A 2bcgskew Fused by a RHSP
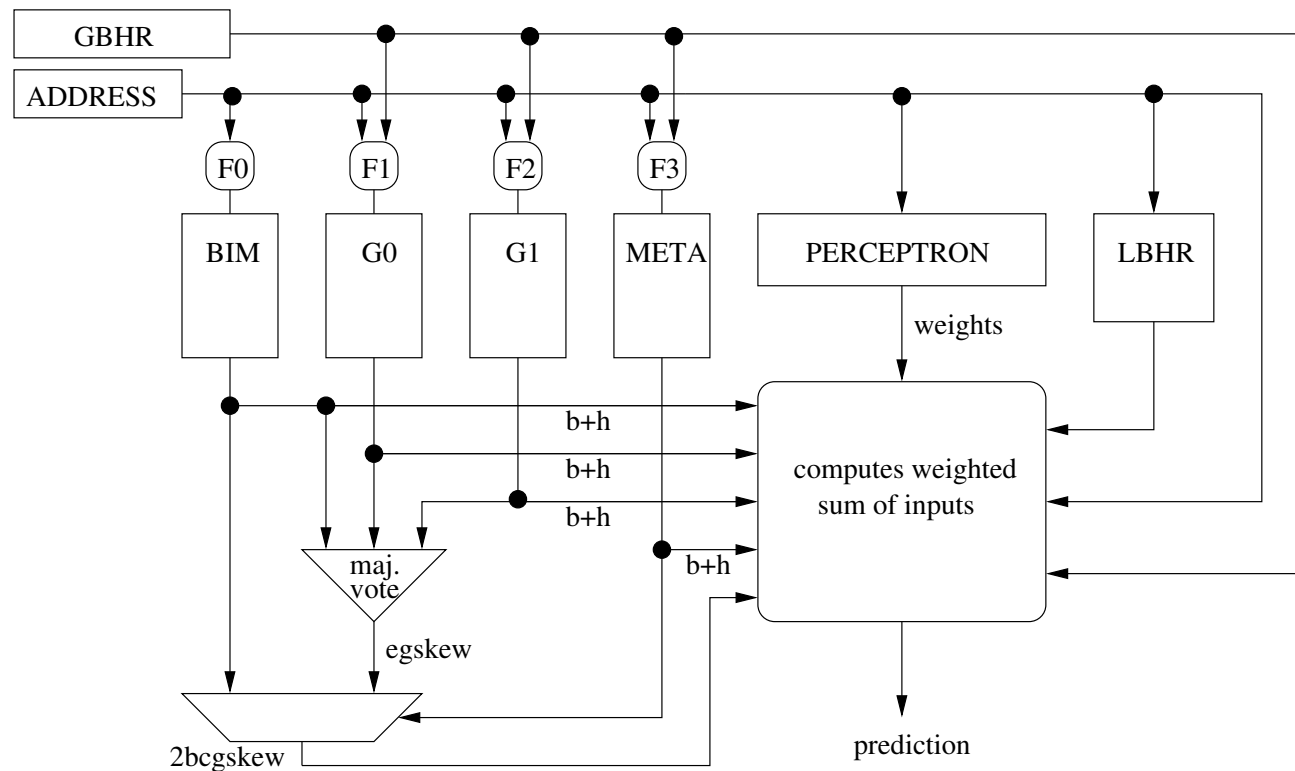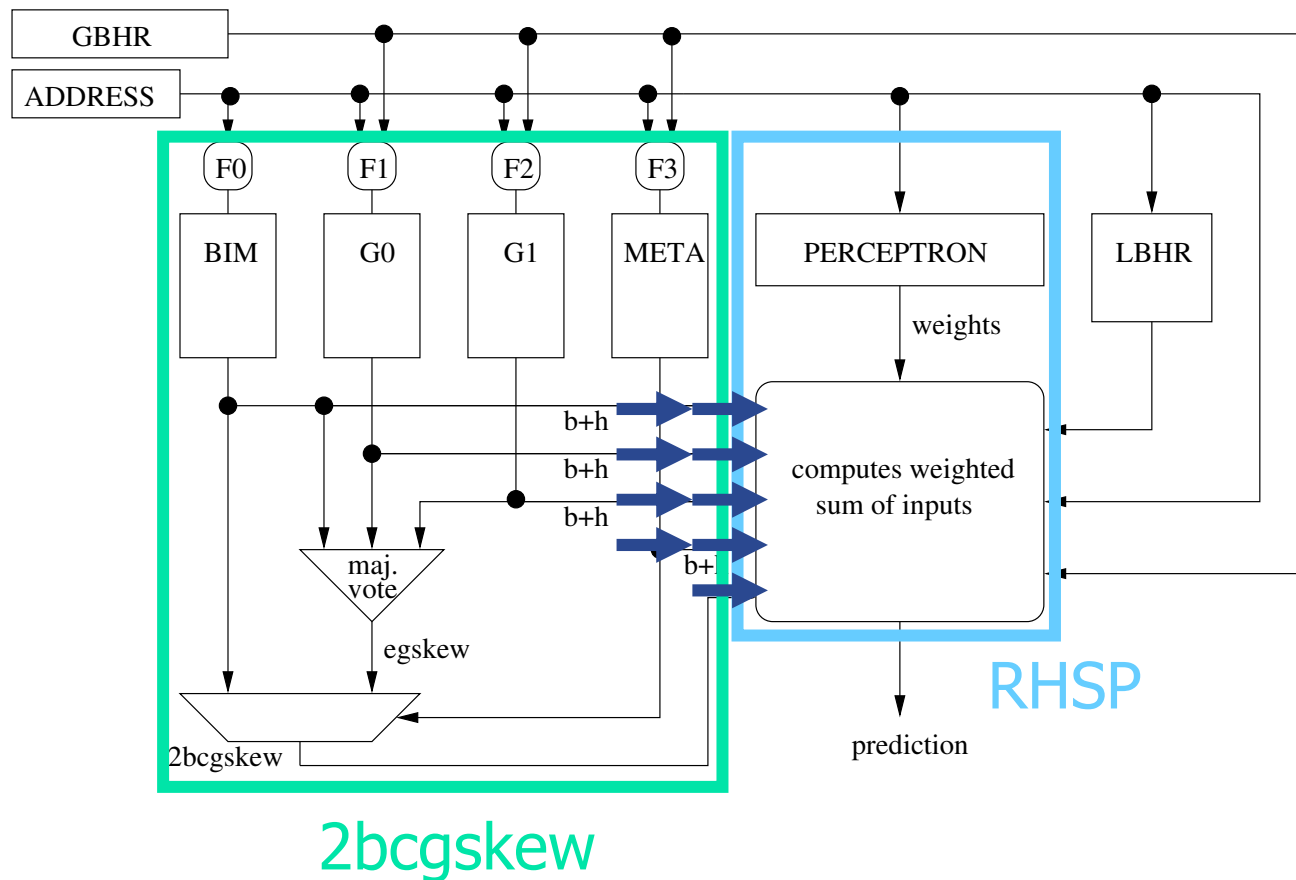
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Elektronica en Informatiesystemen

HiPEAC
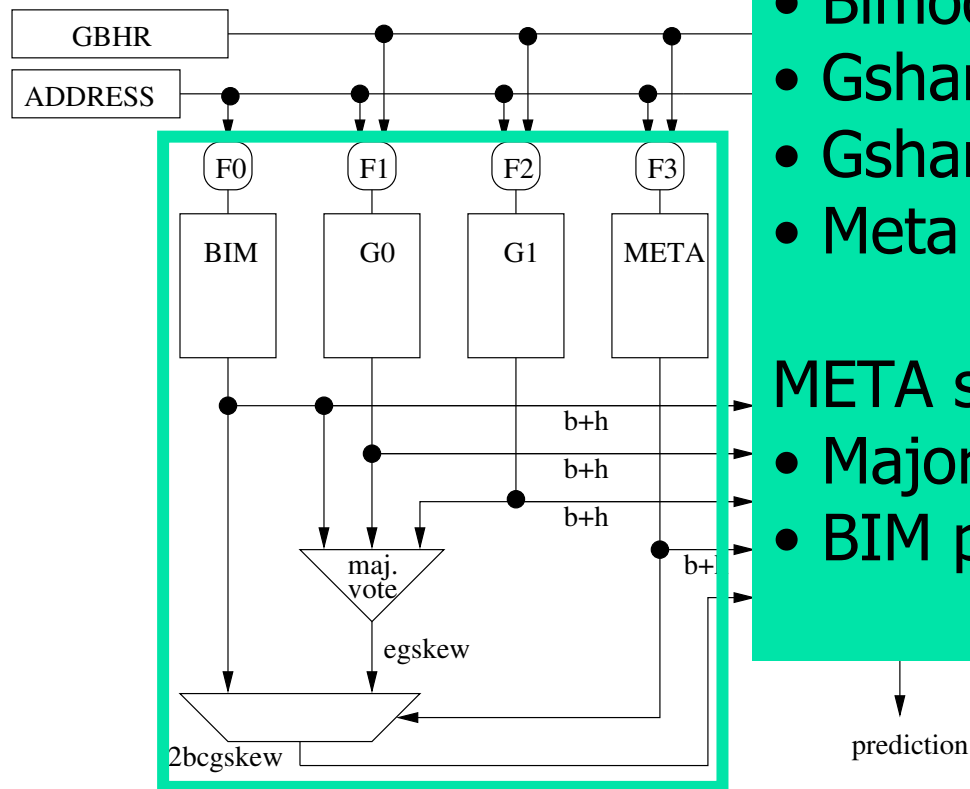COMPILATION ARCHITECTURE

A 2bcgskew Fused by a RHSP

A 2bcgskew Fused by a RHSP

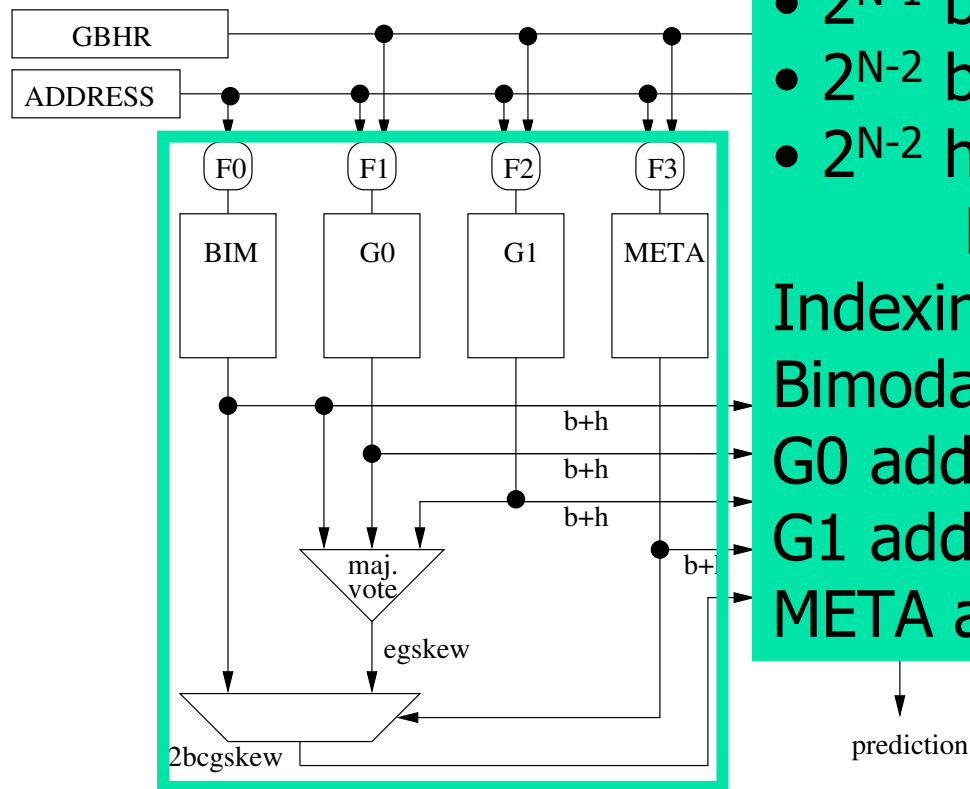# A 2bcgskew...

[André Seznec, 2003]

2bcgskew

4 component predictors:
- Bimodal
- Gshare (G0)
- Gshare (G1)
- Meta

META selects between
- Majority vote BIM/G0/G1
- BIM prediction

A 2bcgskew…

Shared prediction tables:
- 2^{N-1} bias G0/G1
- 2^{N-2} bias BIM/META
- 2^{N-2} hysteresis bits
      BIM/G0/G1/META

Indexing:

Bimodal pure addr

G0 addr + 12 global hist

G1 addr + 24 global hist

META addr + 3 global hist

GBHR

ADDRESS

F0   F1   F2   F3

BIM   G0   G1   META

b+h

b+h

b+h

b+l

maj. vote

egskew

2bcgskew

prediction

2bcgskew
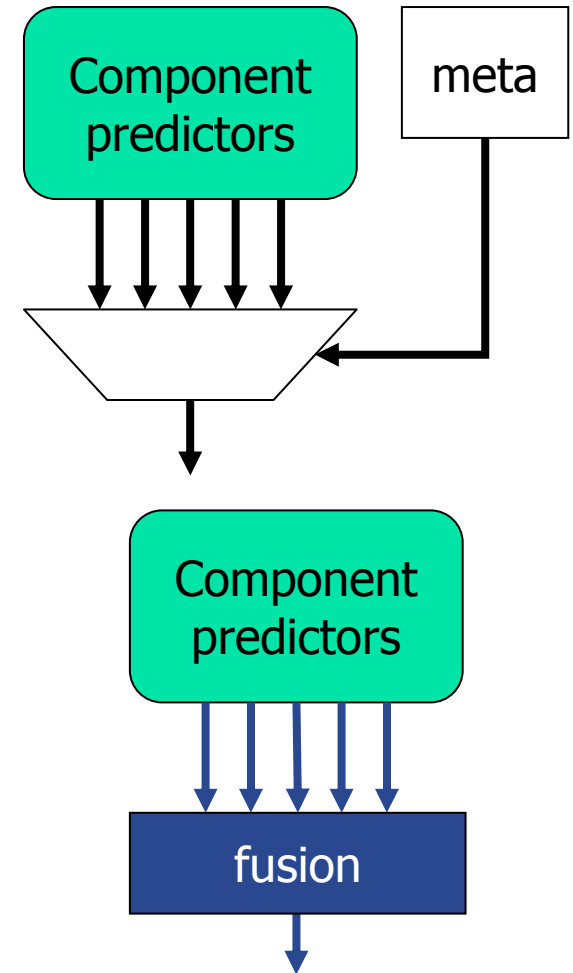
Fusion principle

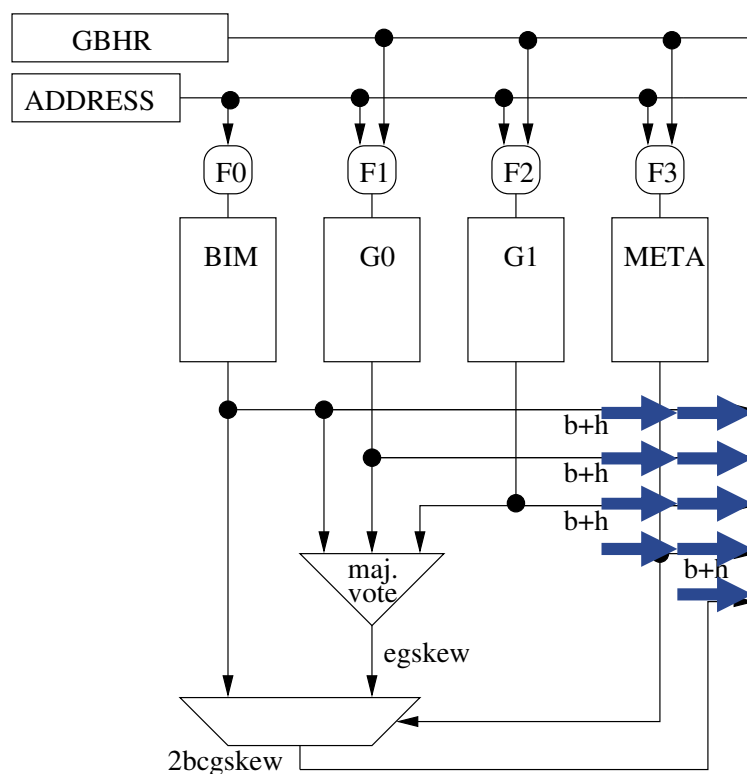[Gabriel Loh, 2002]

- ## Hybrid
  - selects component based on META-predictor
  - follows outcome of one component

- ## Fusion
  - learns patterns from component outcomes
  - improved accuracy if component outcomes differ

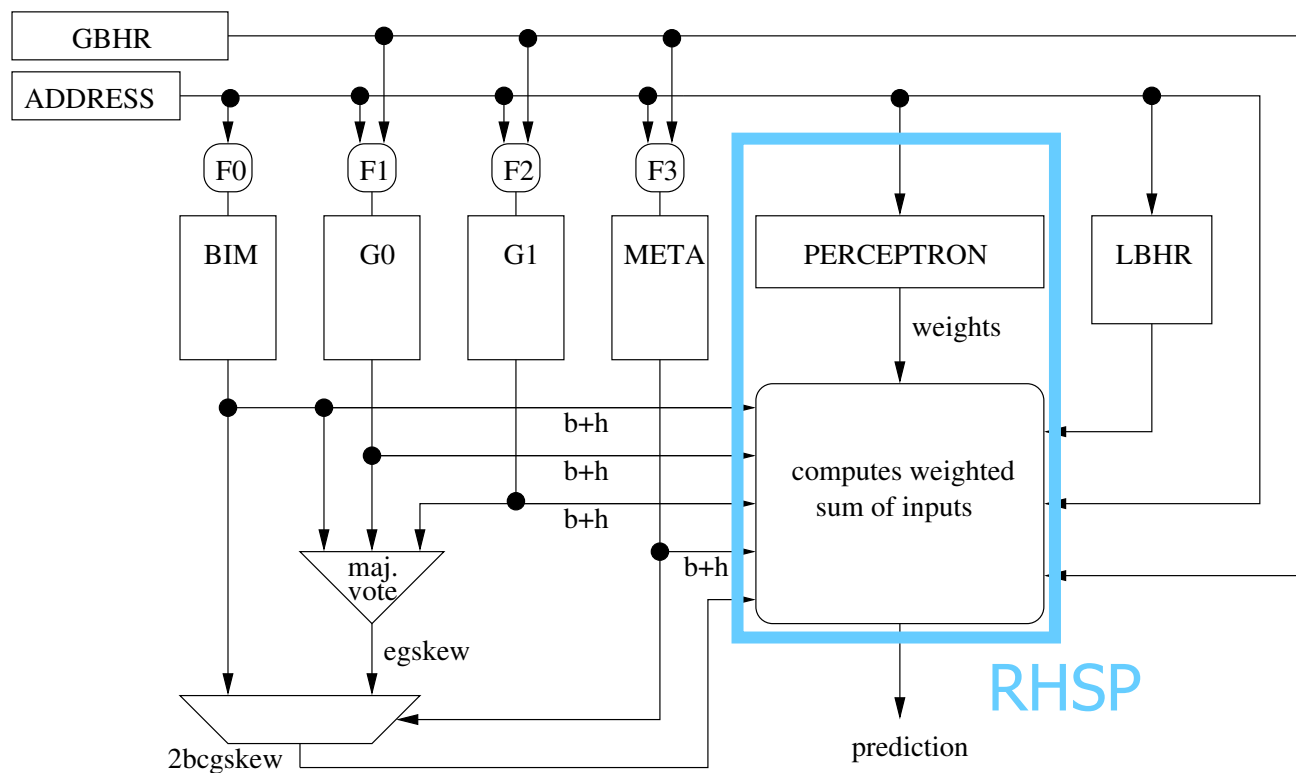# ... Fused by...

Extracts multiple bits from 2bcgskew

9 outcome bits:
- 2bcgskew
- BIM bias + hysteresis
- G0 bias + hysteresis
- G1 bias + hysteresis
- META bias + hysteresis

… a RHSP predictor

[André Seznec, 2003]

Perceptron Predictor

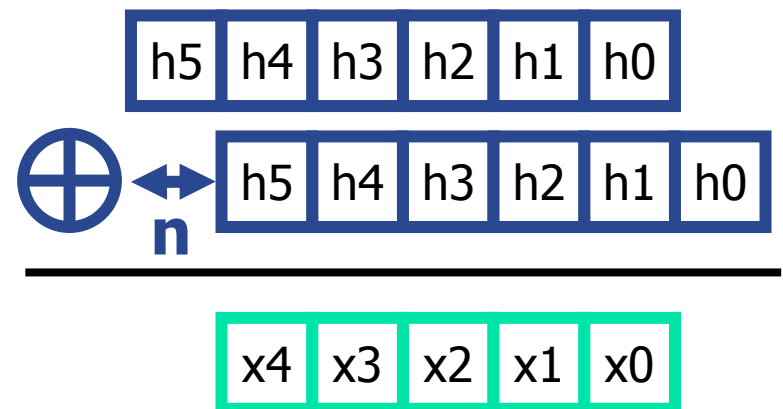| Information	#bits
Global History	33
Local History	6
Pseudo-tag	8
Outcomes	9
Bias	1

- **Local history table**
  - 512 entries
  - indexed by branch address
- **Pseudo-tag bits**
  - [André Seznec, 2003]
  - higher order address bits
  - not used to select weights

Redundant History Perceptron Predictor

Information	Redundancy	#bits
Global History	pure	33
	1	33
Local History	pure	6
	1	5
	2	4
	3	3
Pseudo-tag	pure	8
	1	8
	2	6
Outcomes	pure	9
Bias	pure	1

116

n-th order redundancy of h:

h5	h4	h3	h2	h1	h0

$\oplus$ ↔ n

h5	h4	h3	h2	h1	h0

x4	x3	x2	x1	x0

Redundant History Skewed Perceptron Predictor

| | | | **34** | **27** | **25** | **30** |
Information	Redundancy	#bits	Bank 1	Bank 2	Bank 3	Bank 4
Global History	pure	33	8	8	8	9
	1	33	8	8	8	9
Local History	pure	6	1	2	1	2
	1	5	1	1	1	2
	2	4	1	1	1	1
	3	3	0	1	1	1
Pseudo-tag	pure	8	2	2	2	2
	1	8	2	2	2	2
	2	6	1	2	1	2
Outcomes	pure	9	9	0	0	0
Bias	pure	1	1	0	0	0

Redundant History Skewed Perceptron Predictor

Bank 1	Bank 2	Bank 3	Bank 4

- ## 4 banks

- ## 32 entries = 5 bits index

- ## indexed by global history and

    rotation hashing function of branch address

- ## 8-bit weights

- ## MAC: (A+B, A-B) coding

- ## together 116 weights/entry

0	3	5	10

a8	a7	a6	a5	a4

$\oplus$

a0	a1	a2	a3

r4	r3	r2	r1	r0

Budget

Performance???

The end