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Introducing Distribution into a RTSJ-based Component Framework

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The Real-Time Specification for Java (RTSJ) is becoming a popular choice in the world of real-time and embedded systems. But, a growing complexness of these systems brings a demand for their distribution. However, there are only a few projects addressing application of RTSJ in distributed environments.
In this paper we introduce our approach based on software connectors to support distribution in a RTSJ-based framework. We propose extensions of our Soleil framework to achieve distribution while still preserving its original benefits: separation of concerns and mitigation of complexities in the system development lifecycle.

Introduction

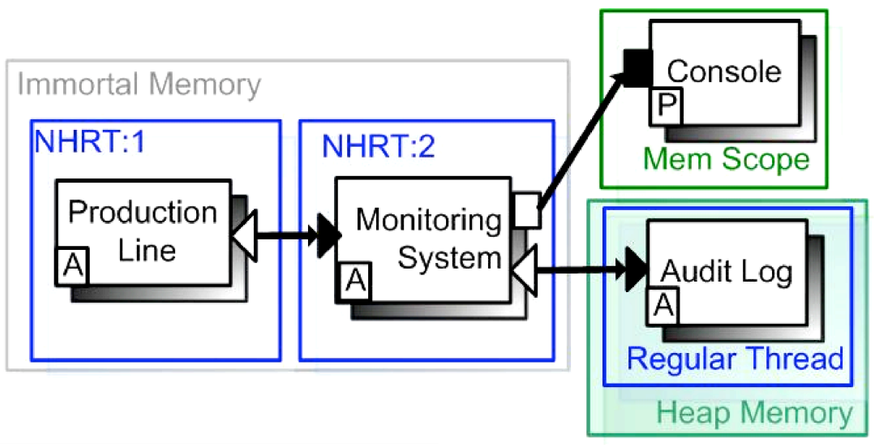
Methods reducing a complexity of developing real-time systems:
- Introducing general-purpose languages (Java)
- Applying software engineering paradigms
  - **CBSE** (Component-based Software Engineering)

Background

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

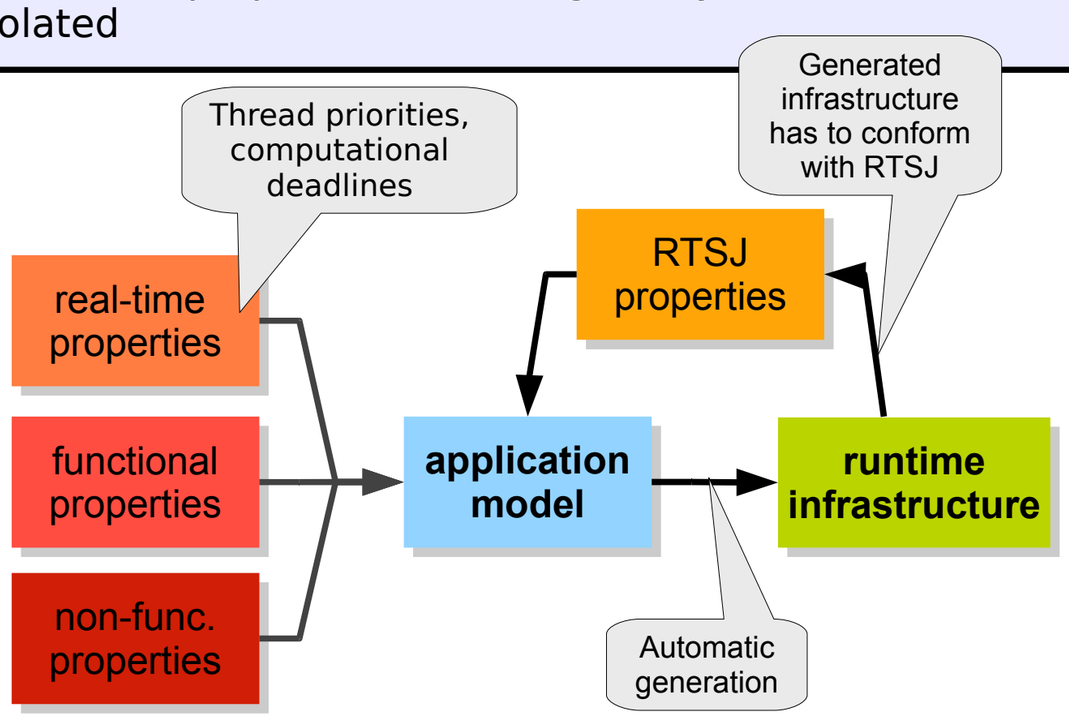
Component based systems
- **Application of CBSE paradigm into RTSJ world**:
  - Component framework ***Soleil*** [4] which brings *RTSJ views* of a component-based application by introducing *domain components*

Domain components describe utilization of memory areas as well as thread types used by active components



Challenges

Introducing distribution into RTSJ-based component framework requires:
- *Reflecting various properties* at different stages of a system's development lifecycle;
- *General binding representation*
  - To allow reflecting properties and encapsulating a selected middleware and communication style (method call, messaging) in the automatically generated binding's infrastructure
- Real-time properties of a designed system cannot be violated



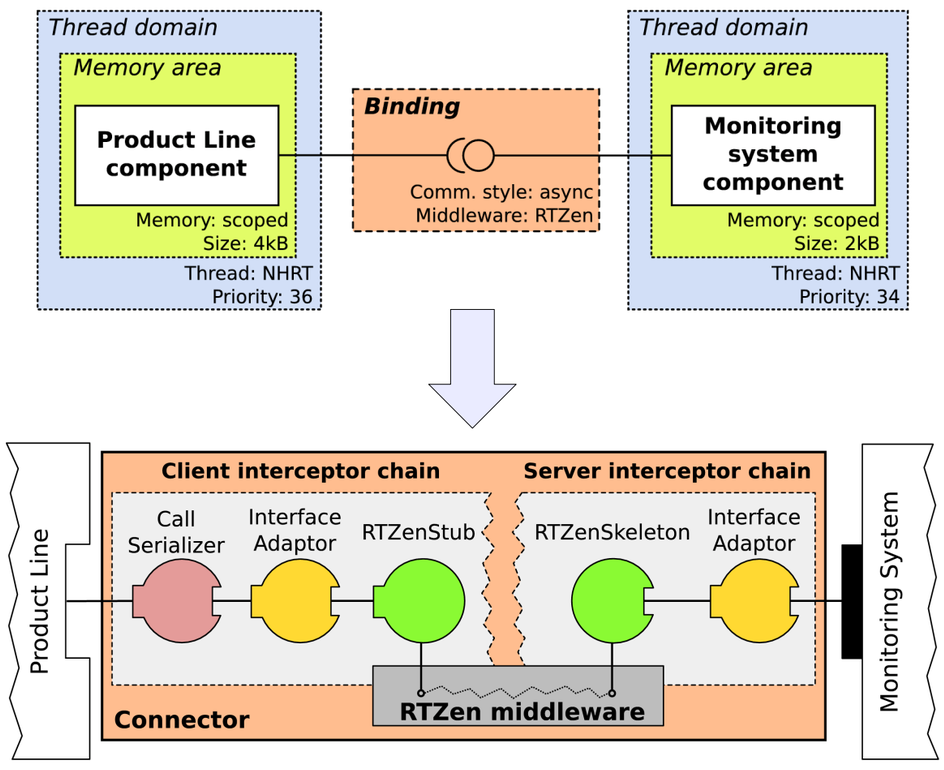
Approach

Design time of application
- Binding is described by properties

Architecture of a connector ([2], [3])
- *Chains of interceptors* represent connection end-points
- Interceptors reflect specified properties (1:1)

Binding infrastructure generation process
- Selecting connector architecture (interceptors in chains)
- Interceptor code generation

Runtime infrastructure
- Has to reflect specified properties & comply to RTSJ



Design of application specifies binding properties

Generation process produces binding infrastructure

Runtime infrastructure of binding encapsulating *RTZen* middleware [5]

Conclusion & Future Work

- Applying connector paradigm in RTSJ component-based framework *Soleil* and mitigating the complexity of designing and implementing distributed RTSJ-based component systems.

- Taxonomy of RTSJ-based connectors
  - Mapping between properties and connector arch.
- Advanced examples, benchmarks

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