Real-Time Prototyping in Ptolemy

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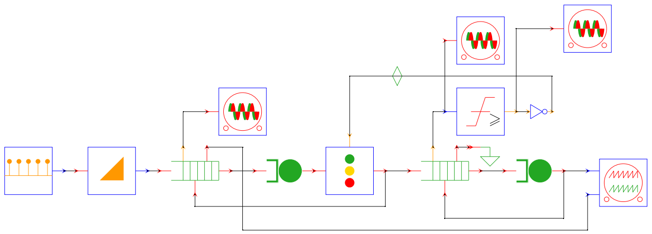
Objectives

Provide a framework to:

- Specify systems using natural models of computation
- Use hardware within a simulation
- Use the user's computing environment
- Construct heterogeneous multiprocessor real-time prototypes
- ★ Shorten the design cycle

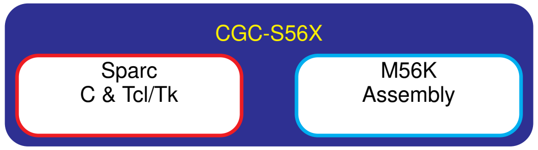
System Simulation

- Interpreted — blocks compiled into Ptolemy system
- Multiple models of computation — process networks, communicating processes, discrete event, RTL



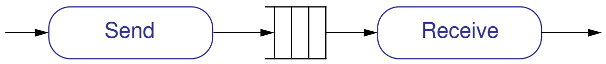
Code Synthesis

- Compile-time scheduling
- SDF & BDF models supported with extensions that allow for nondeterminate communication
- Object-oriented target specification

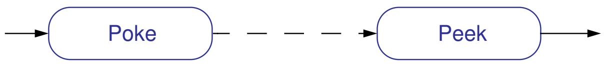


Communication Actors

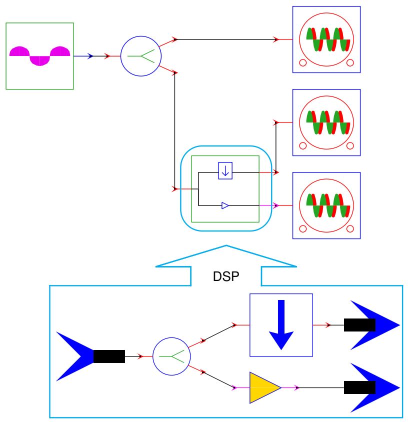
- Send/Receive
  Multiprocessor self-timed SDF graphs



- Peek/Poke — Asynchronous & nondeterminate
  Multiple independent SDF graphs

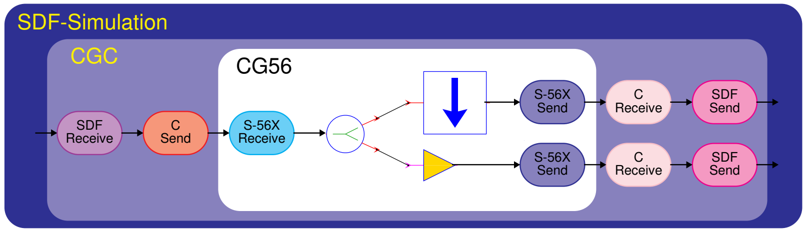


Migration to Hardware



- Top level — runs using a Ptolemy simulation domain (SDF)
- Subsystem compiled, downloaded and run on a S-56X DSP board installed in a host workstation

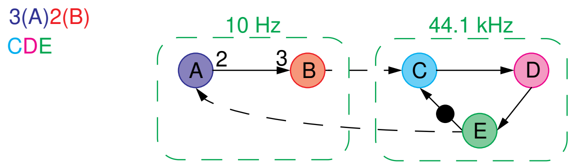
Simulation Interface Construction



- Uses send/receive communication actors
- Incremental compilation
- Simulation block is constructed

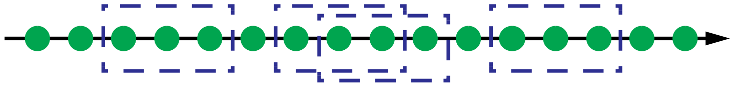
Stand-alone Prototype Synthesis

- Heterogenous multiprocessor support
- Hierarchical scheduling
- Peek/Poke — Extend SDF and BDF by allowing for nondeterminate communication
- Example of useful nondeterminism — real-time prototype user interfaces

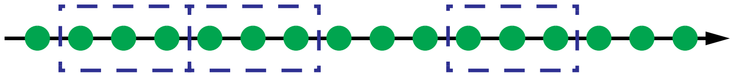


Peek/Poke Properties

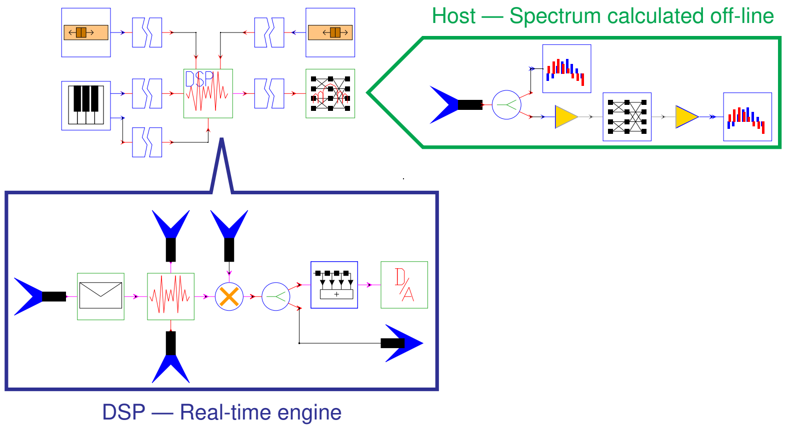
- Update rate is explicit, implicit or event driven (change of value)
- Single Sample
- Sliding Window



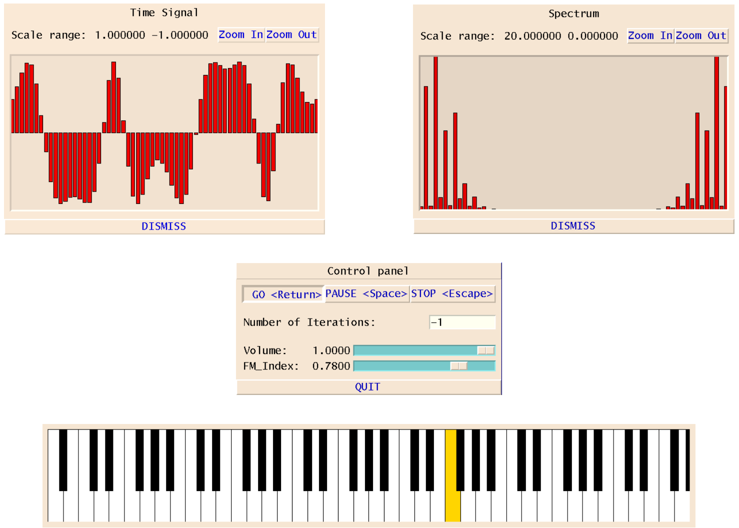
- Block aligned



FM Synthesis Specification



FM Synthesis: GUI



Conclusions

- Describe system with simulation domains
- Migrate subsystems to prototype hardware, generating a composite block for simulation which can be added to block library
- Generate a real-time stand-alone system using nondeterminate peek/poke communication actors as necessary