

Discrete Time Dataflow in Ptolemy II



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4-th Biennial Ptolemy Miniconference
March 22-23, 2001, Berkeley, CA

What is Discrete Time?

Timed Synchronous Dataflow (TSDF)

- Adds Timed data type
 - Parameters on signals are Δ , I, Q, f_c
- Adds Δ and f_c consistency checks
- Adds cosimulation with analog RF simulations
- Benefits
 - Enables modeling of RF effects to signals
 - Enables efficient RF simulations

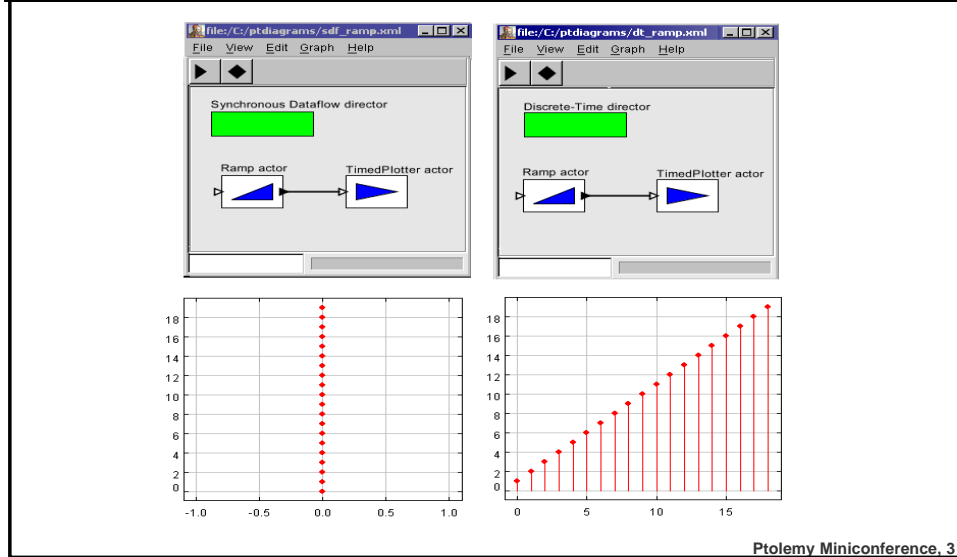


HEWLETT
PACKARD

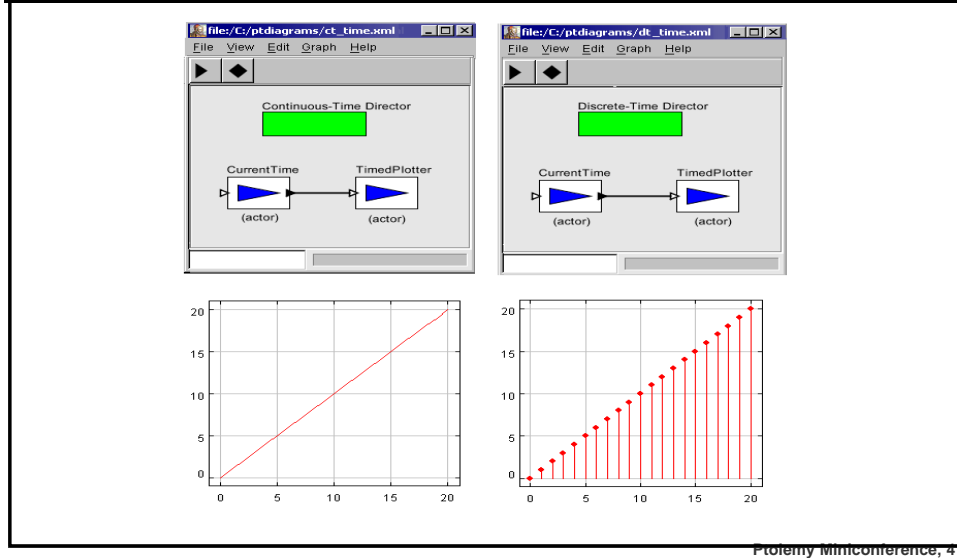
based on
Jose Pino's work:
*"Cosimulating DSP
Designs With Analog
RF Circuits"*

(Ptolemy
miniconference '99)

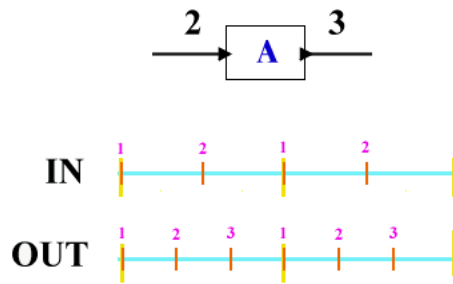
SDF vs. Discrete Time



CT vs. Discrete Time

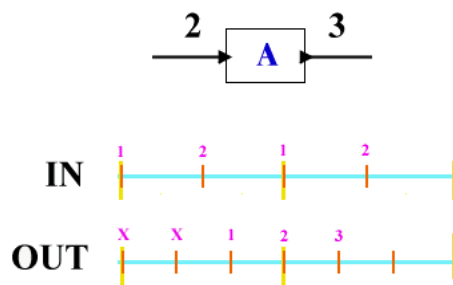


Causality



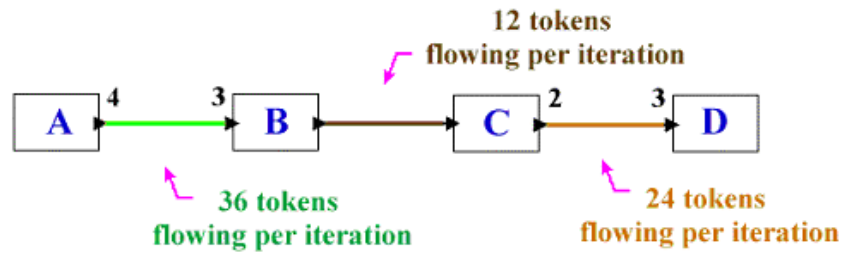
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Causality (continued ...)



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Token Flow Rate



token flow rate = actor repetitions * port rate

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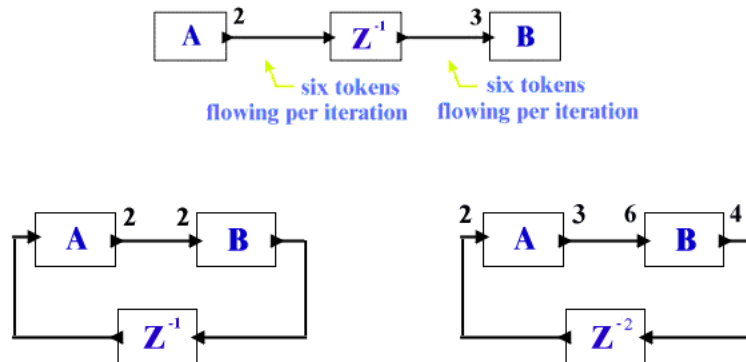
Design Criteria

- Causality
- Uniform Token Flow
- SDF-style semantics



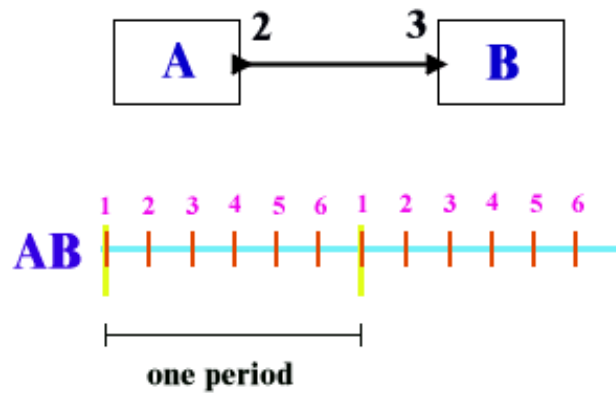
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Delays, Loops, and Deadlocks



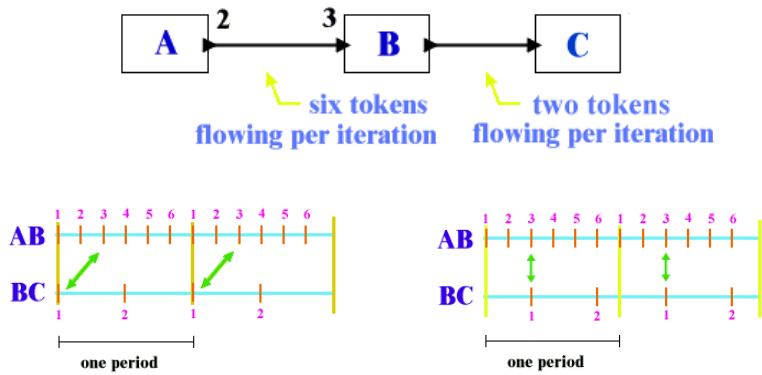
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Token Timeline Charts



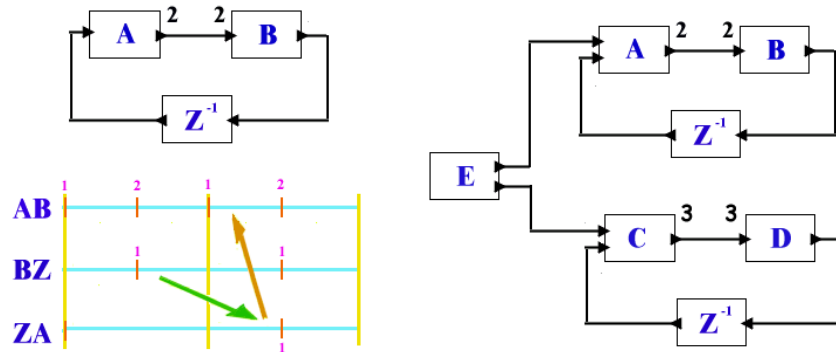
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Token Timeline Charts (continued ...)



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Causality and Latency

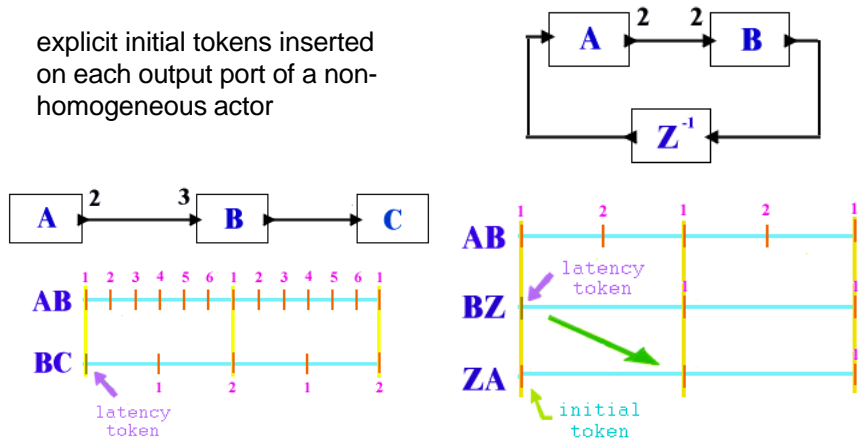


Are all deadlock-free SDF graphs causal? NO!!

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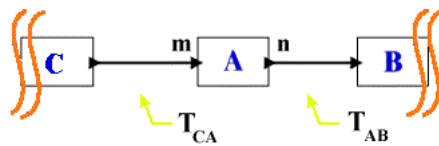
Latency Tokens

explicit initial tokens inserted on each output port of a non-homogeneous actor



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Minimum # of Latency Tokens



$$k * T_{AB} \geq (m-1) * T_{CA}$$

$$\Rightarrow k \geq \frac{(m-1) * T_{CA}}{T_{AB}}$$

$$\Rightarrow k \geq \frac{(m-1) * n}{m}$$

$$T_{CA} = \frac{P}{m R} \quad T_{AB} = \frac{P}{n R}$$

$$k_{\min} = \left\lceil \frac{n(m-1)}{m} \right\rceil$$

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