MO601 - Projeto 3

Wormhole: Wisely Predicting Multidimensional Branches

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Situação que queremos melhorar

Program 1

```
// X is a vector with the position of objects
//    randomly placed in a 3D space
// p is a point in the 3D space
while(true)                          // Loop 1
  for( j=0; j<NumObjects; j++)       // Loop 2
    if( distance(X[j], p) < threshold )   // Branch 1
    { /* do something */ }
```

Program 2: Jacobi1 algorithm

```
// A is the matrix
// B is the right hand side
// X is the current solution estimate
// X0 is the partial solution
for ( i = 0; i < N; i++ ) {   // Loop 3
  X0[i] = B[i];
  for ( j = 0; j < N; j++ )        // Loop 4
    if ( j != i )                    // Branch 2
      X0[i] = X0[i] - A[i + j*n] * X[j];
  X0[i] = X0[i] /A[i + i*n];
}
```

Como fazemos isso?

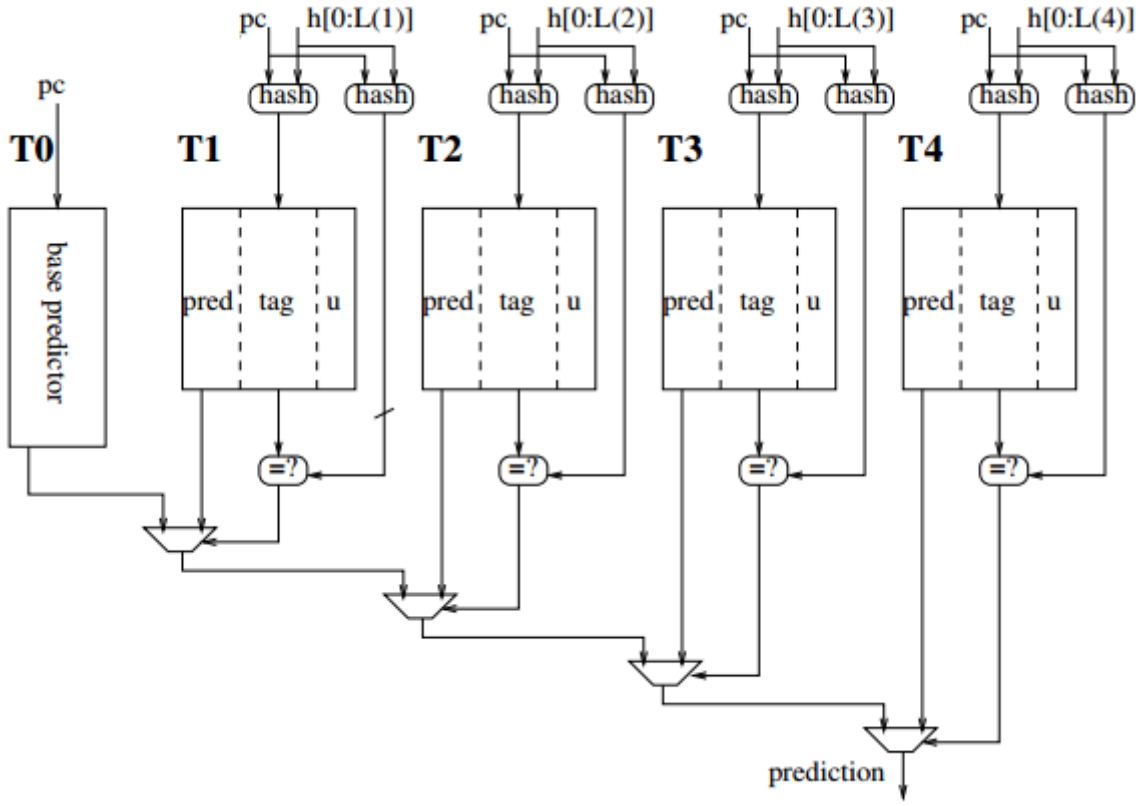
Exemplo para o programa 2.

E os outros Branchs?

ISL-TAGE – “A 64 Kbytes ISL-TAGE branch predictor”, André Seznec INRIA/IRISA

- TAGE predictor.
- Loop predictor
- Statistical Corrector predictor (SC)

TAGE predictor



O que reproduzir?

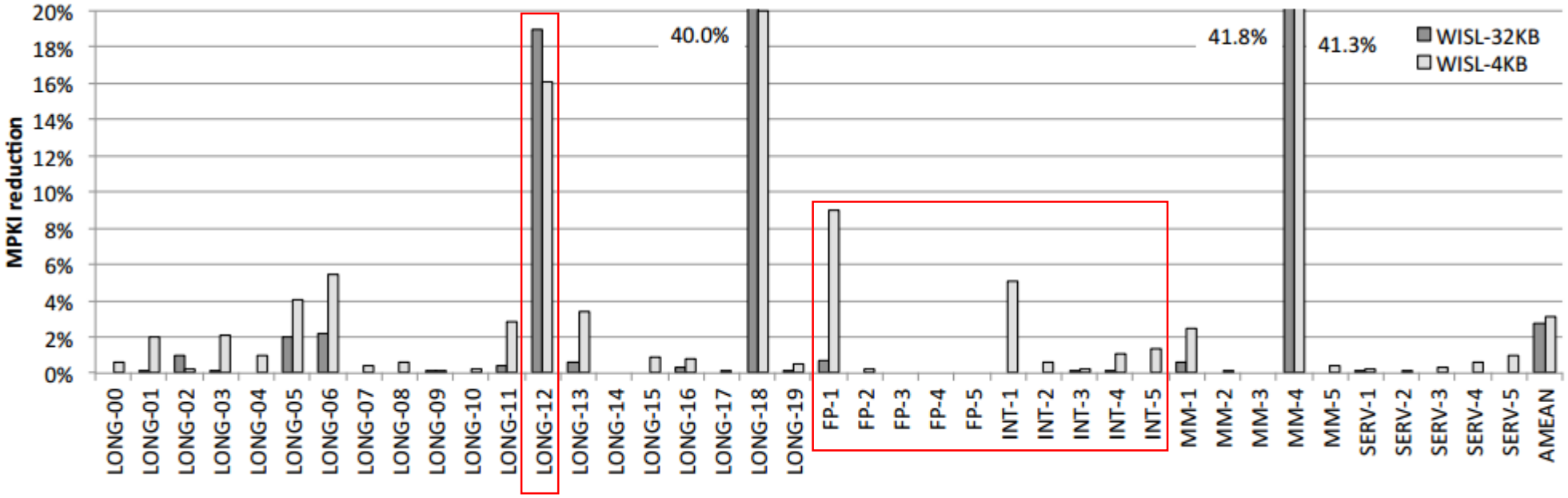
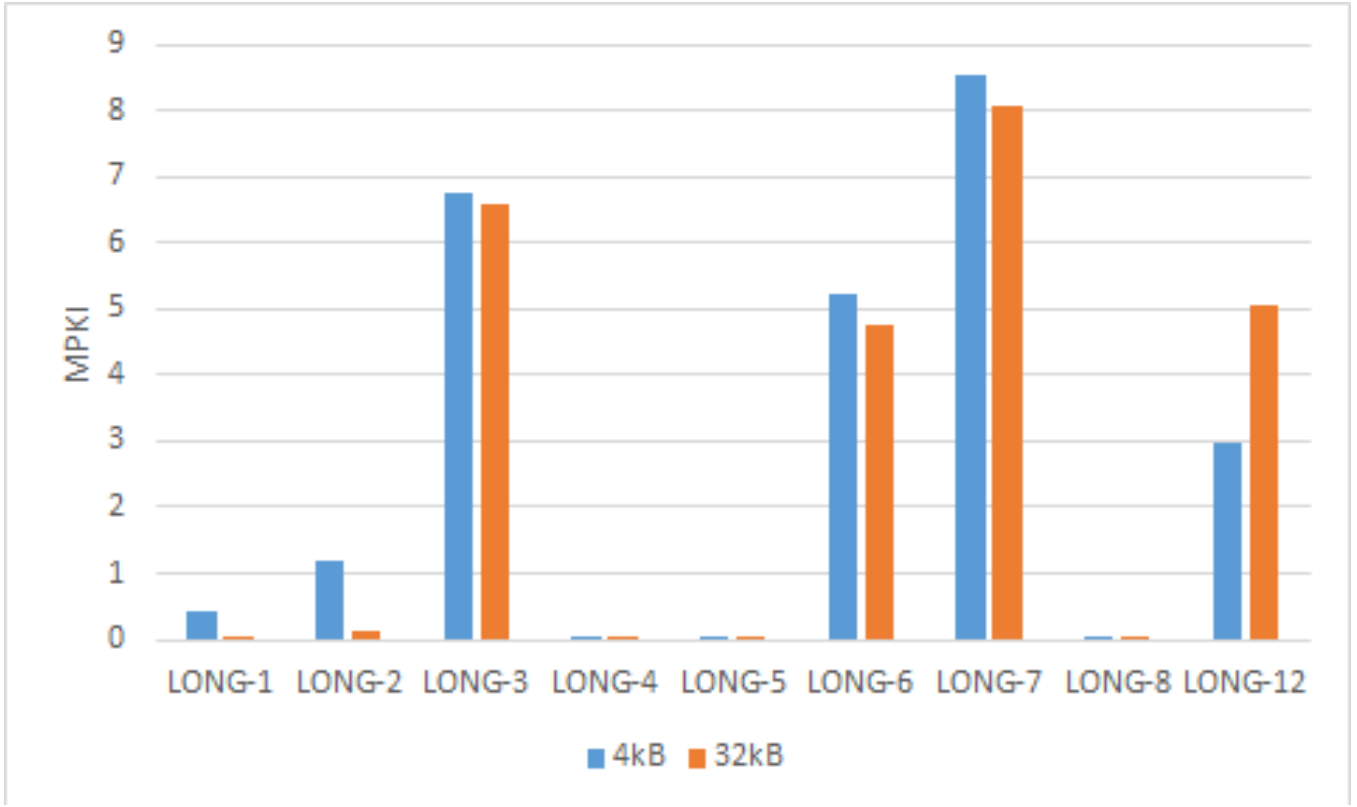


Figure 6: MPKI reductions with respect to ISL-TAGE for the 40 traces, for 4KB and 32KB base predictors.

O que reproduzir?

Figure 6: MPKI reductions with respect [illegible] for 4KB and 32KB base predictors.

O que foi reproduzido?



Dados relevantes

WH 4 kB							
Programa	**Num. Instruções**	**Num. Branches**	**Num. Mispredictions**	**MPKI**	**Predictor Accuracy**	**Num. Uncond. Branch**	**Num. Cond. Branch**
LONG-1	642168792	29269647	278770	0,4341	99,048%	54105	29215542
LONG-2	1271560006	112993125	1537234	1,2089	98,640%	1404676	111588449
LONG-3	1283893069	163272689	8700921	6,777	94,671%	26253683	137019006
LONG-4	999999976	13881337	713	0,0007	99,995%	22884	13858453
LONG-5	1000000000	4038314	1651	0,0017	99,959%	2489985	1548329
LONG-6	514635404	71815794	2690608	5,2282	96,253%	14786976	57028818
LONG-7	599758591	102414543	5116323	8,5306	95,004%	6556201	95858342
LONG-8	5789354553	811360113	1462	0,0003	100,000%	426874521	384485592
LONG-12	1688784689	436394748	5059554	2,996	98,841%	112850745	323544003

Dados relevantes

WH 32 kB							
Programa	**Num. Instruções**	**Num. Branches**	**Num. Mispredictions**	**MPKI**	**Predictor Accuracy**	**Num. Uncond. Branch**	**Num. Cond. Branch**
LONG-1	642168792	29269647	15579	0,0243	99,947%	54105	29215542
LONG-2	1271560006	112993125	144050	0,1133	99,873%	1404676	111588449
LONG-3	1283893069	163272689	8479199	6,6043	94,807%	26253683	137019006
LONG-4	999999976	13881337	594	0,0006	99,996%	22884	13858453
LONG-5	1000000000	4038314	1302	0,0013	99,968%	2489985	1548329
LONG-6	514635404	71815794	2439320	4,7399	96,603%	14786976	57028818
LONG-7	599758591	102414543	4832385	8,0572	95,282%	6556201	95858342
LONG-8	5789354553	811360113	1157	0,0002	100,000%	426874521	384485592
LONG-12	1688784689	436394748	8517902	5,0438	98,048%	112850745	323544003

Dificuldades encontradas

- O simulador do CBP-4 estava com o link de download quebrado.
- O código do preditor foi escrito para o simulador da CBP-4.
- O simulador do CBP-3 era muito diferente dos demais, dificultando a simulação do ISL-TAGE.
- Os programa de entrada do simulador do CBP-5 mudaram.
- Dificuldade em reproduzir o código do ISL-TAGE para o novo simulador por ser pouco documentado.

Referências

- **Wormhole: Wisely Predicting Multidimensional Branches**:

Jorge Albericio, Joshua San Miguel, Natalie Enright Jerger, and Andreas Moshovos

Edward S. Rogers Sr., Department of Electrical and Computer Engineering, University of Toronto

- **A 64 Kbytes ISL-TAGE branch predictor:**

André Seznec, INRIA/IRISA

- **A case for (partially) TAgged GEometric history length branch prediction:**

André Seznec, Pierre Michaud, IRISA/INRIA/HIPEAC

- **Analysis of the O-GEometric History Length branch predictor**:

André Seznec, IRISA/INRIA/HIPEAC

Obrigado