

The Ptolemy Project

Heterogeneous Modeling and Design



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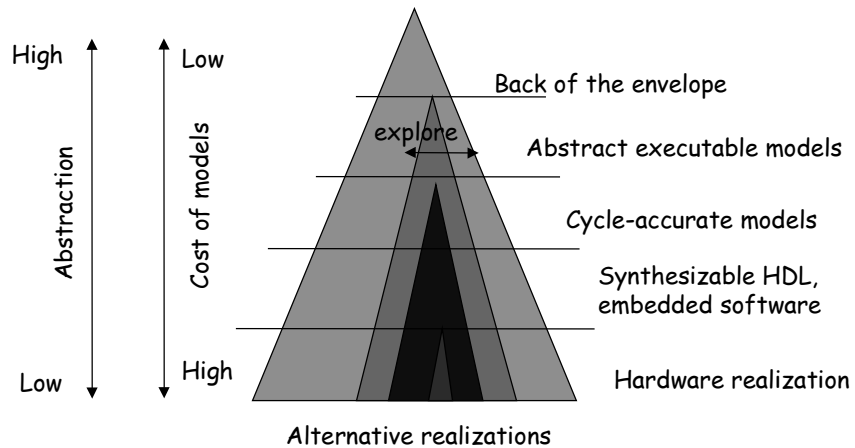
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Design Space Shadowing



Do more of the design at higher levels...

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Bottom-Up or Top-Down Design?



Bottom-up design



Top-down design

Top-down design, informed by bottom-up issues.

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Interactions of Components

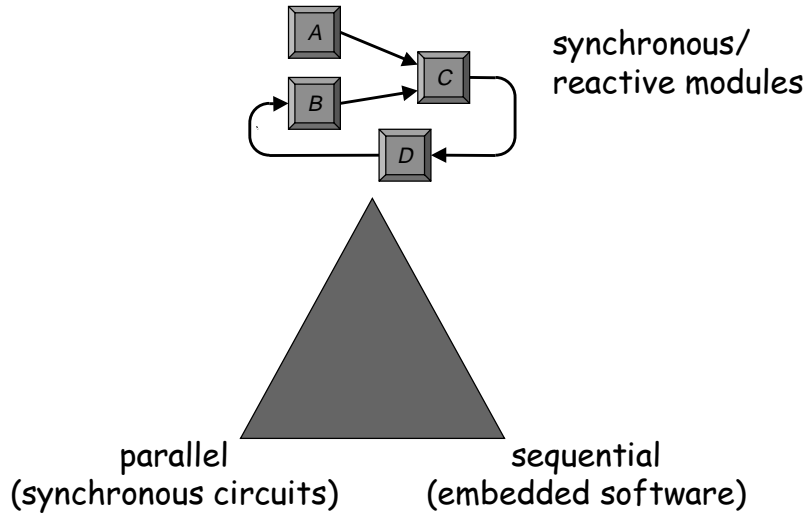
- Procedures
- Synchronous logic
- Asynchronous logic
- Bus protocols
- Shared memory
- Semaphores
- Rendezvous
- Timed events
- Streams
- Message passing
- Communication protocols/handshaking

Tower of Babel, in painting by Bruegel, 1563



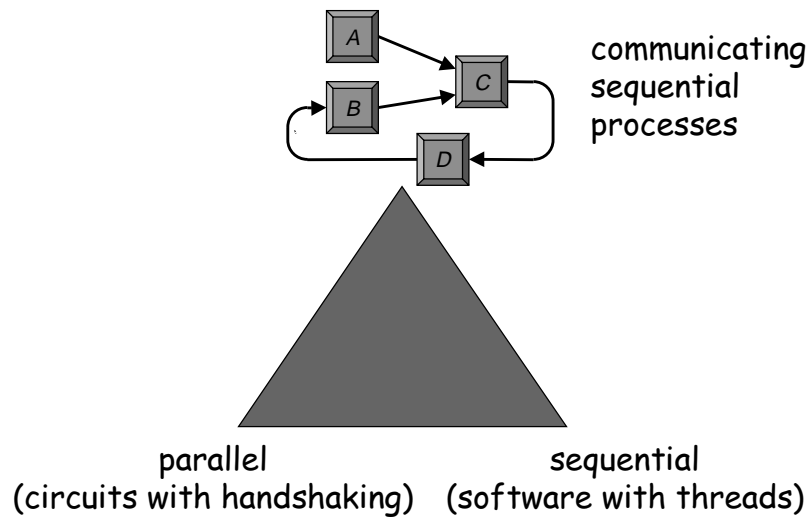
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Abstracting Synchrony



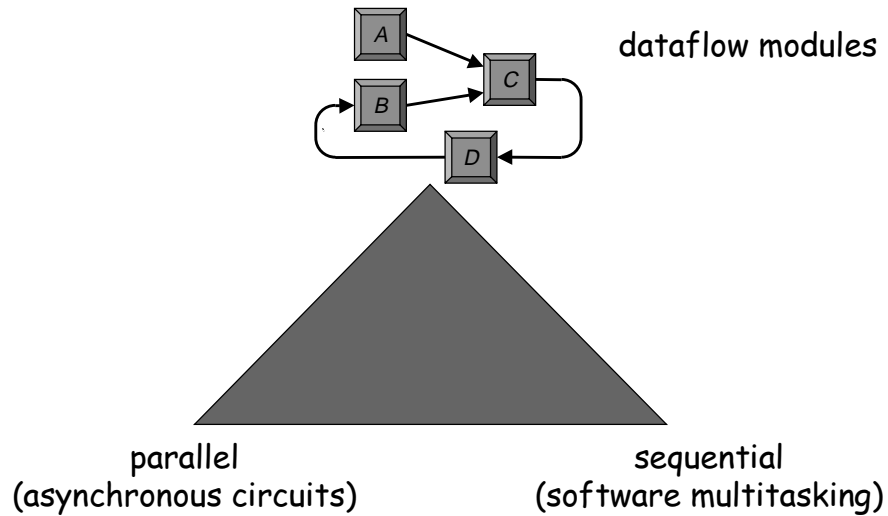
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Abstracting Rendezvous



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Abstracting Message Passing



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Current Trajectory

- Focus on modeling, simulation, and design of embedded systems.
 - networked, real-time systems with control and signal processing.
- Theory and techniques for combining diverse models of computation:
 - mixed signal, hybrid systems, discrete and continuous events, codesign
- Software architecture for modular, distributed, and heterogeneous design, modeling and visualization tools.

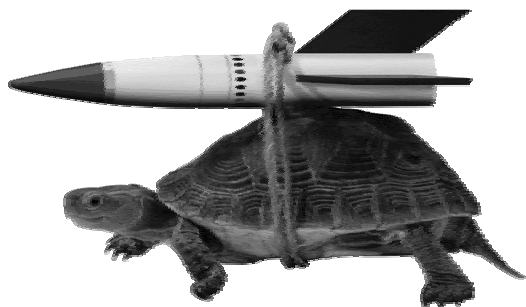
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Approach

- Use of programming language concepts:
 - semantics, type theories, reflection, and concurrency theories.
- Focus on domain-specific modeling and design problems
 - so the designer can focus on the problem, not the tools.
- Emphasis on visual representations.
- Use of Java.

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Modeling in Java ?!?!?!?!?



- Choosing the best modeling technique can have a far bigger impact than using a faster modeling tool.
- Mixing modeling techniques permits multi-domain modeling using the best available modeling techniques.
- Threads, objects, and UI infrastructure helps with both.
- Network integration of Java promotes sharing of modeling methods.
- Java performance and infrastructure is rapidly improving.

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Ptolemy Classic vs Ptolemy II

C++	Java
Mature platform	Experimental
Does code generation	All Java (now)
Monolithic tool	Modular packages
Standalone	Networked
Sequential	Multi-threaded
GUI-centric	Applet-centric
Ad-hoc development	Good software practice
Dynamically linked	Reflective
Astronomical lexicon	Boring lexicon