The Synchronous Data Flow Domain in Ptolemy II

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SDF Overview

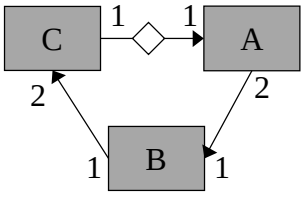
- Useful for simple Dataflow systems without control
  - Signal Processing
  - DSP code synthesis
- Enables efficient execution
  - No threads!
  - No deadlock detection!
  - No time ordered queues!

SDF Requirements

- Data rates on each port are constant and known a priori
  - unspecified rates are assumed to be one
- Delays are added to avoid deadlock
  - represented by initial tokens
- Graph is consistent (a static schedule exists)

Example SDF graphs

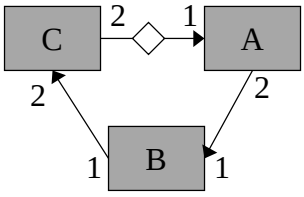
- Consistent graph



A Valid Schedule: ABBC

This schedule is also the minimum valid schedule.

- Inconsistent graph



No valid schedule exists!

Tokens will always accumulate between C and A

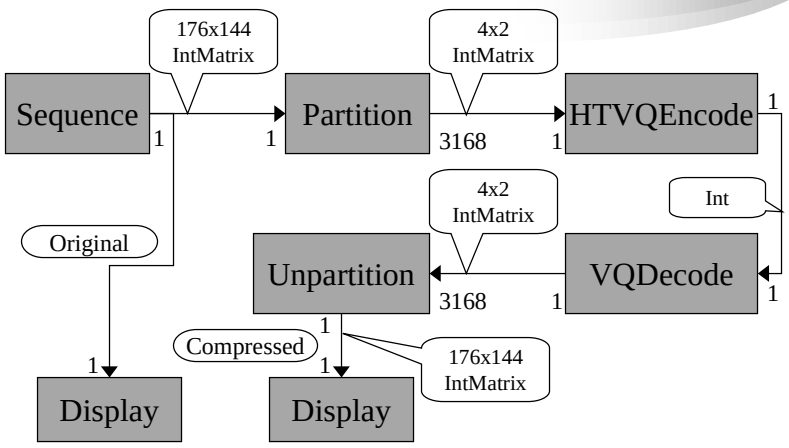
SDF Operation

- Scheduler creates a minimum valid schedule, if one exists.
  - Buffers on relations have bounded size
  - Each actor fires the minimum number of times necessary.
- Schedule is executed an integral number of times for each firing of the system
- Only linear (Single Processor) schedules are currently supported.

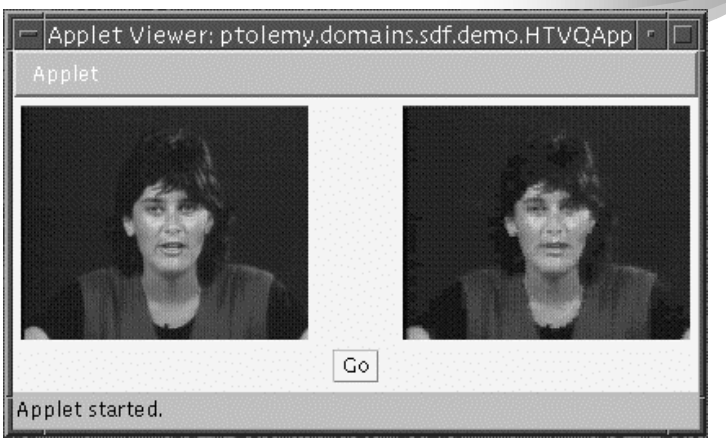
Vector Quantization Demo

- 8 Dimension VQ
- Each image is separated into 4x2 blocks, and the best approximation to the block is chosen from a codebook.
- Fast implementation using table lookups
- Video compression at 8:1

Vector Quantization Demo



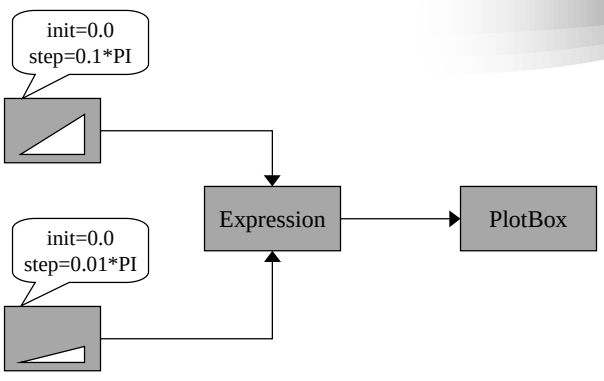
Vector Quantization Demo



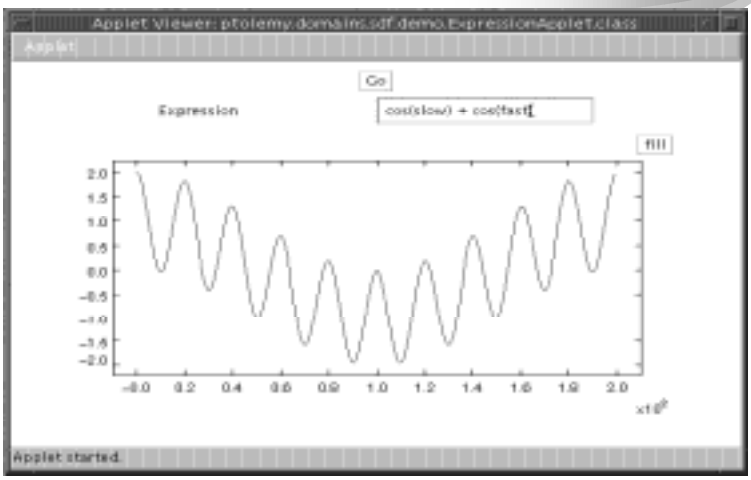
Expression Demo

- Based on Expression Actor
  - Type Polymorphic
    - Works with any ScalarToken
  - Domain Polymorphic
  - Shape Polymorphic
    - Operation depends on number and type of ports
  - Performs arbitrary arithmetic on input scalar tokens

Expression Demo



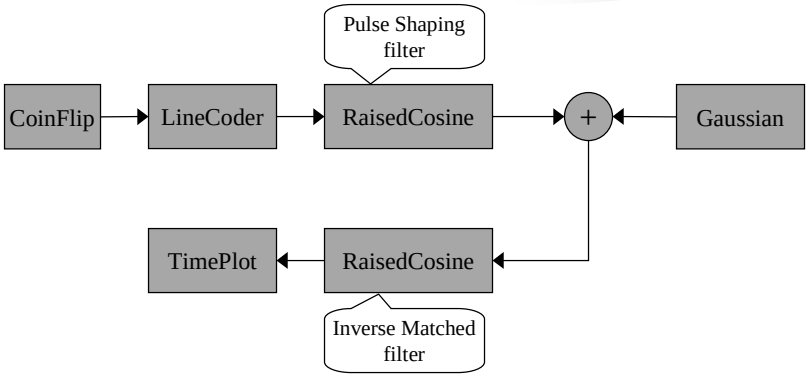
Expression Demo



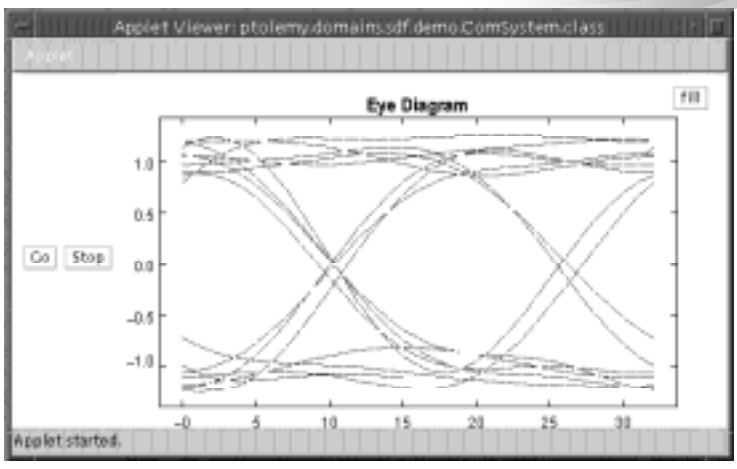
Communications System Demo

- Simulates a baseband signaling communications system operating under Additive White Gaussian Noise channel
- Raised Cosine pulse shape
  - Implemented using standard FIR filter actor.

Communications System Demo



Communications System Demo



SDF Summary

- SDF allows many signal processing algorithms to be modeled with very little runtime overhead
- Very similar to SDF domain in Ptolemy Zero, but currently only supports simple schedules.