

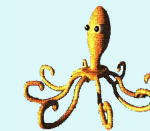
# Design-Space Exploration of High-tech Embedded Systems

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- Octopus project



- Funding: SenterNovem

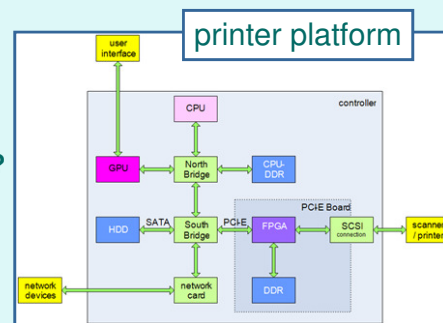


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## Design-space exploration: an example

- Use-cases to be mapped onto a professional printer
  - Copying (black&white, color, various paper sizes, zoom factors, ...)
  - Printing
  - Scanning
  - Simultaneous printing and scanning

- How many CPUs, GPUs ?
- Processor speeds ?
- How to achieve X images/min ?
- Double resolution ?



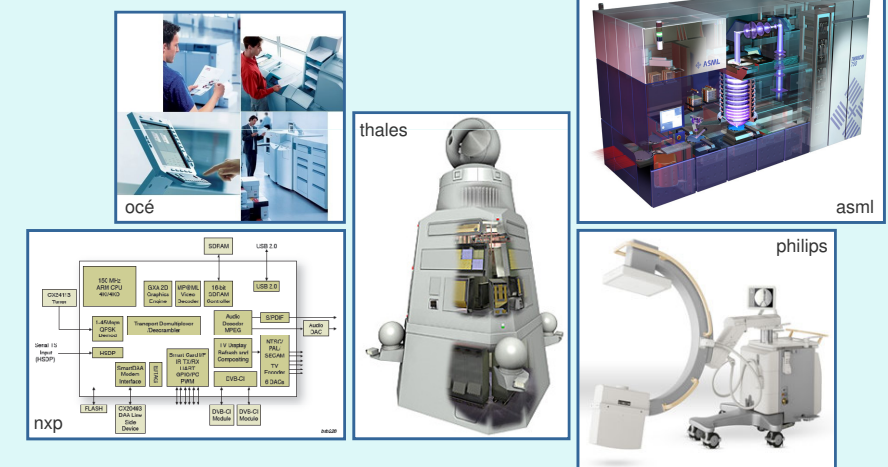
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Octopus

## Observation

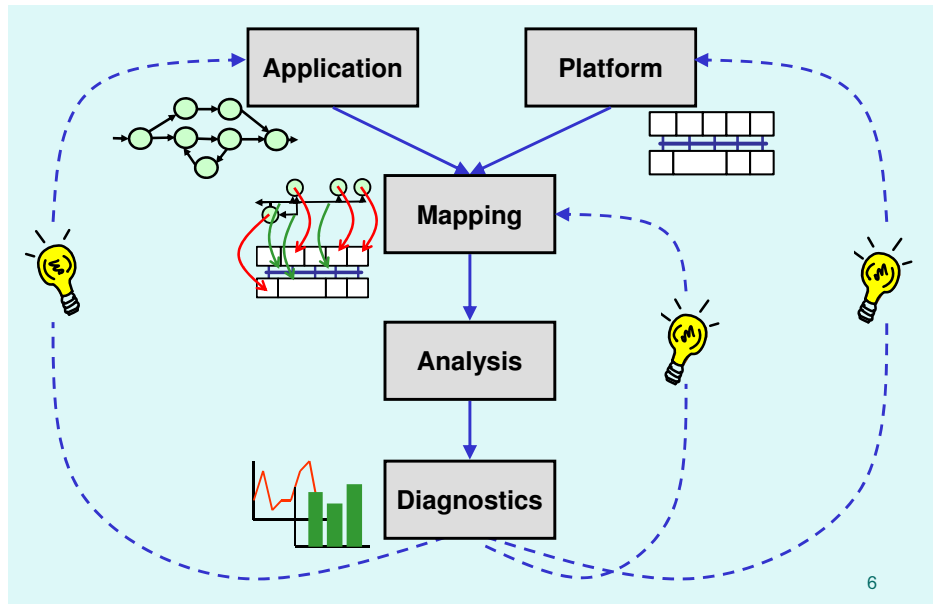
Many high-tech industries face very similar  
design-space exploration problems



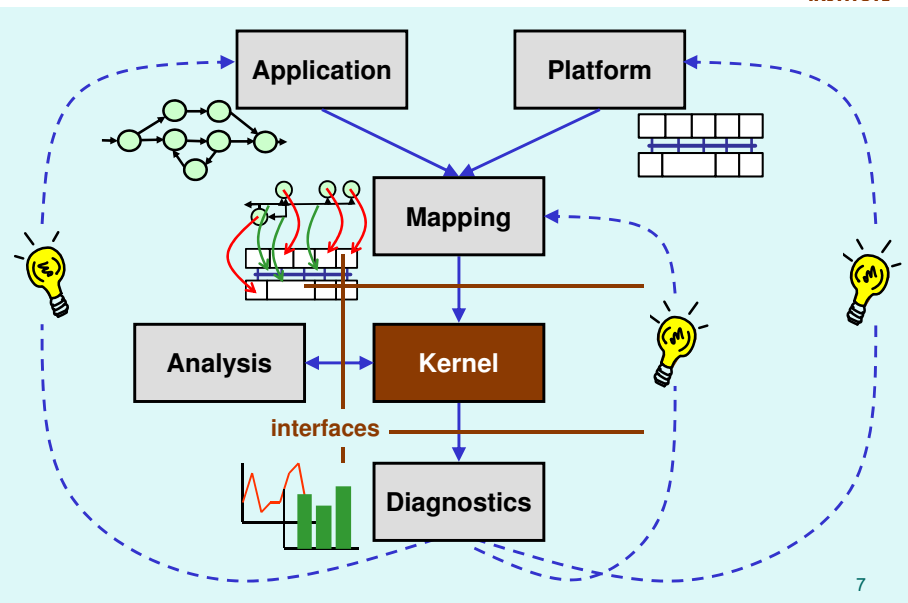
## Design-space exploration support for high-tech embedded systems

- **Flexible set of tools**
- **Support for formal analysis**
- **Support for (semi-)automatic exploration**
- **Prototype for professional printers**
- **Retargetable to other systems**

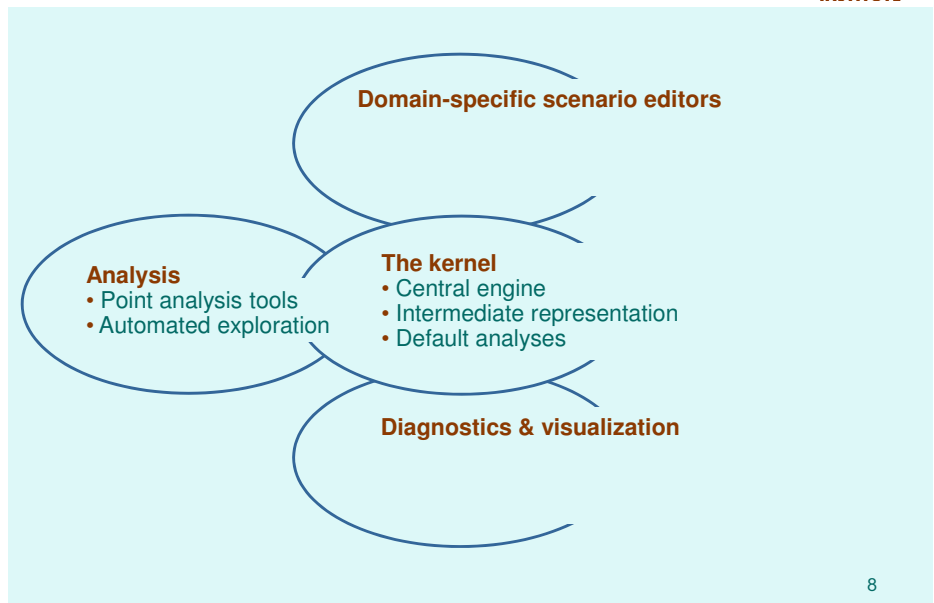
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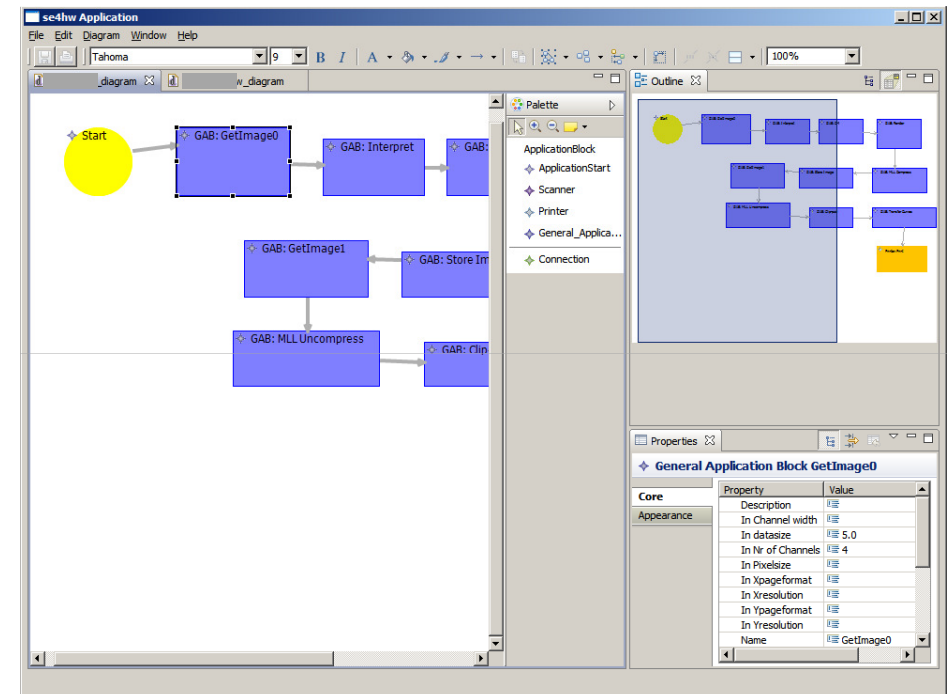
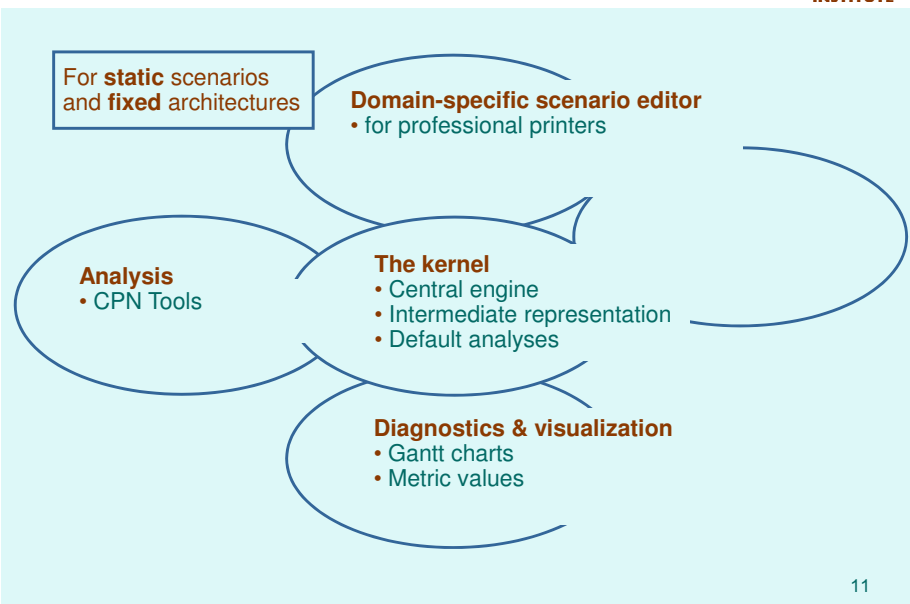
- Intuitive domain-specific modeling environments
- One UI, access to multiple analysis tools
- Hides complexity of formal methods and models
- Reduces modeling effort
- Provides consistency between different analyses
- Flexible, extensible toolset
- Reuse potential between different industries
- Potential to support the DSE process
  - Model storage and versioning
  - Decision tracking and decision support
  - Code generation and synthesis

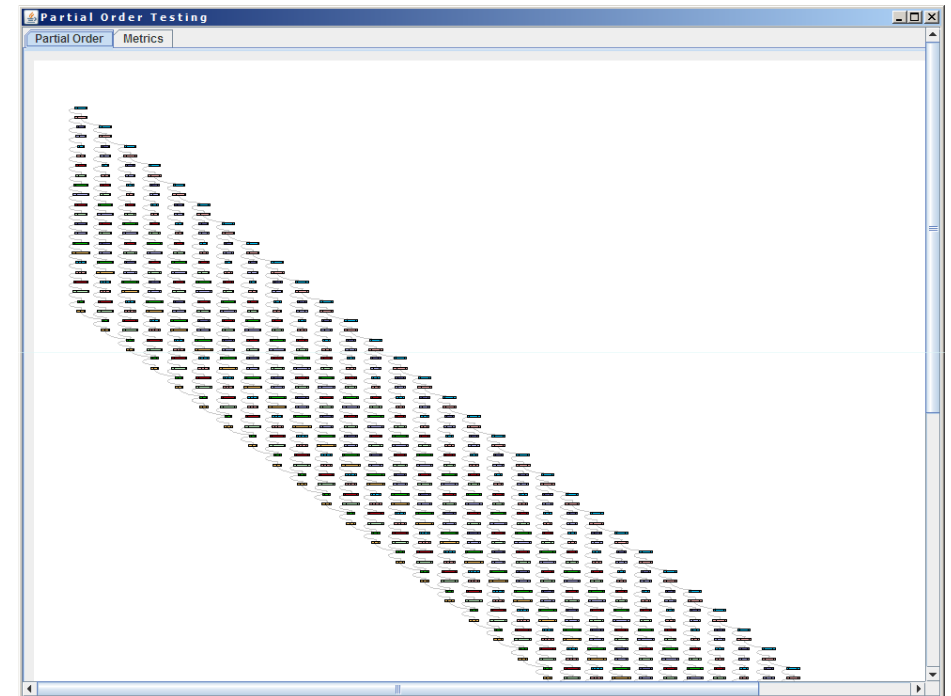
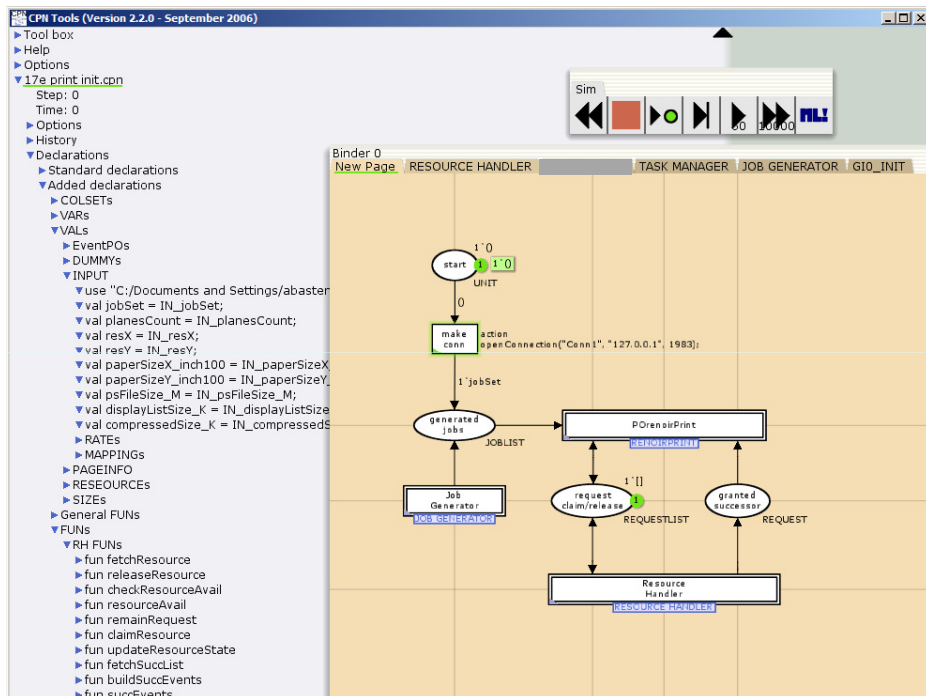
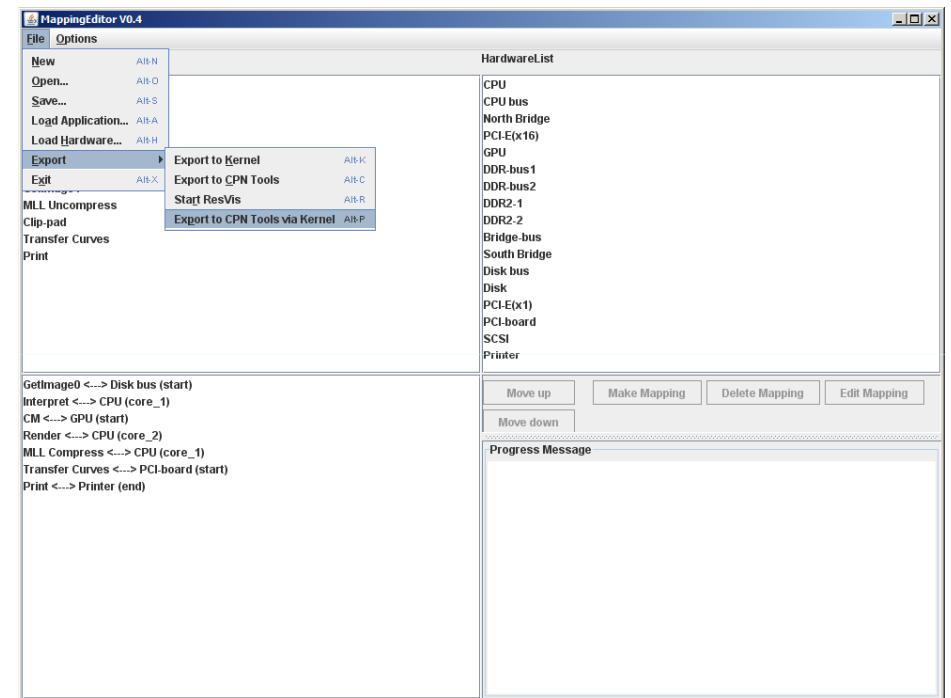
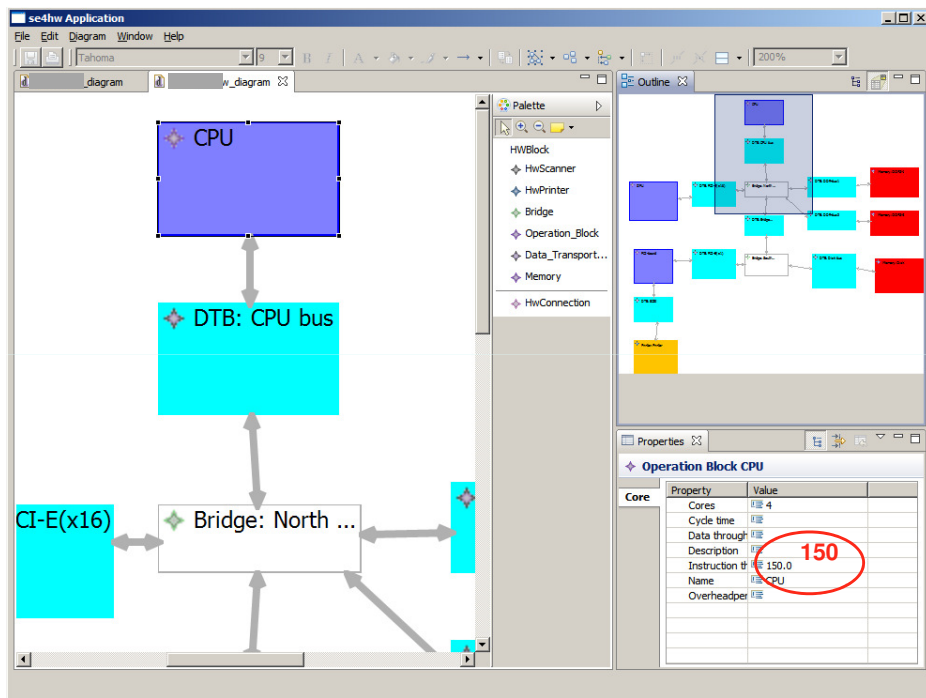
- Domain- and/or tool specific
  - e.g., Autosar/AADL, Deadalus, Mescal, Metropolis, Scade
- Generic, but without well-defined kernel
  - e.g., Opt4J, PISA

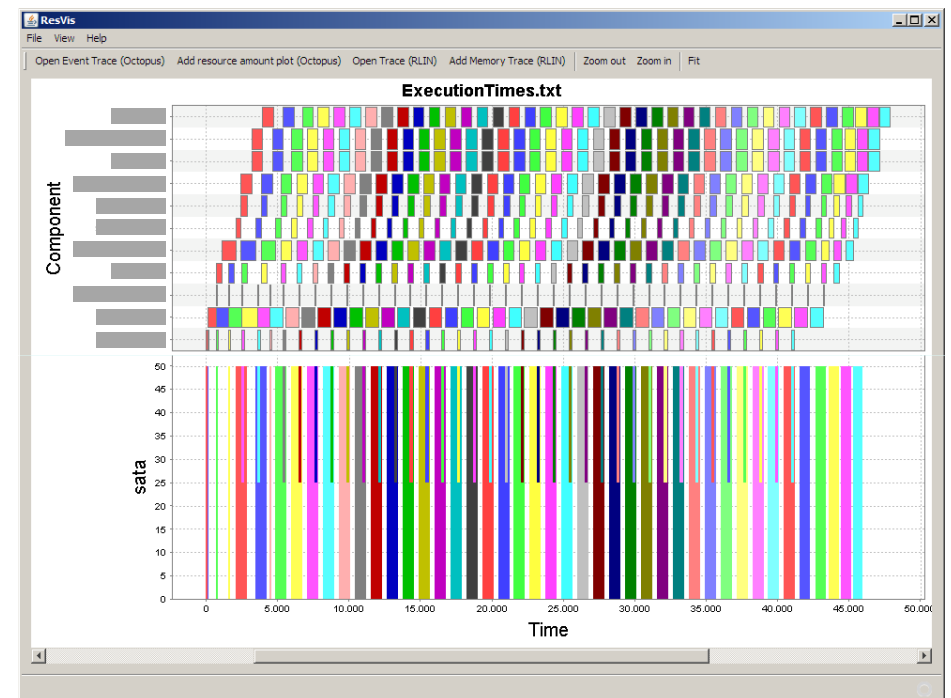
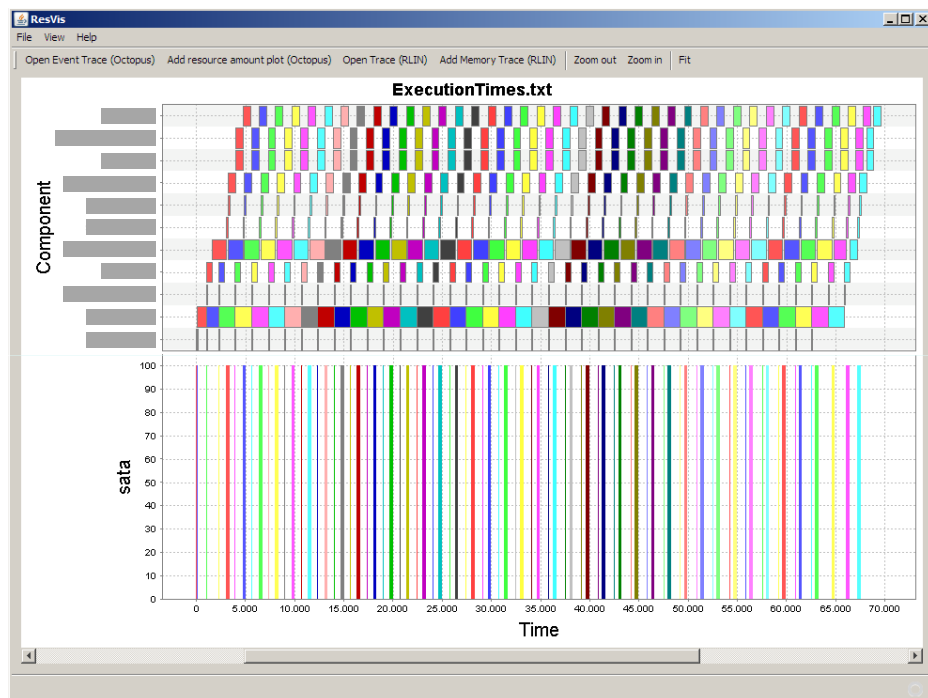
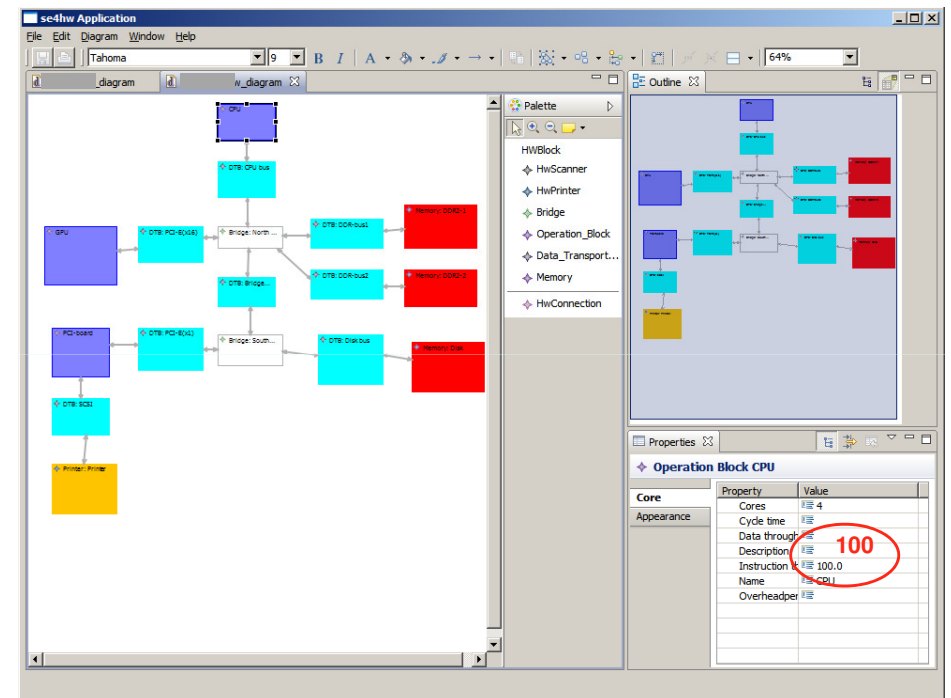
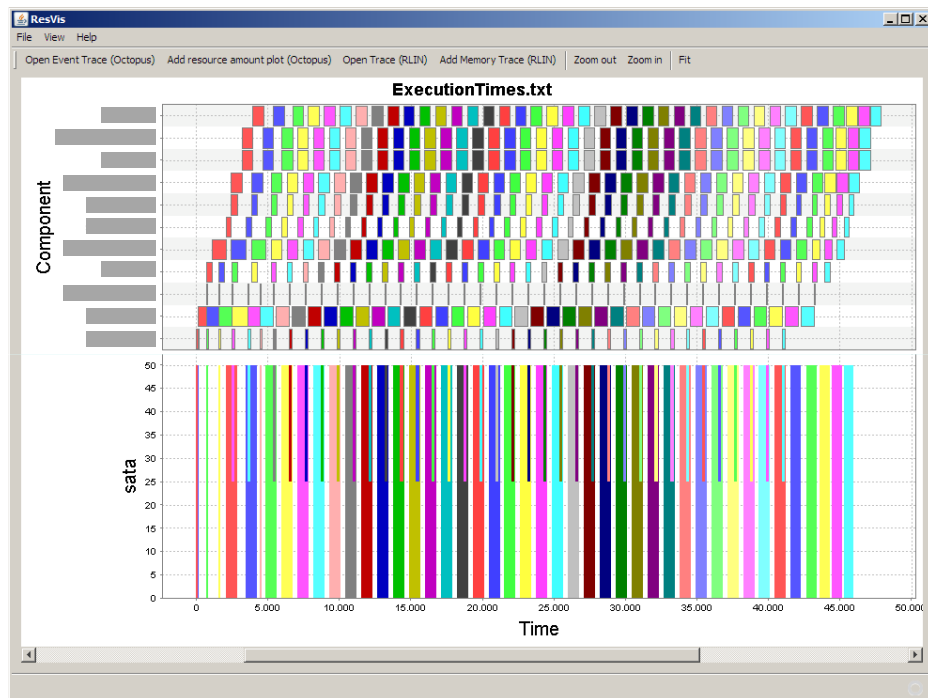
None of these targets the combination of

- support for the entire DSE process
- across application domains, and
- formal analysis by different tools

## The current toolset







## The envisioned toolset

### The kernel

- Central engine
- Intermediate representation
- Default analyses

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## The envisioned toolset

### Domain-specific scenario editor

- UI for the system designer
- Specification of design alternatives
- Specification of experiments, metrics

### The kernel

- Central engine
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## The envisioned toolset

### Domain-specific scenario editor

- UI for the system designer
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### Analysis

- Point analysis tools
- Automated exploration

### The kernel

- Central engine
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## The envisioned toolset

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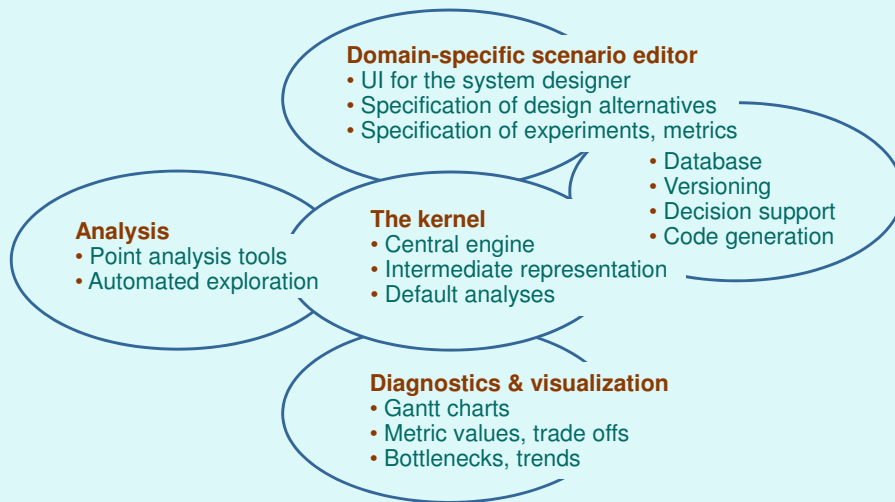
### Analysis

- Point analysis tools
- Automated exploration

### Diagnostics & visualization

- Gantt charts
- Metric values, trade offs
- Bottlenecks, trends

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- **Computational modeling, analysis, synthesis**
- **Intermediate representation**
  - Expressive
  - Conceptually simple
- **Translations to different modeling formalisms**
- **(Semi-)automatic DSE**
- **Diagnostics and back-annotation**

### Questions ?

