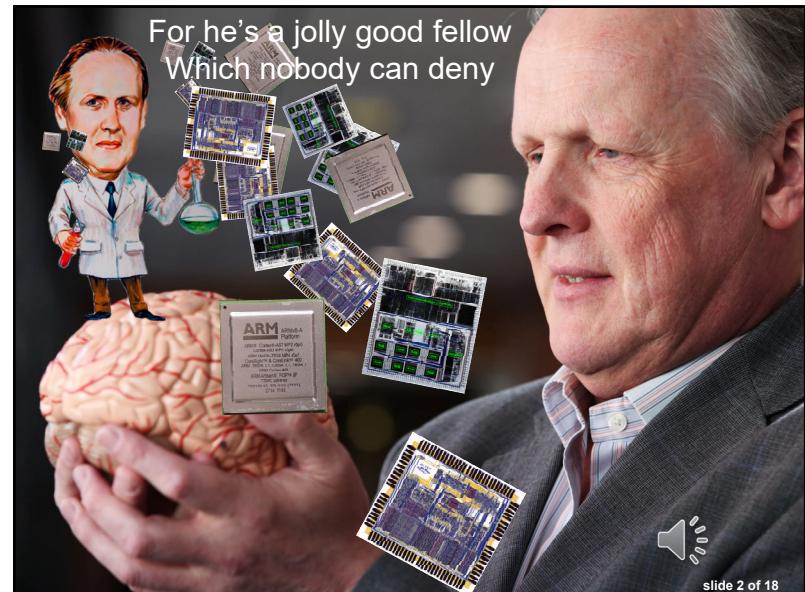
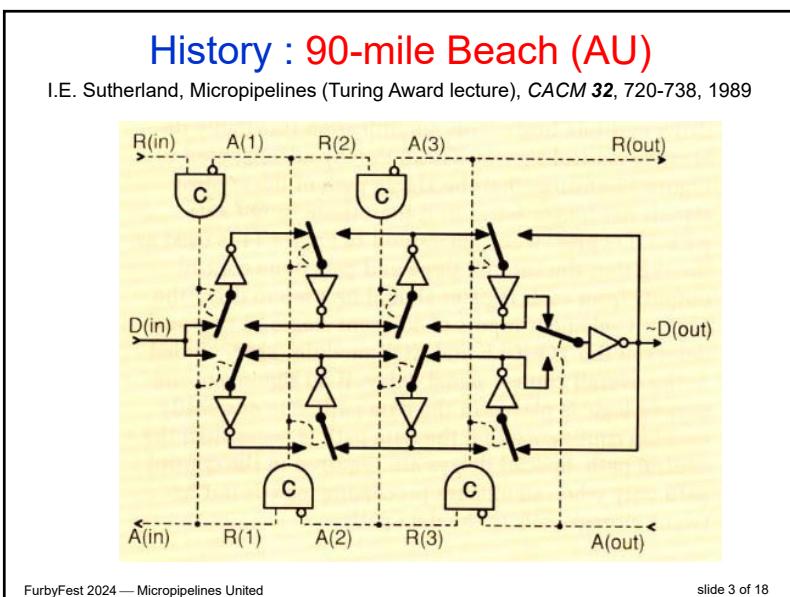


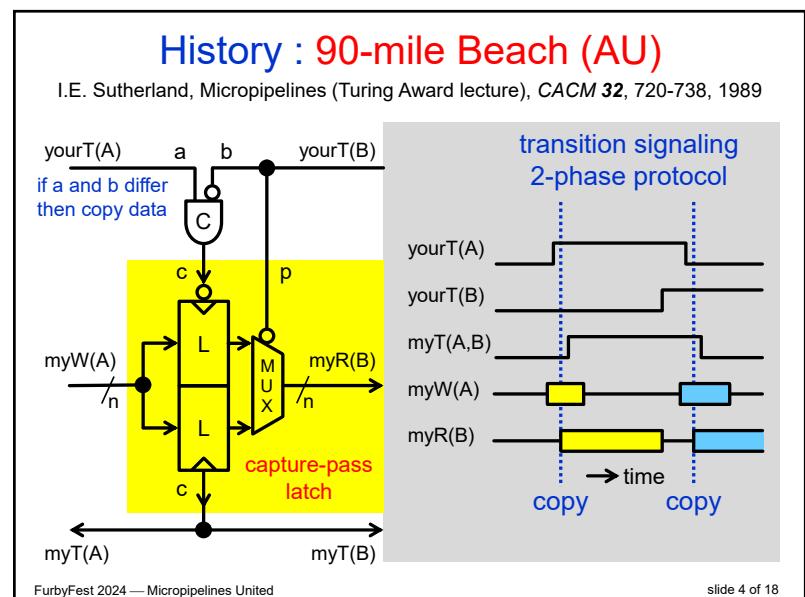
1



2



3



4

History : Salt Lake City (USA)

- E. Brunvand
Translating Concurrent Communicating Programs into Asynchronous Circuits
PhD thesis, Carnegie Mellon University, 1991

- A. Khoche and E. Brunvand
Testing Micropipelines
Proc. ASYNC, 239-246, 1994

and more...

test design

FurbyFest 2024 — Micropipelines United

slide 5 of 18

design
test

History : Manchester (UK)

- S.B. Furber, P. Day, J.D. Garside, N.C. Paver, and J.V. Wood
AMULET1: A Micropipelined ARM
Proc. COMPCON, 476-485, 1994
- S.B. Furber and P. Day
Four-Phase Micropipeline Latch Control Circuits
TVLSI / 4, 247-253, 1996
- O.A. Petlin and S.B. Furber
Scan Testing of Micropipelines
Proc. VTEST, 296-301, 1995
- O.A. Petlin and S.B. Furber
Scan Testing of Asynchronous Sequential Circuits
Proc. GLSVLSI, 224-229, 1995
- O.A. Petlin and S.B. Furber
Built-in Self-Testing of Micropipelines
Proc. ASYNC, 296-301, 1997

and more...

FurbyFest 2024 — Micropipelines United

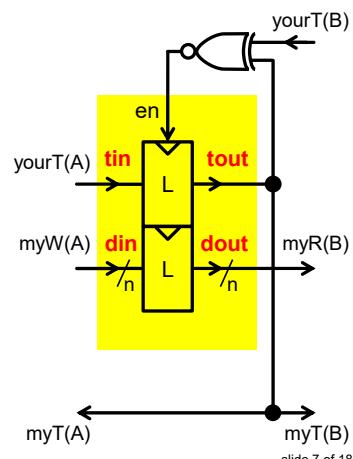
slide 6 of 18

6

History : New York City (USA)

M. Singh and S.M. Nowick, MOUSETRAP: High-Speed Transition-Signaling Asynchronous Pipelines, *TVLSI / 15*, 684-698, 2007

- different design
- same interface
- same protocol



FurbyFest 2024 — Micropipelines United

slide 7 of 18

7

Micropipelines United

- unite transition signaling families
- for a general design and test approach
- focus on same-ness, internalize differences

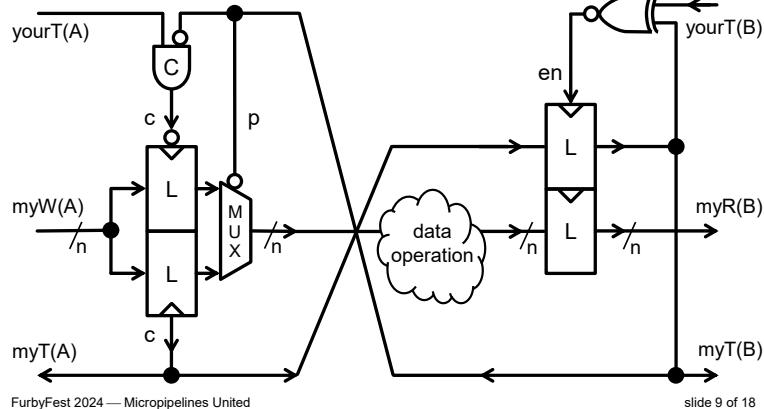
FurbyFest 2024 — Micropipelines United

slide 8 of 18

8

United Design

Micropipeline

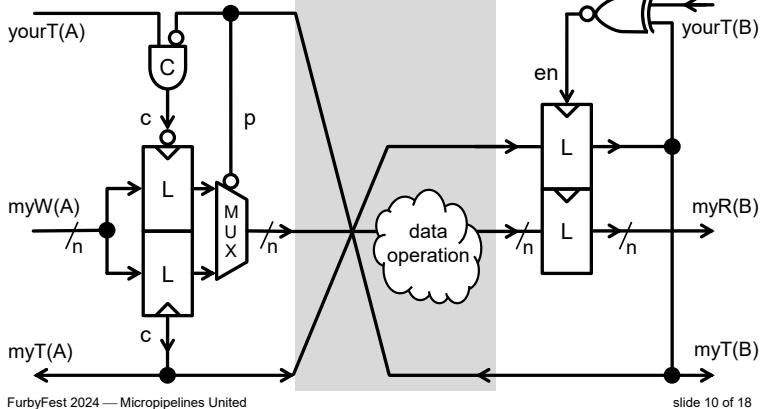


Mousetrap

United Design

Micropipeline Link

- communication
- state storage



Joint

- computation
- flow control

Mousetrap Link

- communication
- state storage

9

10

United Test: go-nogo per Joint

Micropipeline Link

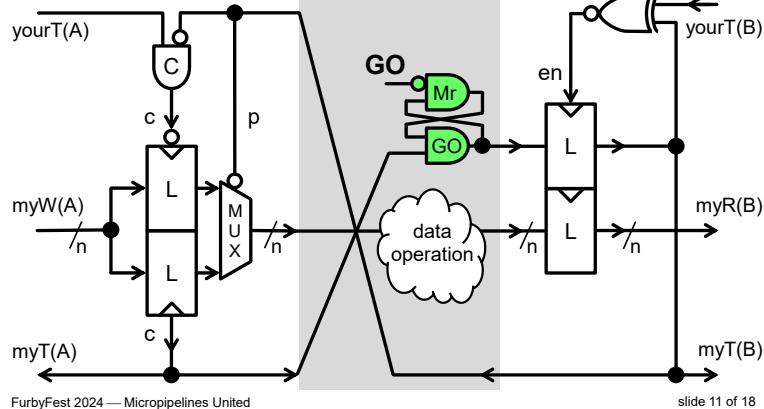
- communication
- state storage

Joint

- computation
- flow control

Mousetrap Link

- communication
- state storage



slide 11 of 18

11

United Test: scan Link à la SLC-MAN

Micropipeline Link

- communication
- state storage

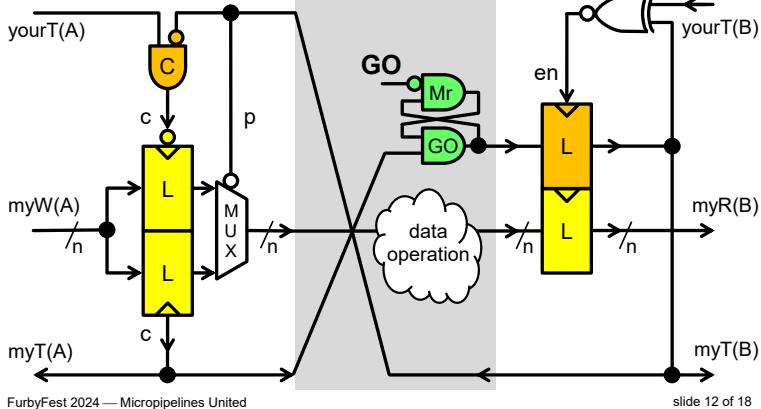
Joint

- computation
- flow control

Mousetrap Link

- communication
- state storage

must
maybe



slide 12 of 18

12

Micropipelines United

... unite with level signaling

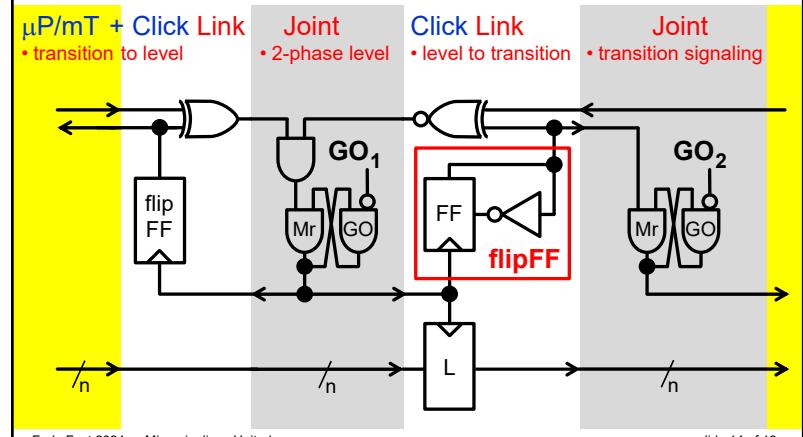
FurbyFest 2024 — Micropipelines United

slide 13 of 18

13

Transition to and from 2-phase Level

A. Peeters, F. te Beest, M. de Wit, W. Mallon, Click elements: An Implementation style for Data-Driven Compilation, Proc. ASYNC, 3-14, 2010



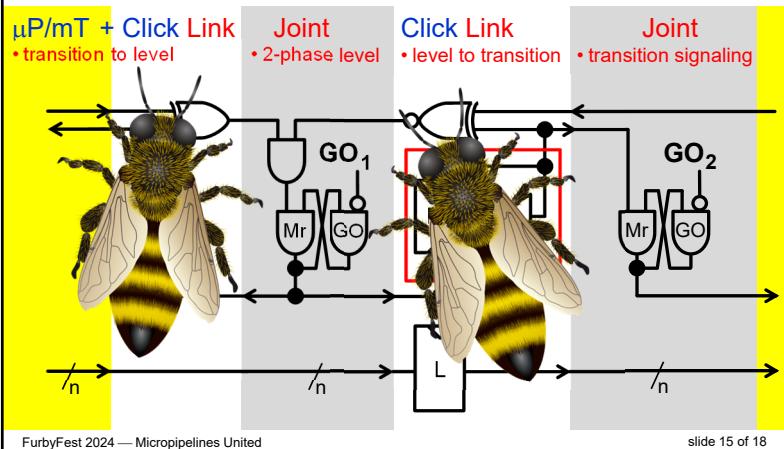
FurbyFest 2024 — Micropipelines United

slide 14 of 18

14

Bees

A. Peeters, F. te Beest, M. de Wit, W. Mallon, Click elements: An Implementation style for Data-Driven Compilation, Proc. ASYNC, 3-14, 2010



FurbyFest 2024 — Micropipelines United

slide 15 of 18

15

The Elephant and the bee

... for another time



FurbyFest 2024 — Micropipelines United

slide 16 of 18

4

SPECIAL THANKS

Manchester (UK)
Oleg Petlin
Steve Furber

Salt Lake City (USA)

Ajay Khoche
Erik Brunvand

New York City (USA)

Montek Singh
Steve Nowick

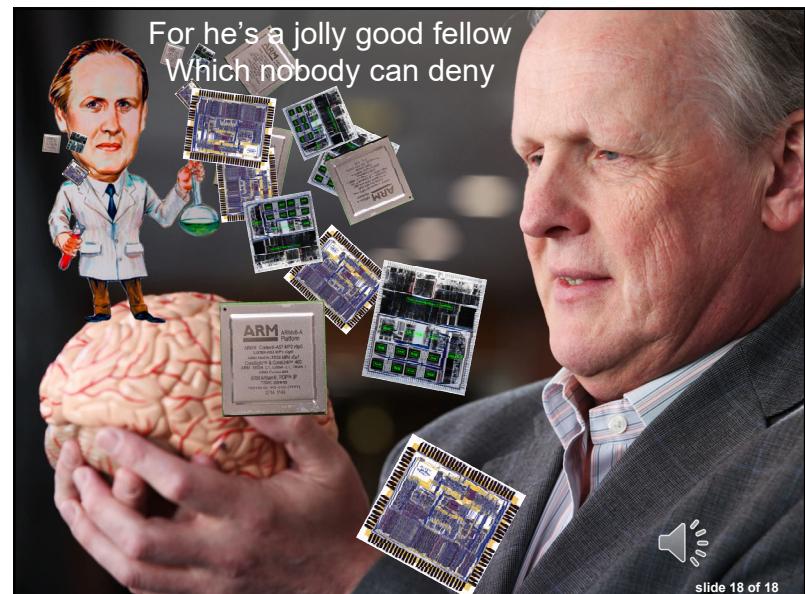
Eindhoven (NL)

Ad Peeters
Frank te Beest
Mark de Wit
Willem Mallon

FurbyFest 2024 — Micropipelines United

slide 17 of 18

17



18

Appendix

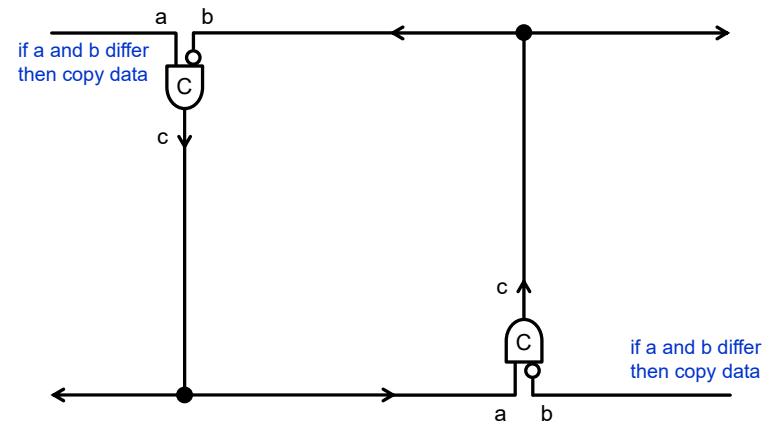
FurbyFest 2024 — Micropipelines United

slide 19 of 18

19

History : 90-mile Beach (AU)

I.E. Sutherland, Micropipelines (Turing Award lecture), CACM 32, 720-738, 1989



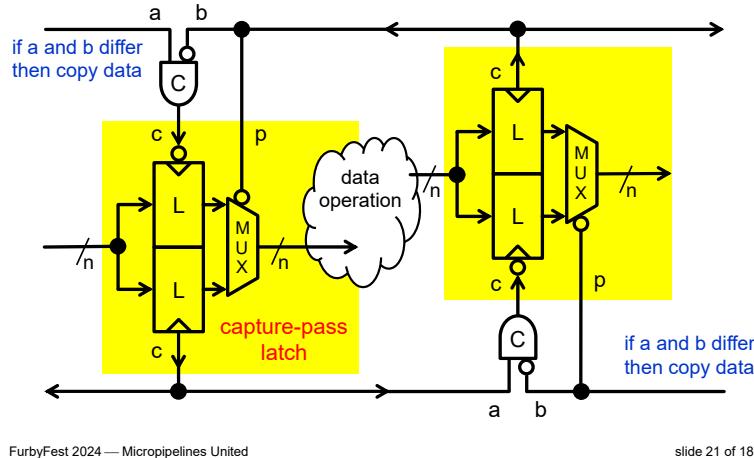
FurbyFest 2024 — Micropipelines United

slide 20 of 18

20

History : 90-mile Beach (AU)

I.E. Sutherland, Micropipelines (Turing Award lecture), CACM 32, 720-738, 1989



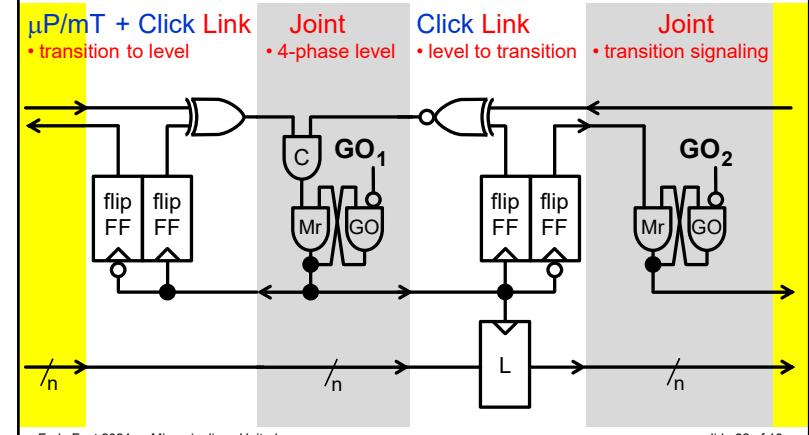
FurbyFest 2024 — Micropipelines United

slide 21 of 18

21

Transition to and from 4-phase Level

E. Esimai and M. Ronken, Flexible Compilation and Refinement of Asynchronous Circuits, Proc. ASYNC, 109-119, 2023



FurbyFest 2024 — Micropipelines United

slide 22 of 18

22