Key Particle methods

class Particle {
public:
    virtual operator int ();
    virtual operator float ();
    virtual operator double ();
    ... etc...

    virtual StringList print ();
    virtual Particle& initialize();

    // Load the Particle with data
    virtual void operator << (int);
    virtual void operator << (double);
    ... etc...

    // Copy a Particle
    virtual Particle* clone();

    // compare two particles
    virtual int operator == (const Particle&);
Red stems indicate stars that operate on any particle. The code inside refers only to type “Particle,” so these stars are polymorphic.

Fork:
replicate a particle

Commutator:
merge particle streams

Distributor:
split particle streams
Color Hints at Data Types

- **blue** = float (double)
- **white** = complex
- **magenta** = fixed point
- **orange** = integer

thicker stems indicate matrices
Data Types in Ptolemy

- ComplexParticle
- Particle
- IntParticle
- FloatParticle
- FixParticle
- MessageParticle
- MatrixParticle
- FloatMatrixParticle

Base class for user-defined data types

Actually a double!
Example of an Inconsistent System

Inconsistent sample rates are detected by Ptolemy
Balance equations:

\[ r_1 O_1 = r_2 I_2 \]
\[ r_2 O_2 = r_3 I_3 \]

Solve for the smallest integers \( r_i \).

Then schedule according to data dependencies until repetitions \( r_i \) have been met for all actors.

The balance equations have no solution if the graph is \textit{inconsistent}. 
Some SDF Stars

SDF Stars
- Signal Sources
- Signal Sinks
- Arithmetic
- Nonlinear Functions
- Logic
- Control
- Conversion
- Signal Processing
- Image Processing
- Communications
- Matrix Functions
- Matlab Functions
- Higher Order
- User Contributions

Arithmetic
- Floating-point
- Complex
- Fixed-point
- Integer
Some SDF Demos

Synchronous dataflow (SDF) is used to model signal processing systems with deterministic control flow:

- Basic
- Multirate
- Communications
- Signal Processing
- Sound
- Image Processing
- Fixed-Point Demos
- Tcl/Tk Graphics Demos
- Matrix Demos
- Matlab Demos
- Higher-Order Functions
- Scripted Runs

Signal Processing Systems

Adaptive Filter Demo
Synchronous Dataflow

Properties

- Flow of control is predictable at compile time
- Schedule can be constructed once and repeatedly executed
- Suitable for synchronous multirate signal processing