Soleil
A Component Framework for Java-based Real-time Embedded Systems

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Goal

Methods reducing a complexity of developing real-time systems:
- Introducing general-purpose languages (Java)
- Applying software engineering paradigms **CBSE** (Component-based Software Engineering)

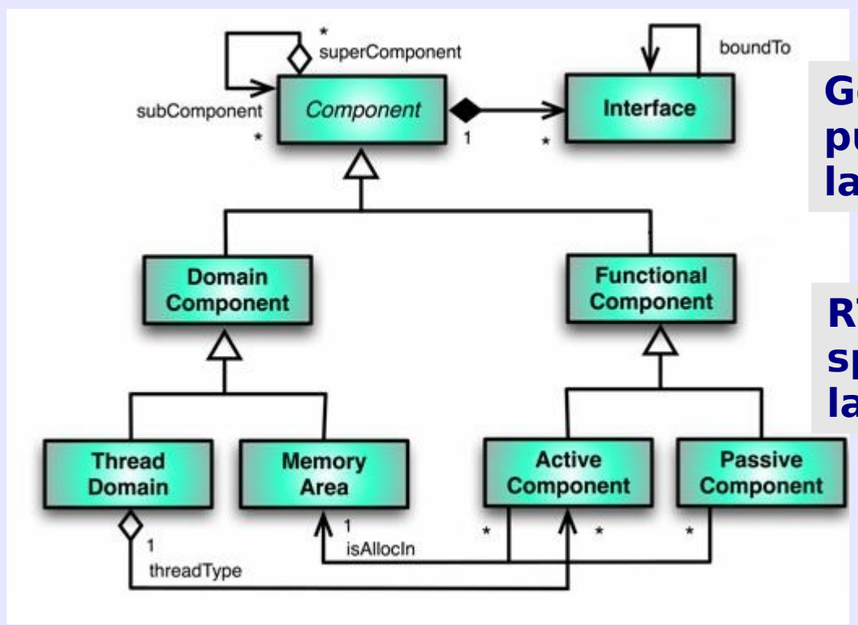
Real-time Specification for Java (RTSJ)
- Determinism in Java is achieved by introducing
- Memory areas (scoped, immortal, heap)
- Schedulable entities (real-time threads, events)

Goals
- **Application of CBSE paradigm into RTSJ world**:
  - **Enhancement** of development with RTSJ
  - **Efficiency** through *CBSE* and *Generative Programming*
  - **Safety** through F*ormal Verification*

Component Metamodel for RTSJ

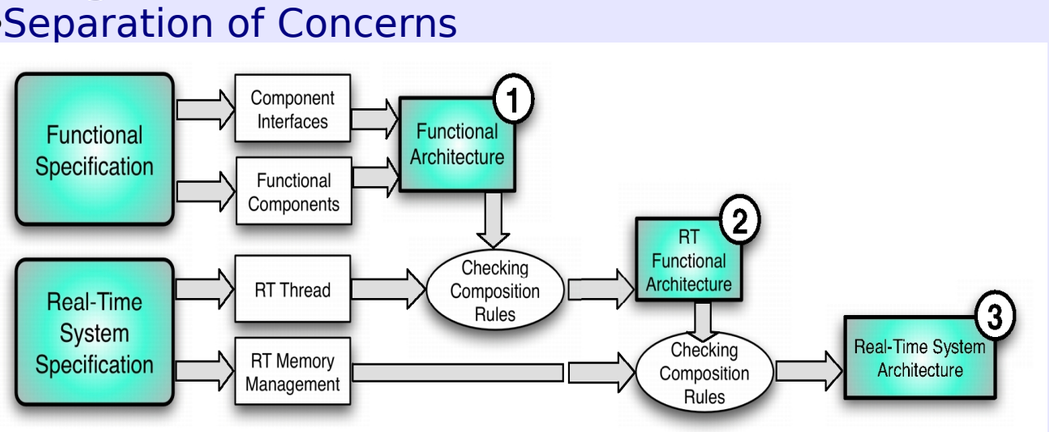
Domain Components
- **RTSJ defined as first-class entities**
- **Explicit separation of functional and real-time components**

Metamodel formally specified
- **Formal verification of architectures towards RTSJ**
- **Reasoning about the application at the design time**

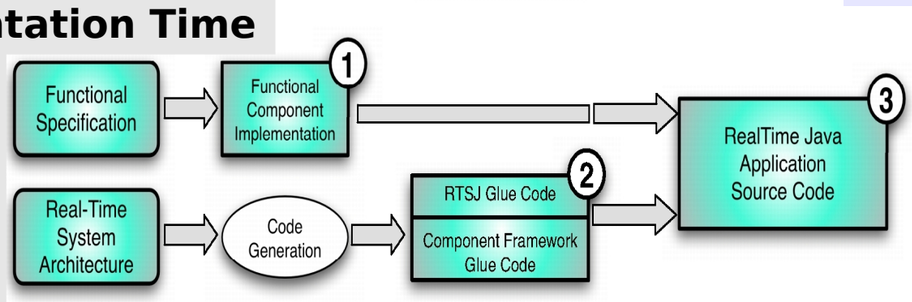


Framework Methodology

Design Time
- Separation of Concerns

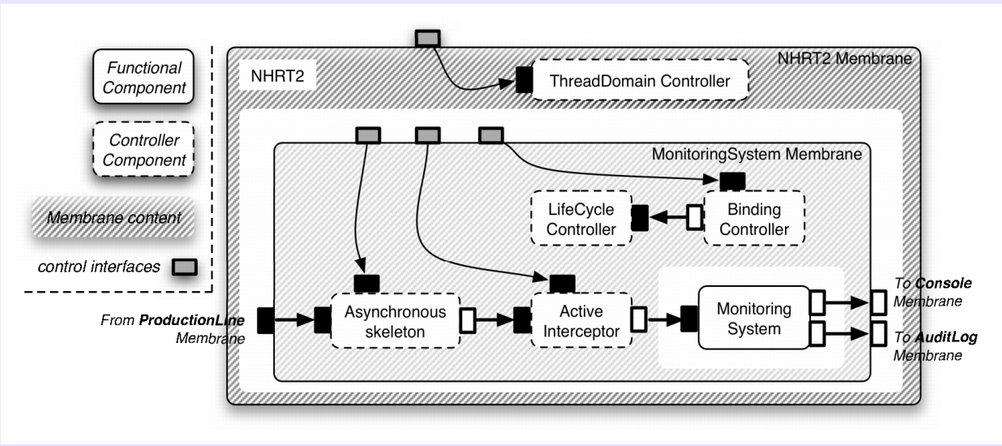


Implementation Time
- Automatic generation of RTSJ-related and framework related code.



Execution Infrastructure

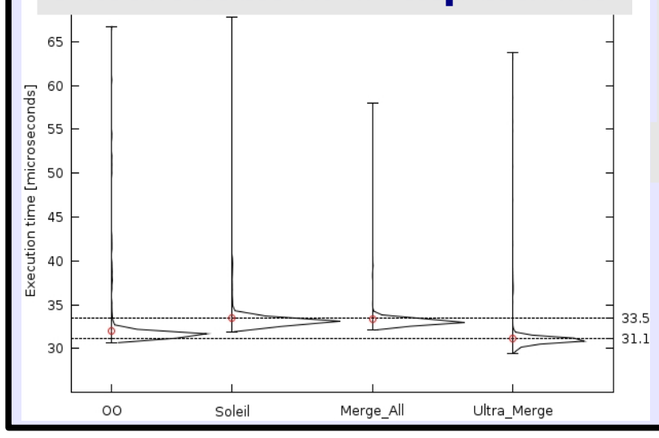
Component Membranes
- Component-oriented Container
- Extensive non-functional support at Runtime
- Runtime Reconfiguration



Experimental Evaluation

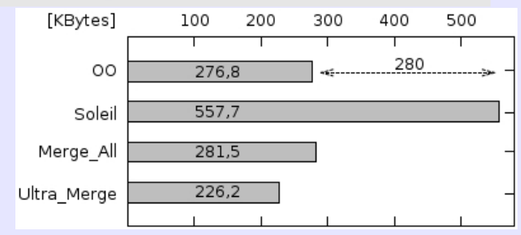
- Achieving **predictability**
- Reducing overhead

Performance Comparison



Legend
OO – object-oriented impl.
Soleil – Soleil implementation
Merge_All & ***Ultra_Merge*** Soleil with different optimization levels

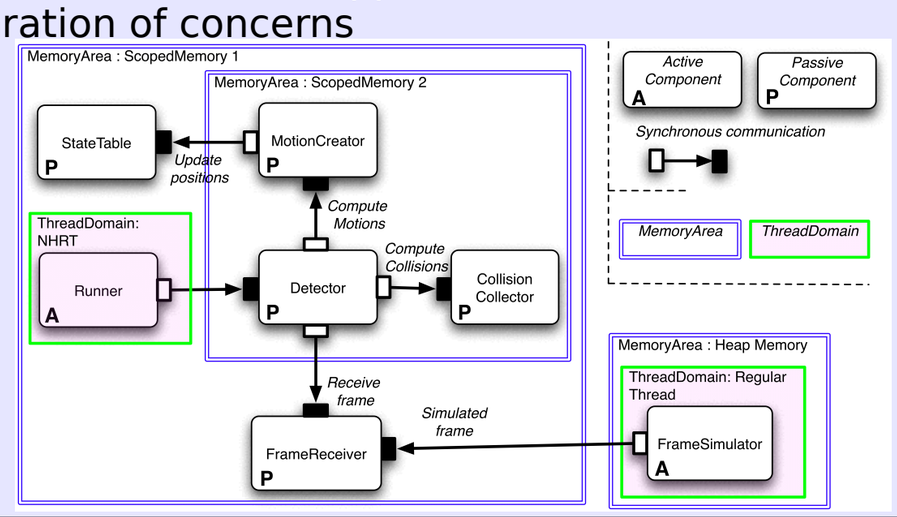
Footprint Reduction



Case Study

Real-time **Collision Detector**
- 10Hz Period, detecting collision courses of aircrafts

Prove of Concept
- Componentization of the application
- Full separation of concerns



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