

Model for Real-Time CORBA

Applying the UML profile for Schedulability, Performance and Time

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Overview

- A brief overview of the issues addressed by the submission.
- Stereotypes used for the schedulability model.
- UML diagrams for the Real-Time CORBA interfaces.
- An approach for modeling Real-Time CORBA applications

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The Profile

- Goals
 - Enable the construction of models that could be used to make quantitative predictions regarding the characteristics of schedulability, performance and time
 - Facilitate communication of design intent between developers in a standard way
 - Enable interoperability between various analysis and design tools
- Concepts addressed
 - Resources
 - Time
 - Concurrency

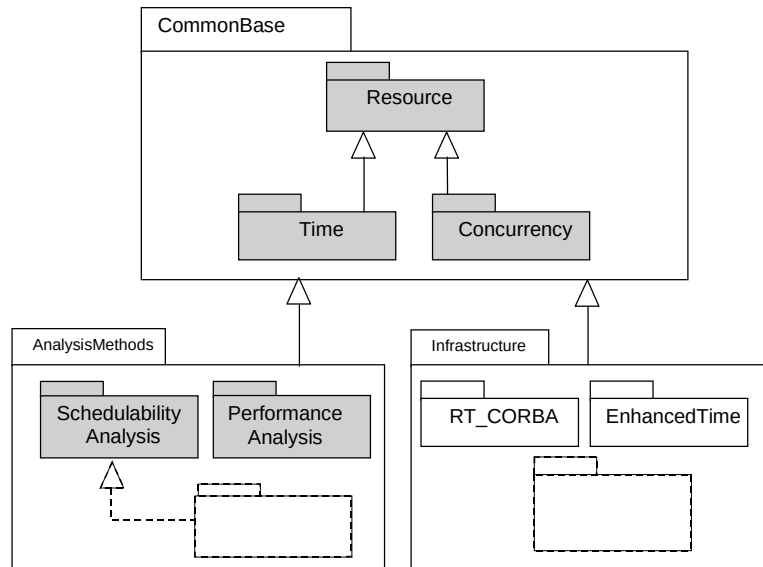
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Problem Domains

- Quantitative analysis techniques
 - Schedulability
 - Performance
 - Queuing Theory
- Quality of Service
 - Specify the QoS (requirements)
 - Determine that QoS is met
 - Consumer - Provider model
 - Required QoS – Offered QoS
 - Potentially complex calculations

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Profile Domain Packages



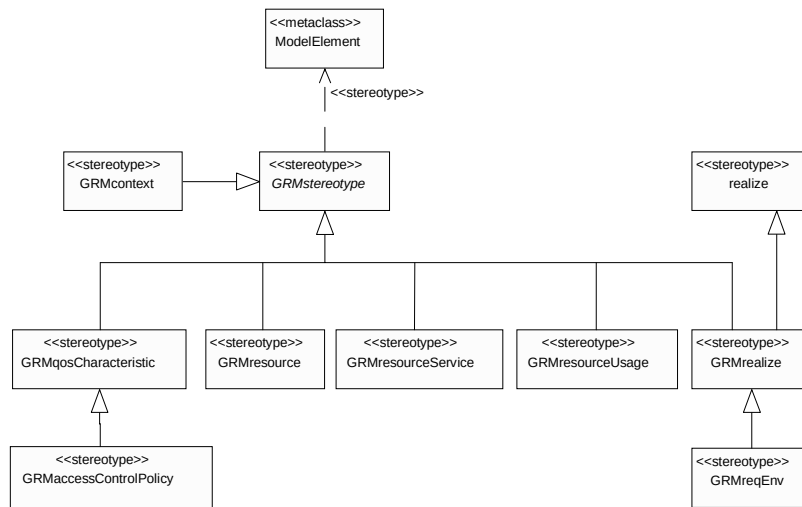
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UML Stereotypes

- A set of UML stereotypes are defined for each domain package.
 - A stereotype assigns semantics to UML elements.
 - Multiple stereotypes can be assigned to a single element.
- Each stereotype has one or more tagged values associated with it.
 - The tagged values supply data about named qualities (time, arrival pattern, usage, etc.)

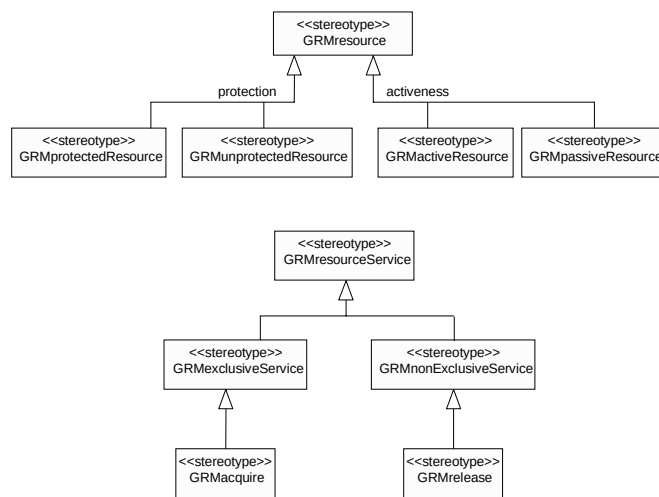
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Profile Stereotypes for Resource Model



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Profile stereotypes (cont.)



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Applying the Profile to a Model

- Create a UML model for the application.
 - Classes, associations, states, messages
 - Class diagrams, sequence diagrams, state diagrams, activity diagrams
- Classify the schedulability semantics
 - Classes as SASchedulable, SAResource, SAAction
 - Associations as SAEvents, SATriggers
 - Messages as SATriggers
- Assign the tagged value parameters
- The model is ready for analysis.

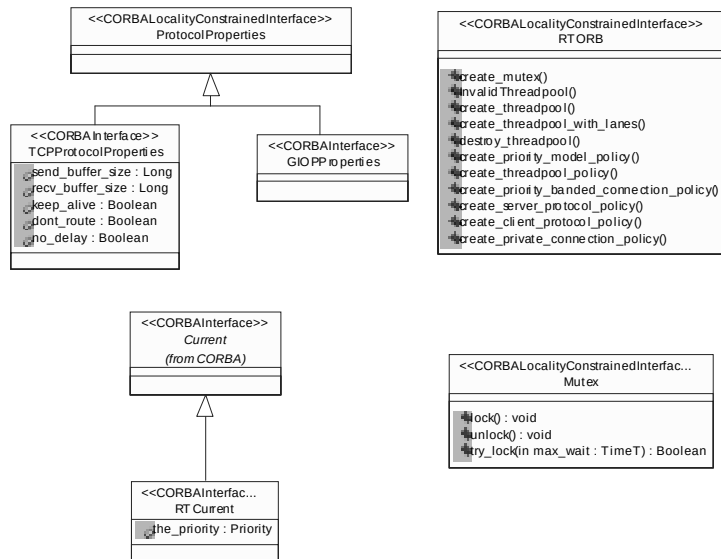
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Real-Time CORBA UML Model

- A model for a Real-Time CORBA application.
- Start with the UML representation for the Real-Time CORBA IDL.
- Use a simple client – server application to illustrate a layered model.
- Describe where the schedulability profile is applied.

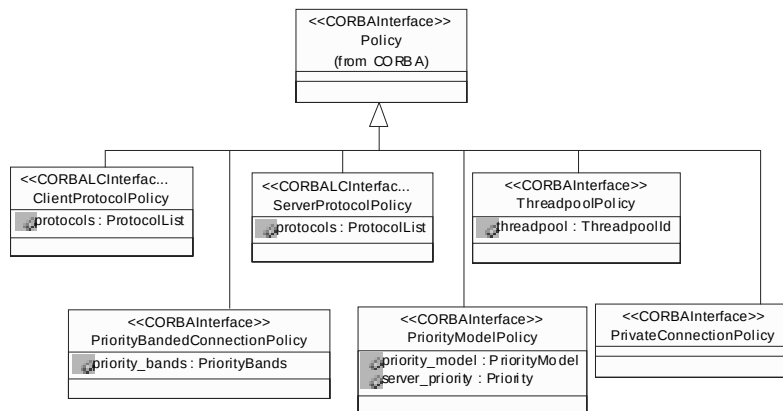
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Real-Time CORBA Interfaces



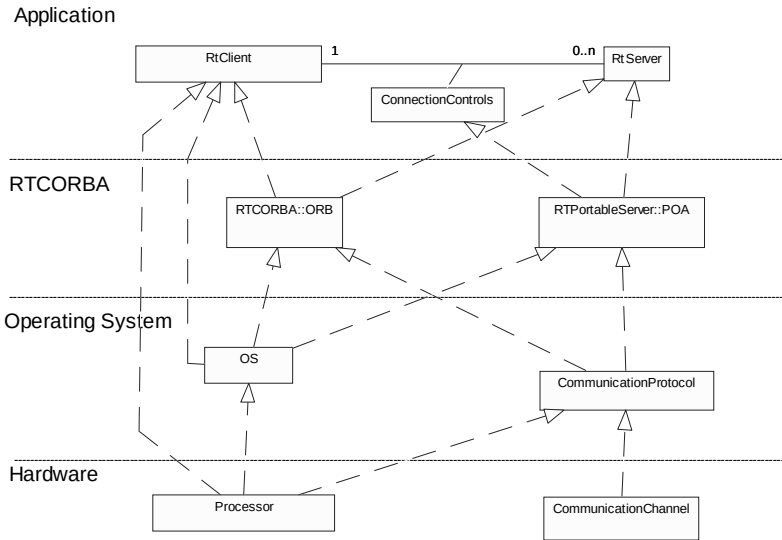
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Real-Time CORBA Interfaces



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A Layered Model



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Adding Schedulability Analysis

Applying Analysis Stereotypes

Application Layer

1. **RtClient**: SASchedulable, SAAction, SAResponse, SAUses
2. **RtServer**: SASchedulable, SAAction, SAResponse, SAUses, SAResource
3. **ConnectionControls**: SAResource
4. Hardware layer description: SAEngine and SAResource

RTCORBA Layer

1. Each Interface or interface operation: Refinements for SASchedulable, SAAction, SAResponse, SAUse
2. Each Policy: Refinements for SAEngine, SAResource and SAAction
3. Considerably more functional detail.

Operating System Layer

1. Still more refinements with more details.

Hardware Layer

1. More details on processor utilization.
2. More details on communication channels as SAEngines.

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Summary

- UML can be used to express functionally correct systems.
- The profile for schedulability, analysis and time provides a mechanism to express real-time and QoS quantities.
- A Real-Time CORBA application can be modeled using a layered approach. The layers expose lower level details that affect QoS.
- Powerful schedulability and performance tools can analyze the model to enable schedulability and performance design.

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Thank you!

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