Overview of Ptolemy II

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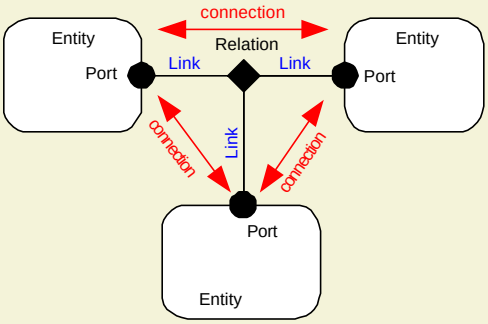
Ptolemy Miniconference
Berkeley, CA, March 22-23, 2001

Status Update

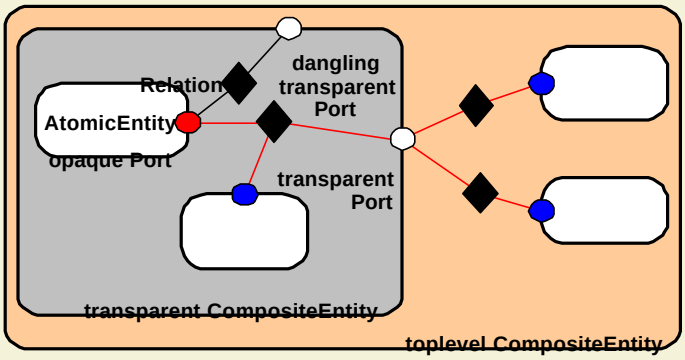
- Ptolemy II version 1.0 available
  - A platform for experimentation, collaboration
  - Open source, open architecture
  - Rated code (red, yellow, green)
  - Core code is very high quality (green)
  - Code is written to be read
  - Extensible GUI (all red, currently)
- Commercial support organization
  - recently formed: Agile Design

Components and their Relationships

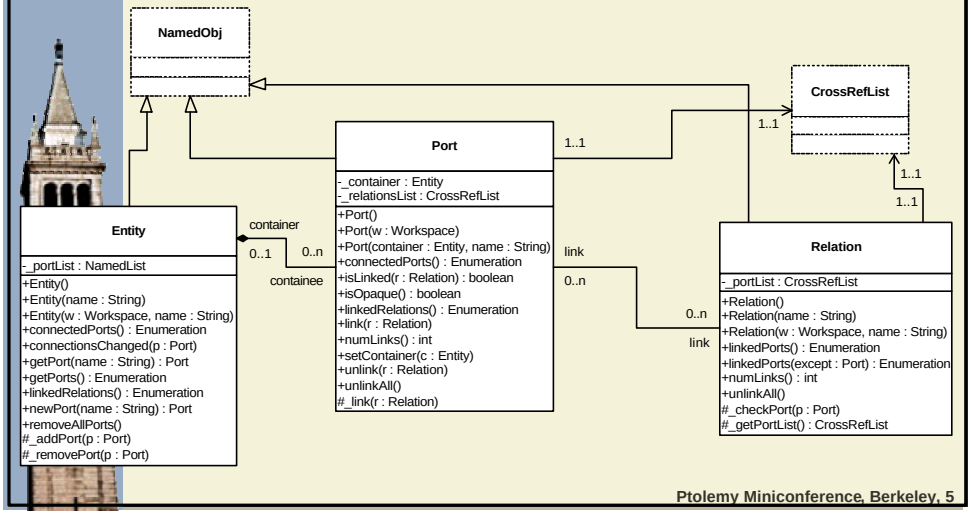


The Ptolemy II kernel provides an *abstract syntax* - clustered graphs - that is well suited to a wide variety of component-based modeling strategies, ranging from state machines to process networks.

Hierarchy - Construct components from finer grain components.

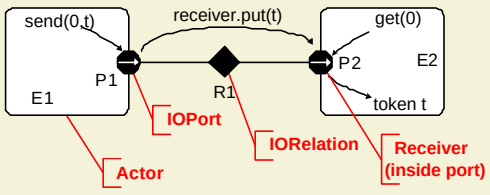


Basic Kernel Classes



Actor Package – Infrastructure for Producer/Consumer Components

Basic Transport:



Services in the Infrastructure:

- broadcast
- multicast
- busses
- mutations
- clustering
- parameterization
- typing
- polymorphism

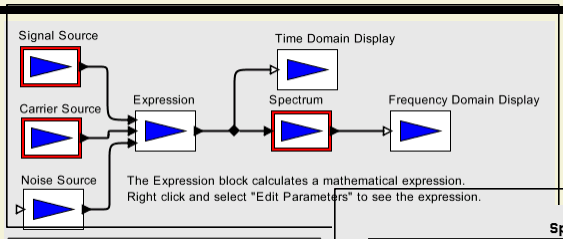
Domains – Provide semantic models for component interactions

- CSP – concurrent threads with rendezvous
- CT – continuous-time modeling
- DE – discrete-event systems
- DDE – distributed discrete events
- FSM – finite state machines
- DT – discrete time (cycle driven) *
- Giotto – synchronous periodic *
- GR – 3-D graphics *
- PN – process networks
- RTOS – priority-driven reactive models *
- SDF – synchronous dataflow
- SR – synchronous/reactive **

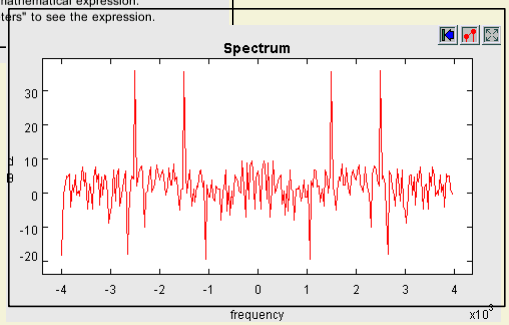
* New domains in Ptolemy II
** Not yet realized in Ptolemy II

SDF domain author:
Steve Neuendorffer

Synchronous Dataflow

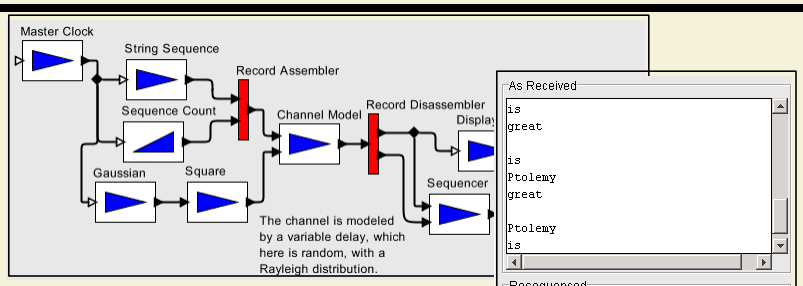


The SDF domain does static dataflow analysis to construct compile-time schedules, and analyze for deadlock and bounded memory.



DE domain authors:
Lukito Muliadi
Jie Liu

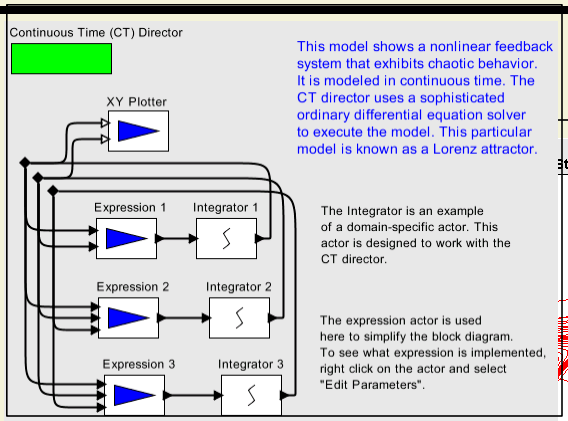
Discrete Event Models

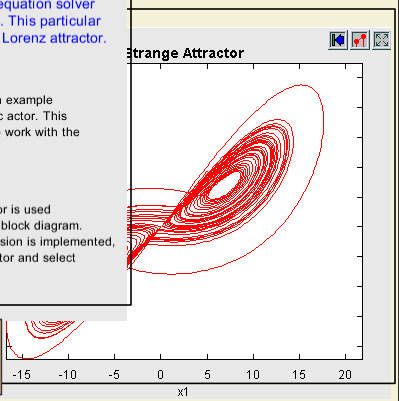


The DE domain uses an event queue to process events in chronological order, as in VHDL, Verilog, and a number of network simulation languages.

CT domain author:
Jie Liu

Continuous Time Models



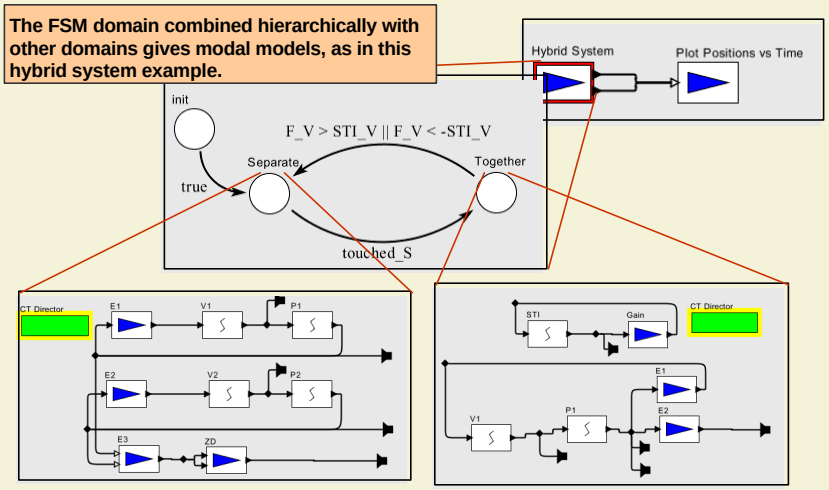


CT uses an ODE solver to model continuous-time systems.

FSM domain author:
Xiaojun Liu

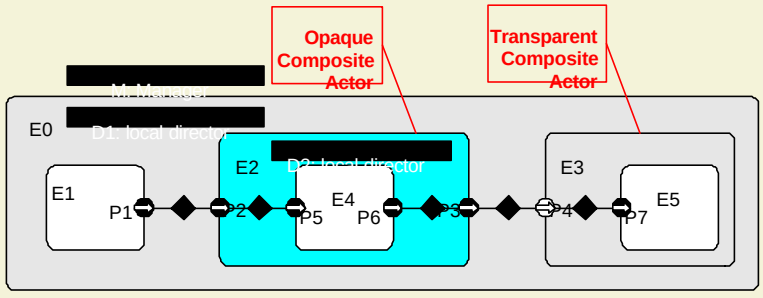
Finite State Machines

The FSM domain combined hierarchically with other domains gives modal models, as in this hybrid system example.

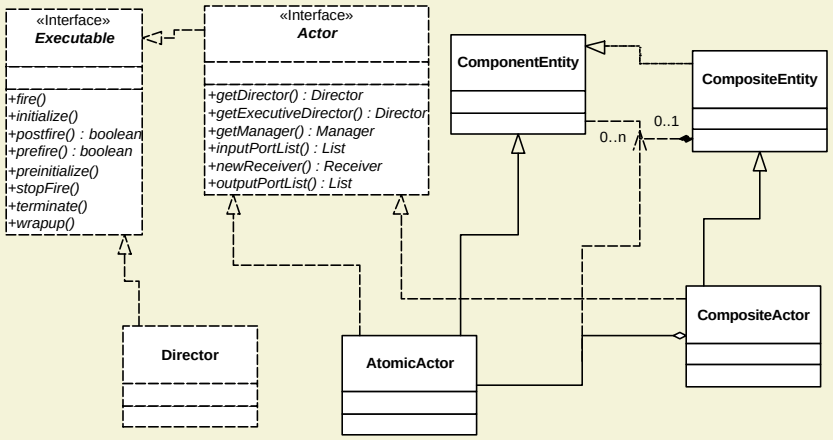


Hierarchical Heterogeneity

Directors are domain-specific. A composite actor with a director becomes opaque. The Manager is domain-independent.



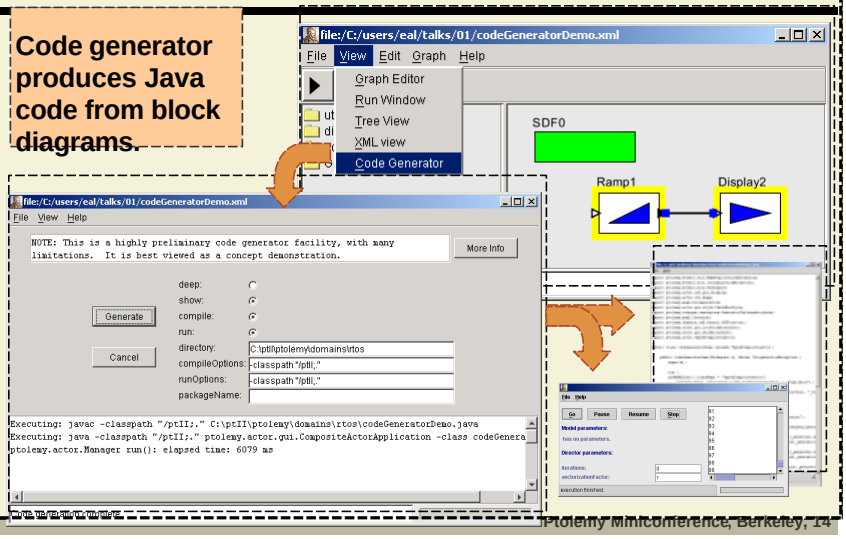
Basic Object Model for Executable Components



Code Generator: "Shallow" and "Deep"

Code gen author: Jeff Tsay

Code generator produces Java code from block diagrams.

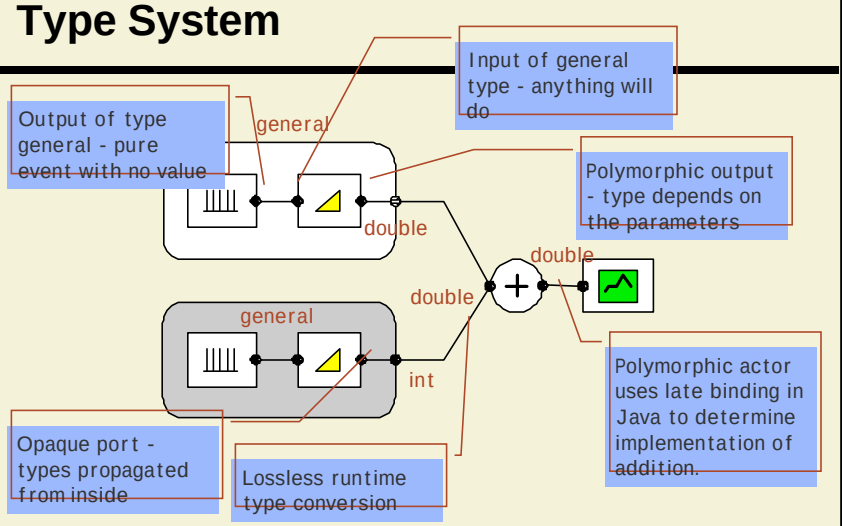


Infrastructure Support

- **Vergil – visual editor** (Steve Neuendorffer)
- **MoML – XML schema** (Edward Lee, Steve Neuendorffer)
- **Expression language** (Neil Smyth, Xiaojun Liu)
- **Type system** (Yuhong Xiong)
- **Math package** (Jeff Tsay, Bart Kienhuis, William Wu)
- **Graph package** (Yuhong Xiong)
- **Plot package** (Edward Lee, Christopher Hylands)
- **3-D graphics** (Chamberlain Fong)
- **Actor library** (all)

Type System

Type system author: Yuhong Xiong



Software Practice

- Object models in UML
- Design patterns
- Layered software architecture
- Design and code reviews
- Design document
- Nightly build
- Regression tests
- Sandbox experimentation
- Code rating

Code rating

- A simple framework for
  - quality improvement by peer review
  - change control by improved visibility
- Four confidence levels
  - **Red.** No confidence at all.
  - **Yellow.** Passed design review. Soundness of the APIs.
  - **Green.** Passed code review. Quality of implementation.
  - **Blue.** Passed final review. Backwards-compatibility assurance.