to BMR noo Static, GAP , PA<sub>2</sub> cum

no local kewonk uudepol

Bench4: - M4wonek to IPC se 0.005

- To BMR noo Static kewonk uudepol cum noo Local,

GAP kai PA<sub>2</sub> kewonke

Bench5: - M4wonek to IPC se 0.005

- To BMR noo Static kewonk uudepol cum noo Local,

GAP , PA<sub>2</sub> kewonke

- 2) Me nu ektegion nuw isiuu predictor configuration,  
 so million Instruction aza le BTB 1024 (anti side)  
 response zu fns
- Bench1: - To IPC luegi nuedeo se ojous  
 - To BMR luegi nuedeo se static, local, PAz  
 nuw no GAP augevngua
- Bench2: - To IPC luegi nuedeo nuw static, nuw se  
 local, GAP kai PAz augevngua  
 - To BMR luegi nuedeo se ojous
- Bench3: - To IPC luegi nuedeo se static, GAP, PAz  
 nuw nuw local augevngua  
 - To BMR luegi nuedeo se ojous
- Bench4: - To IPC luegi se ojous nuedeo  
 - To BMR luegi nuedeo nuw static, local, PAz  
 nuw nuw GAP augevngua
- Bench5: - To IPC luegi nuedeo se ojous  
 - To BMR luegi nuedeo se ojous

- 3) Me nu ektegion 50 million Instruction, le 1024 BTB kai Sijasia  
 gurus zu size nuw local kai egypti jasiuswars nuw GAP kai PAz  
 (nuw static bec ayegek kai jasius deu da auykepdeos auov)
- Bench1: - To IPC no local egypti nuedeo nuw se GAP  
 kai PAz augevngue  
 - To BMR no local egypti nuedeo nuw se GAP kai  
 PAz augevngue
- Bench2: - To IPC nuw local augevngue, nuw nuw GAP kai  
 PAz augevngue  
 - To BMR nuw local kai nuw PAz augevngue nuw  
 nuw GAP augevngue
- Bench3: - To IPC nuw local augevngue nuw nuw GAP kai PAz  
 augevngue  
 - To BMR nuw local egypti nuedeo nuw nuw GAP  
 kai PAz augevngue

Bench4: - To IPC giving number of cycles

- To AMR effective number of cycles

Bench5: - To IPC effective number of cycles

- To BMR effective number of local and GAP, run  
now PAz performance

4) Magmdu ekspresun rupa 50 million Instruction, kq 1024 BTB

kui size predictors

Bench1: - To IPC giving number of local kui PAz run  
now GAP augmented  
- To BMR giving number of local kui PAz run  
now GAP augmented

Bench2: - To IPC augmented size of cycles

- To BMR augmented size of cycles

Bench3. - To IPC no local effective number now GAP augmented  
kq runnow PAz augmented  
- To BMR no local effective number now GAP augmented  
now PAz performance

Bench4: - To IPC effective number

- To BMR of local effective number, GAP augmented  
kq PAz performance

Bench5. - To IPC effective number

- To BMR giving number.

## Conclusion

- O BTB say exel soban entitilwan minu atuboga run  
branch Predictor.

- Tukurunpa oti se likpuu size predictors kq totalis entries  
na tipeisotipa MissPredictions equal TakenIncorrect (Syach qdian  
predict taken appa telpu minu not taken), kq se telajungpa  
size predictors kq nis 1024 entries na tipeisotipa MissPredictions  
nun NotTakenIncorrect.

- Tipentu un batis min kqun run no size two predictors

je basn nis voudres tou da pegou ensi wone va jiuuu vain  
swaga.

Thrusting 819 50 millions Instruction ws 220 kbytes predictor  
le basic kai 20 5 benchmarks 200 local 1024 2048 2

2043 total entries with BTB

→ Local : 1024 1024 2

	IPC	BMR
Bench 1	0,060	0,00013
Bench 2	1,1443	0,079
Bench 3	1,3462	0,13
Bench 4	0,1054	0,0014
Bench 5	0,5233	0,010

→ GAP: 1024 6 64 16 2 | GAP: 1024 4 16 64 2

	IPC	MNR
Bench1	0,1137	0,035
Bench2	0,3512	0,183
Bench3	1,12	0,257
Bench4	0,064	0,0016
Bench5	0,5248	0,0037

\* Tu uo79 kef00h  
ewu1 fu 50m11/m  
Instructions

	IPC	BMR
Bench1	0,060	0,0015
Bench2	0,3551	0,171
Bench3	1,05	0,245
Bench4	0,1034	0,0038
Bench5	0,5233	0,017

→ GAP 1024 5 32 32 2

	IPC	BMR
Bench1	0,060	0,0015
Bench2	2,8682	0,159
Bench3	1,05	0,265
Bench4	0,1034	0,0028
Bench5	0,9282	0,017

PAG	1024	32	5	32	2	PAG	1024	64	4	16	2
	IPC	BMR					IPC	BMR			
Bench1	0,1236	0,10010	+90			Bench1	0,060	0,00012			
Bench2	0,9979	0,153	~1100	Instructions		Bench2	0,9157	0,143			
Bench3	1,3657	0,168	~1100	Data		Bench3	1,313	0,152			
Bench4	0,064	0,0034				Bench4	0,1054	0,00131			
Bench5	0,5243	0,0025				Bench5	0,5233	0,011			

PAG: 1024 16 6 64 2

	IPC	BMR
Bench1	0,060	0,00015
Bench2	0,384	0,173
Bench3	1,2504	0,1639
Bench4	0,1054	0,0014
Bench5	0,5233	0,014

→ Στην το δεύτερο λήφθει στα αυτόν της πρώτης επέγεια του 10 million Instruction.

- Τα αποτελέσματα του εβδομάτη είναι οτι η γενική κατανομή είναι
- o Local predictor, όπως στην το Bench1 και Bench4 είναι κατανομένη
- o PAG δια πλο μήπο.

## ΓΕΝΙΚΟ ΣΥΜΠΕΡΑΣΜΑ

To global History δεν είναι η καλύτερη επιλογή. Όπως ως της της τον global predictor φανερώνεται στην συγκεκρινά benchmarks είναι ουσιαίας ρόλος ή ακόλη μήπο κατανομένης από τον local predictor. Ουχίστην o GAP δεν γίνεται στην το συγκεκρινά benchmarks κατανομένης από το local και o PAG. Ενώ o PAG είναι οι κατιόντες περιπτώσεις μήπο κατανομένης ή αγίετος το local (Bench1 και Bench4)