Karlsruhe Institute of Technology

Descartes research

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From Offline to Online Component Models for Run-Time Resource Management

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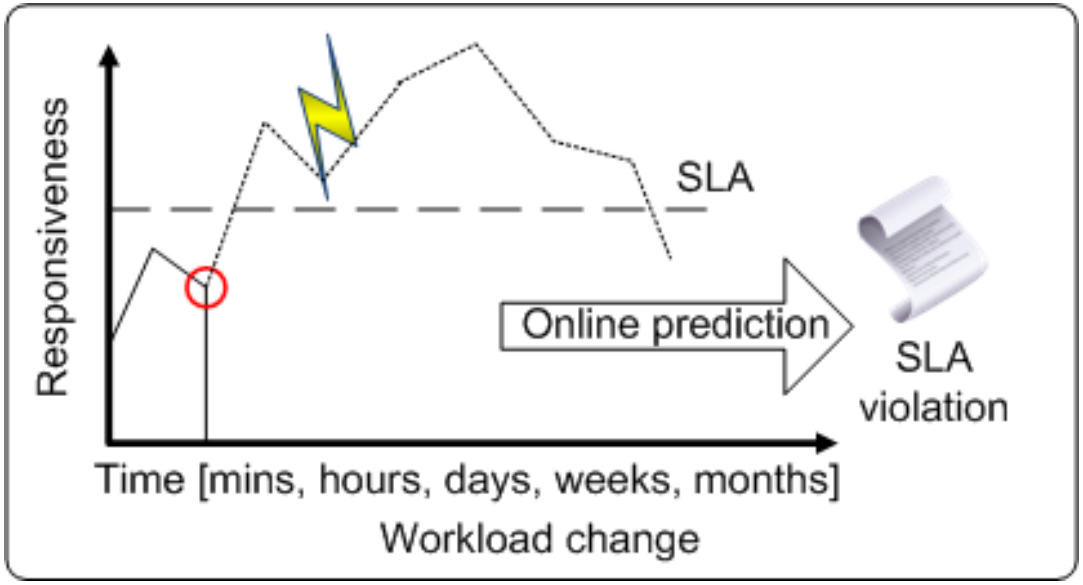
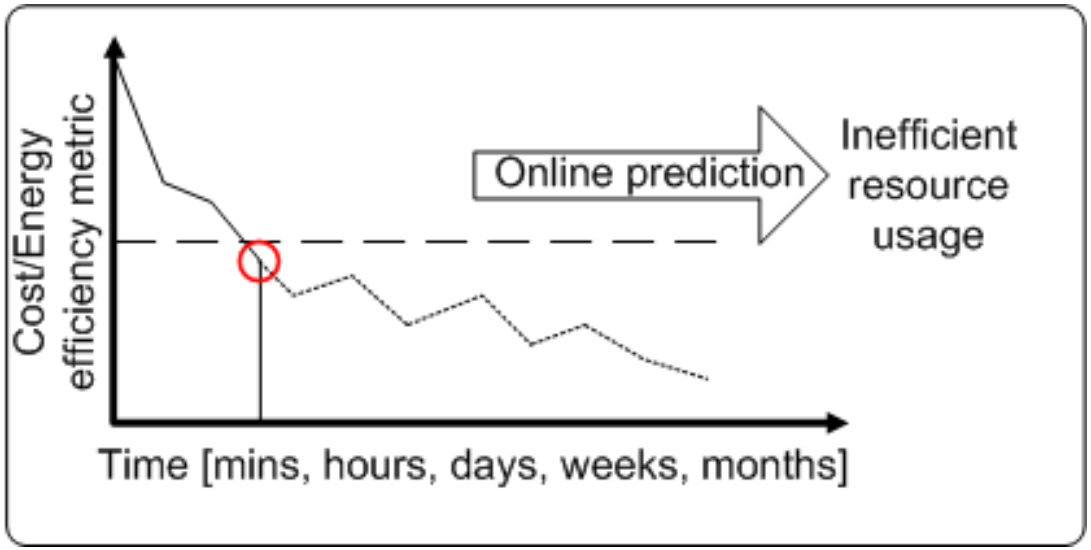
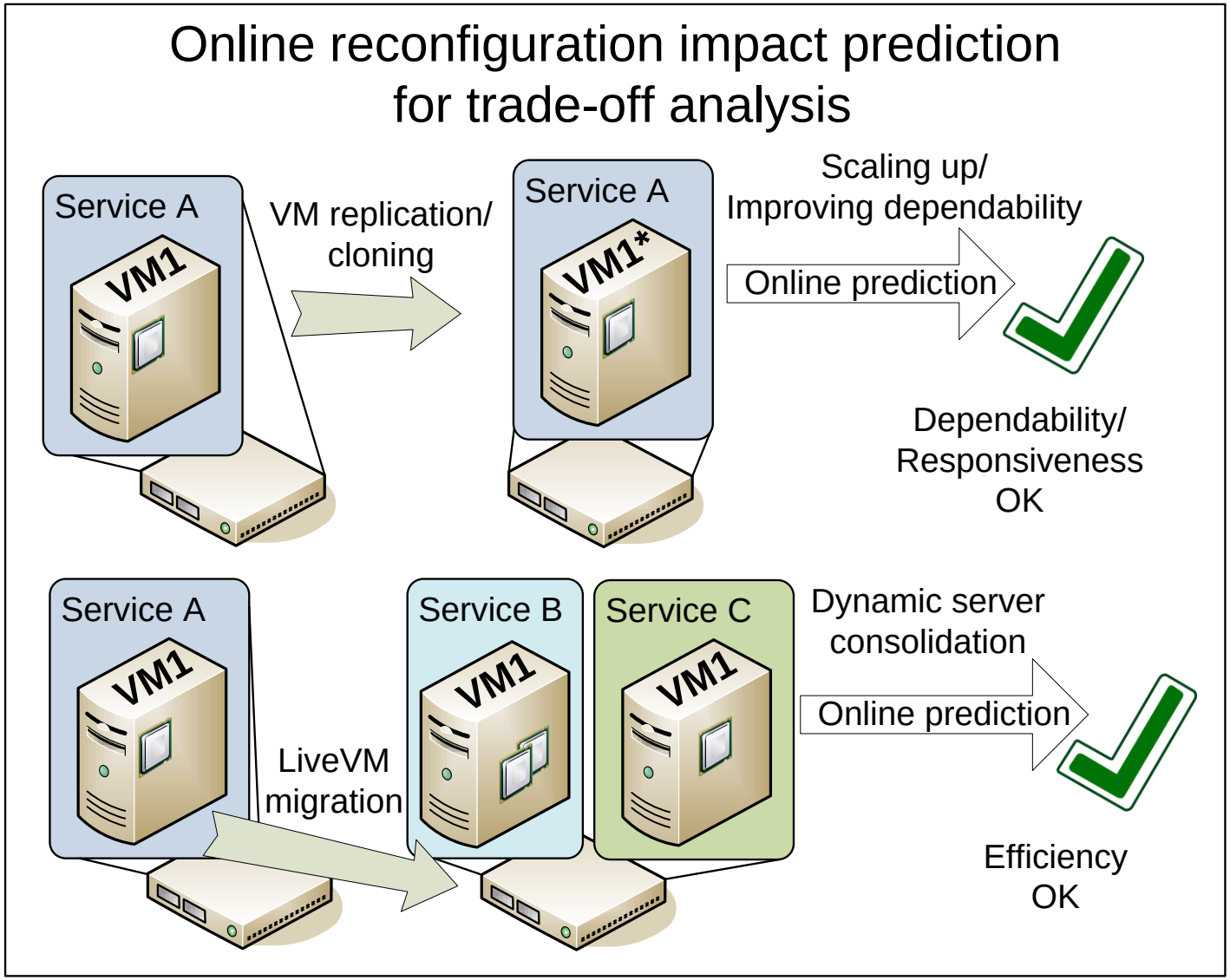
SOFTWARE DESIGN AND QUALITY GROUP
INSTITUTE FOR PROGRAM STRUCTURES AND DATA ORGANIZATION, FACULTY OF INFORMATICS

Proactive Run-time Resource Management

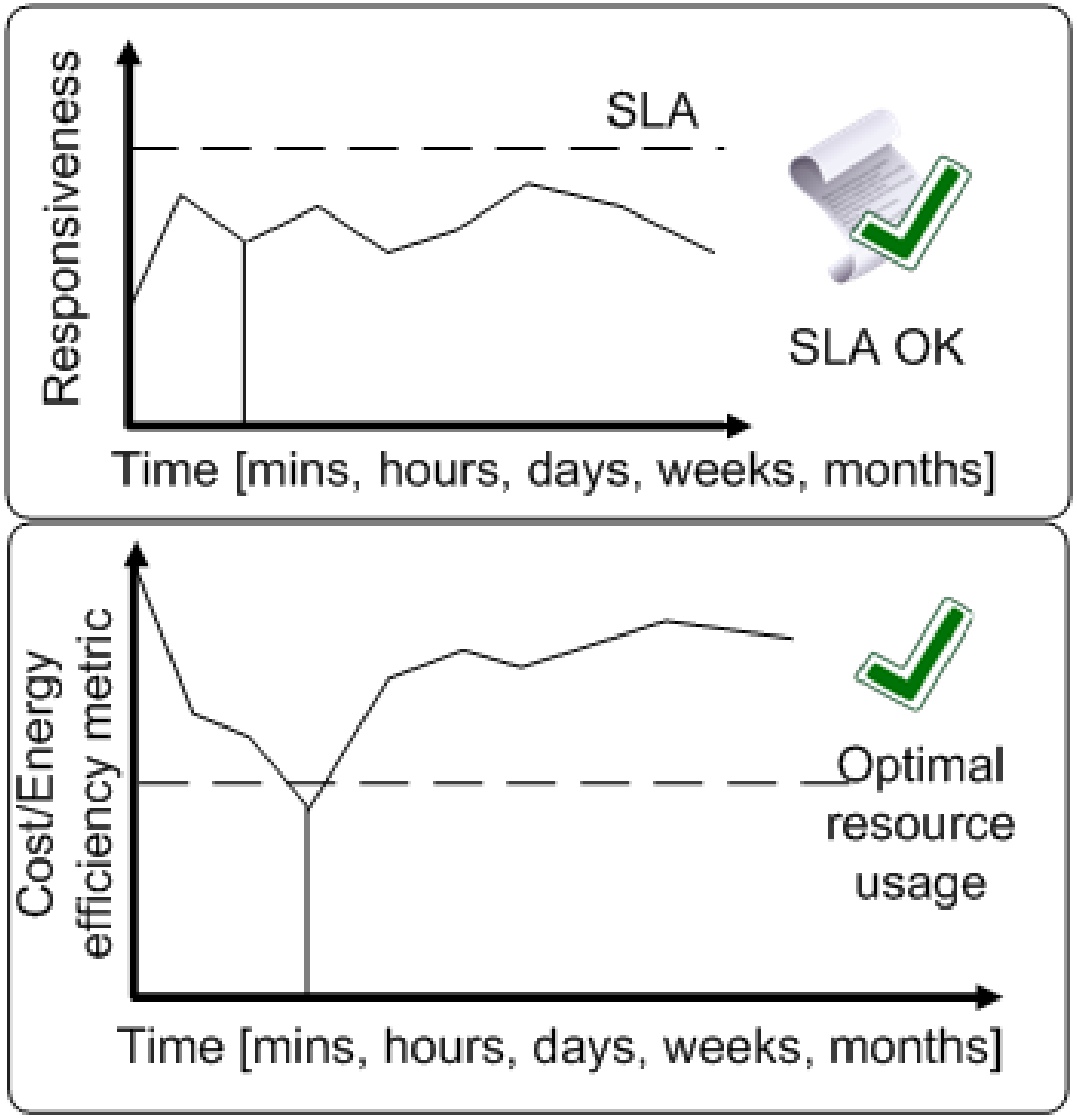




Proactive Run-time Resource Management



Proactive Run-time Resource Management

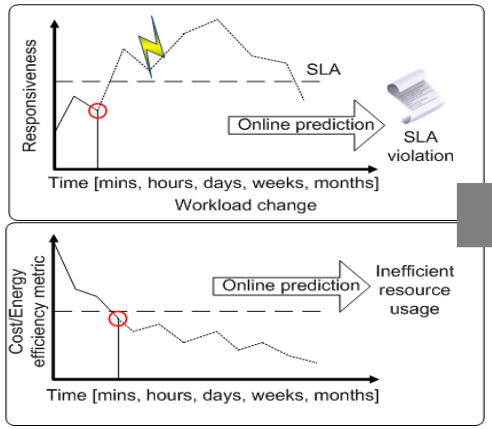


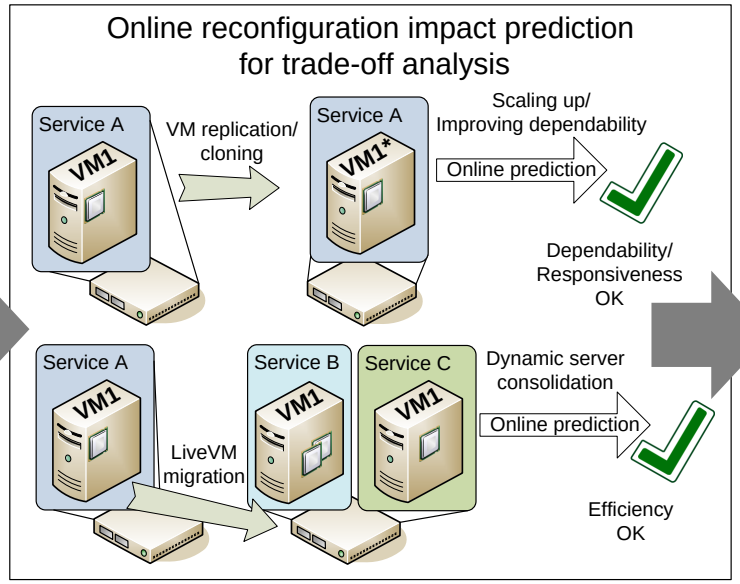
Proactive Run-time Resource Management

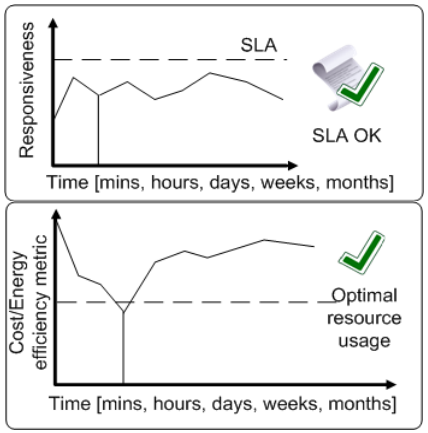
Online QoS prediction for problem anticipation

Online QoS prediction for reconfiguration impact analysis

Autonomic system adaptation

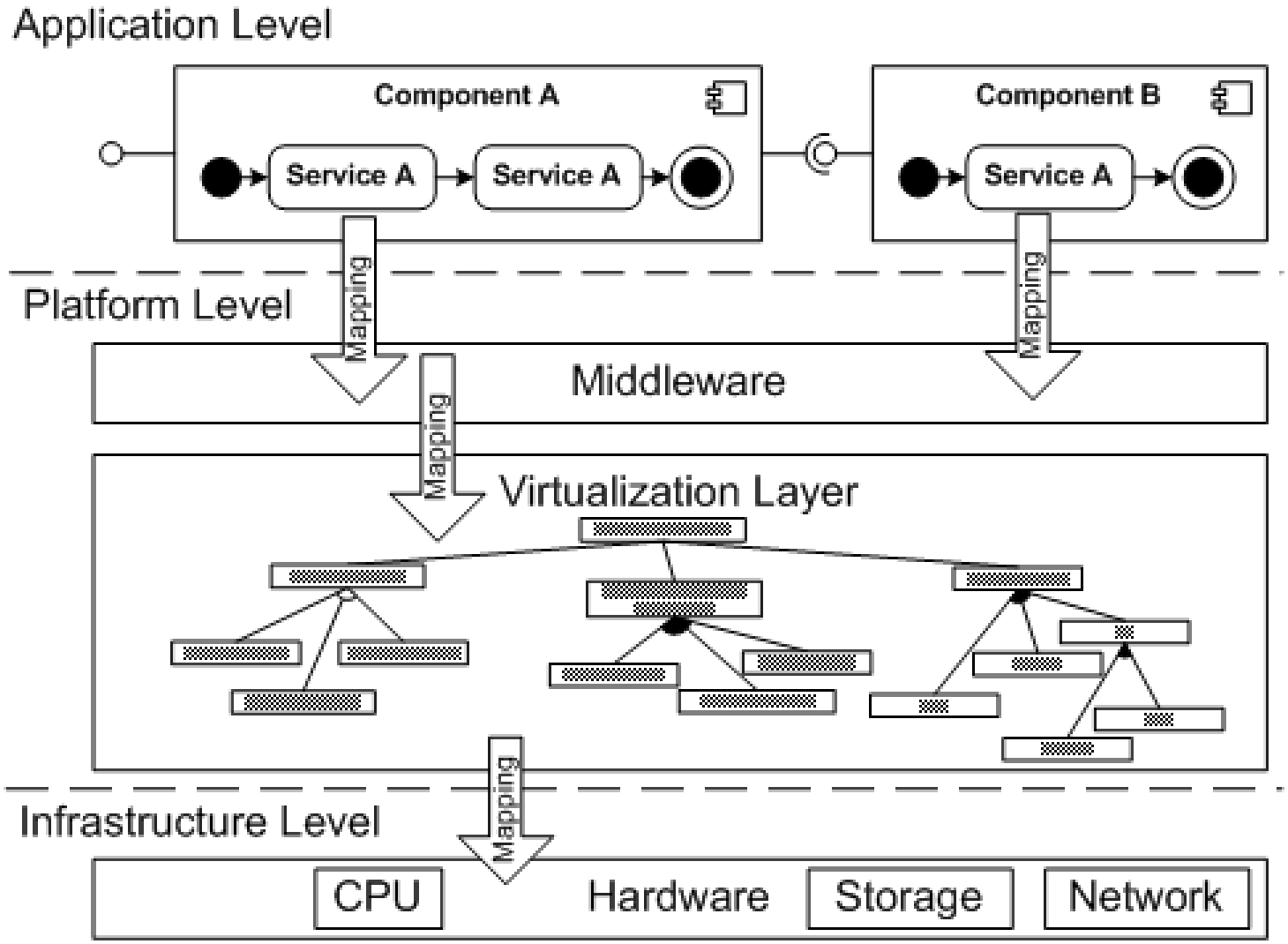




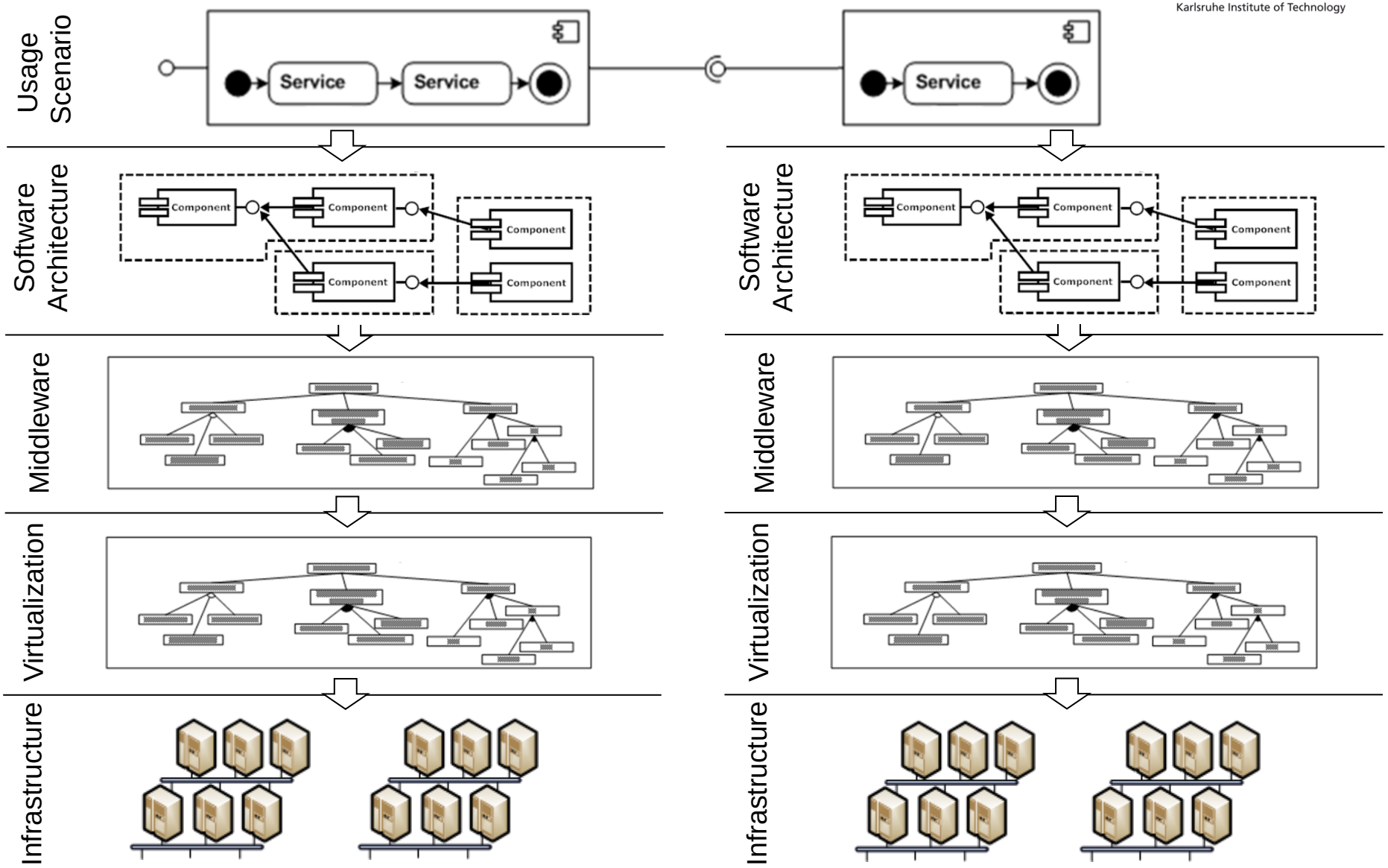


PART 1 **PART 2** **PART 3**

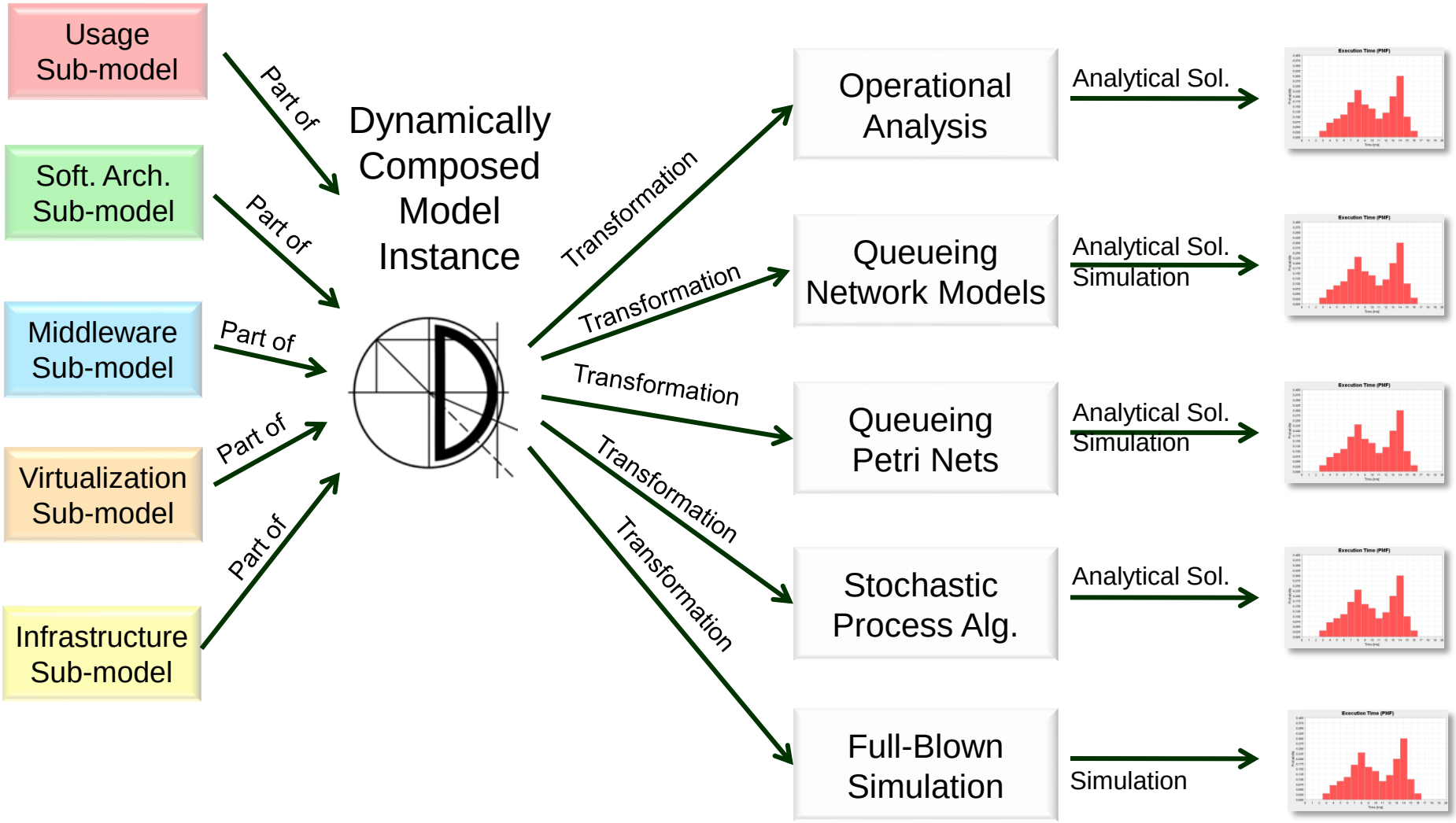
Coming Soon: Descartes Meta-Model



Dynamic Model Instance Composition



Tailored Model-to-Model Transformations



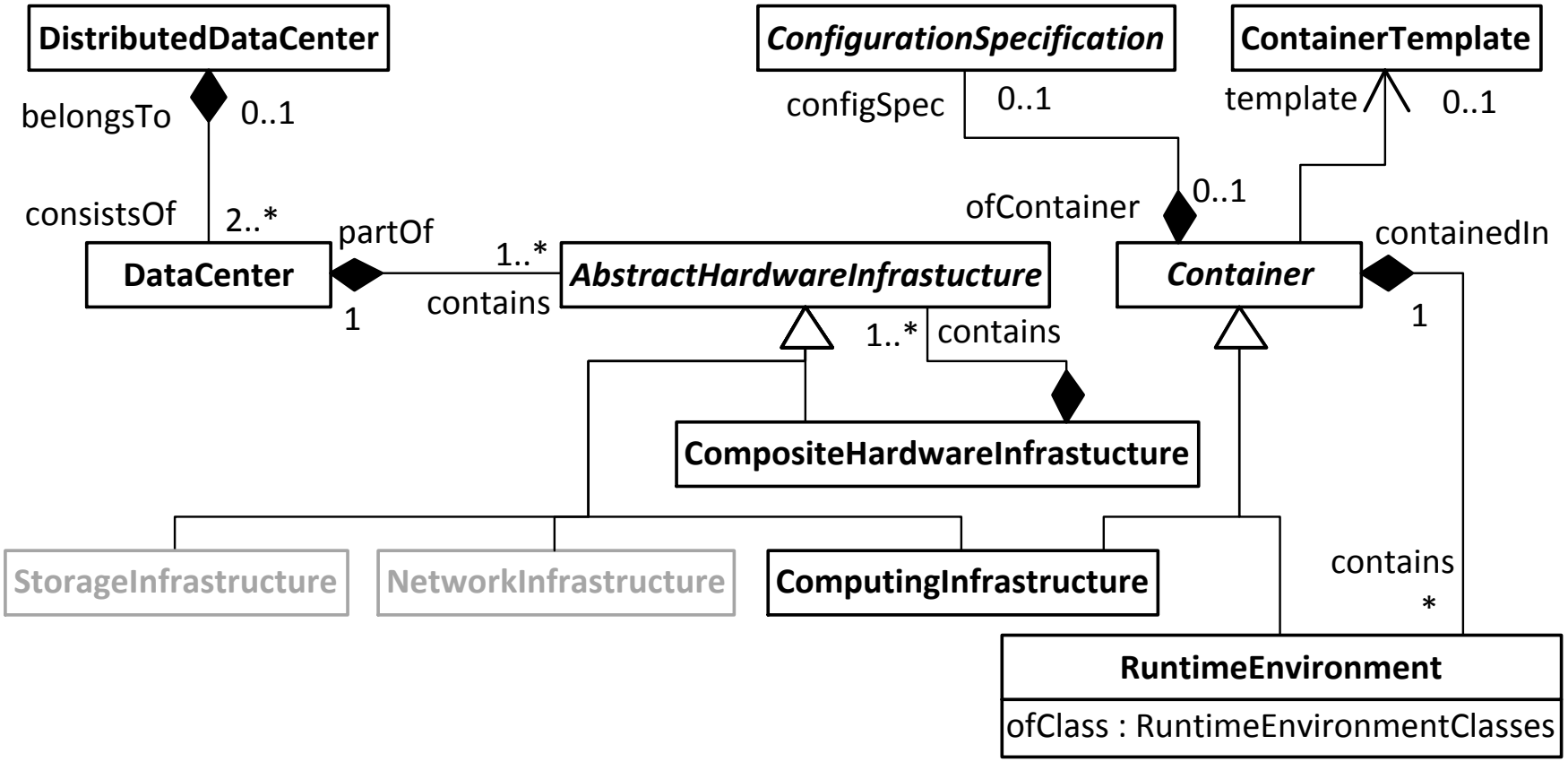
Online Architecture-Level Perf. Models

- Models should capture both static and dynamic aspects
- “Component” is a unit of composition *at run-time*
- Alignment with system layers as opposed to developer roles
- Dynamic model composition
  - Horizontally across components and vertically across layers
- Sub-models integrated into the system components
- Integration with monitoring data available at run-time
- Models intended for use by system as opposed to human
- Different abstraction levels & solution methods

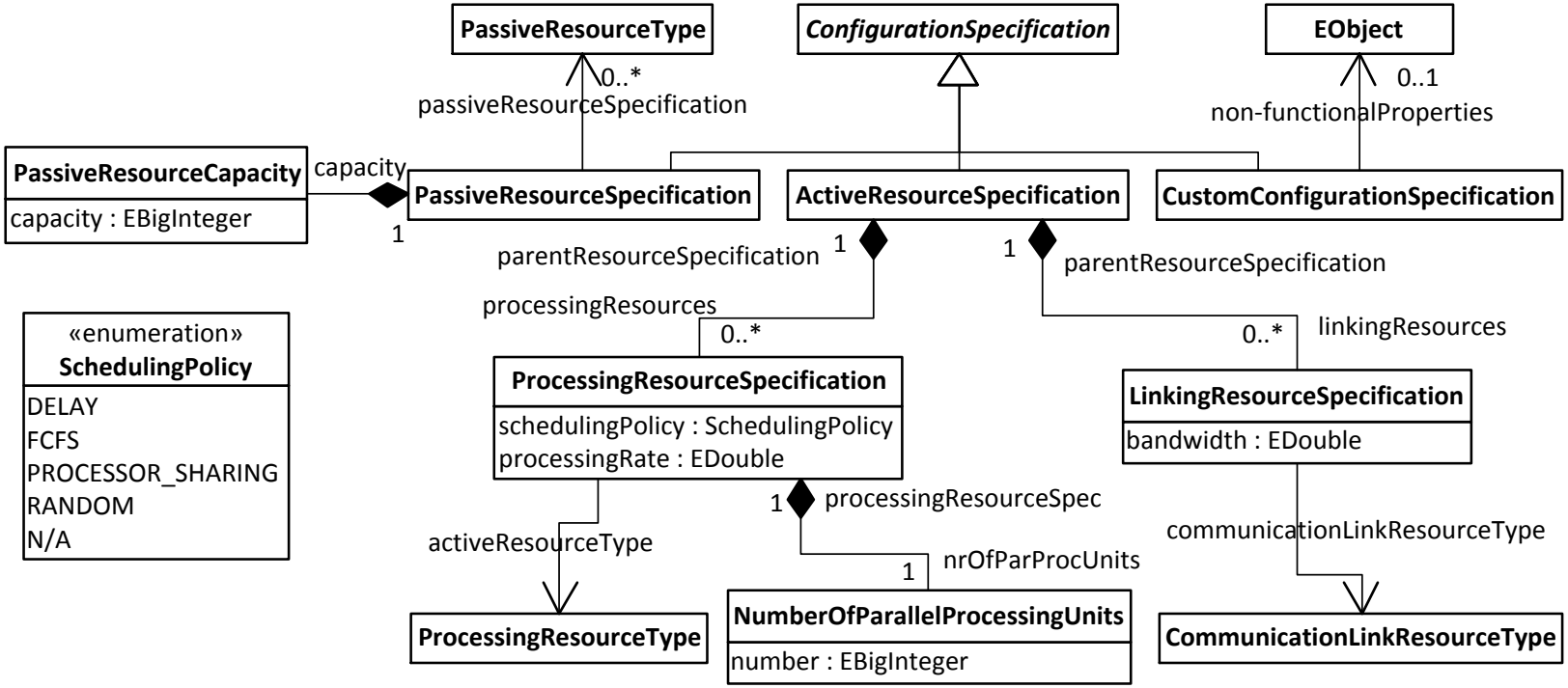
Models for Virtualized Data Centers

- Resource Landscape (static view)
  - Computing resources (physical, logical)
  - Layers of resources (Hardware, Virtualization, …)
- Variability Points (dynamic view)
  - Configuration (#cores, #appServer, …)
  - Landscape (Deployment, Users, …)
- Ongoing Work: Reconfiguration Language
  - Description of the system reconfiguration
  - Example: SystemConfigA → SystemConfigB

Resource Landscape: Layering

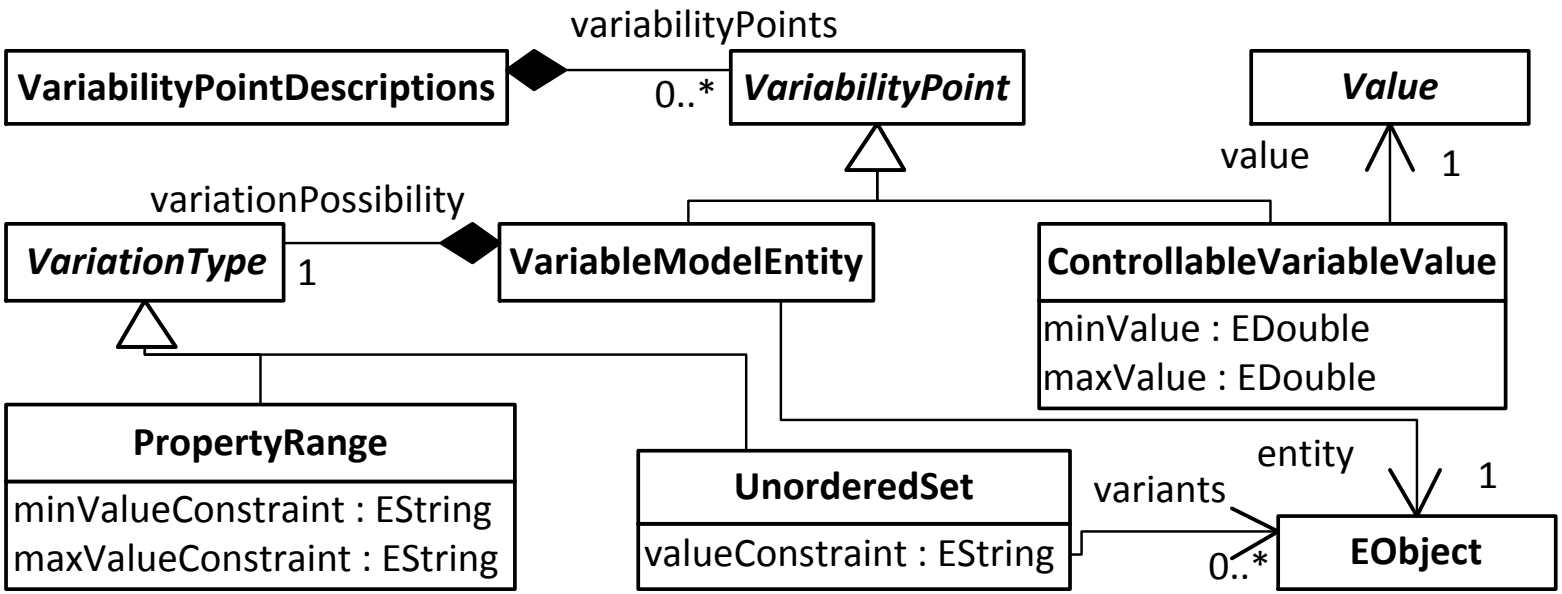


Resource Landscape: Config.Spec.



Variability Points

- “Decorator” model
- Dynamic view of the resource landscape



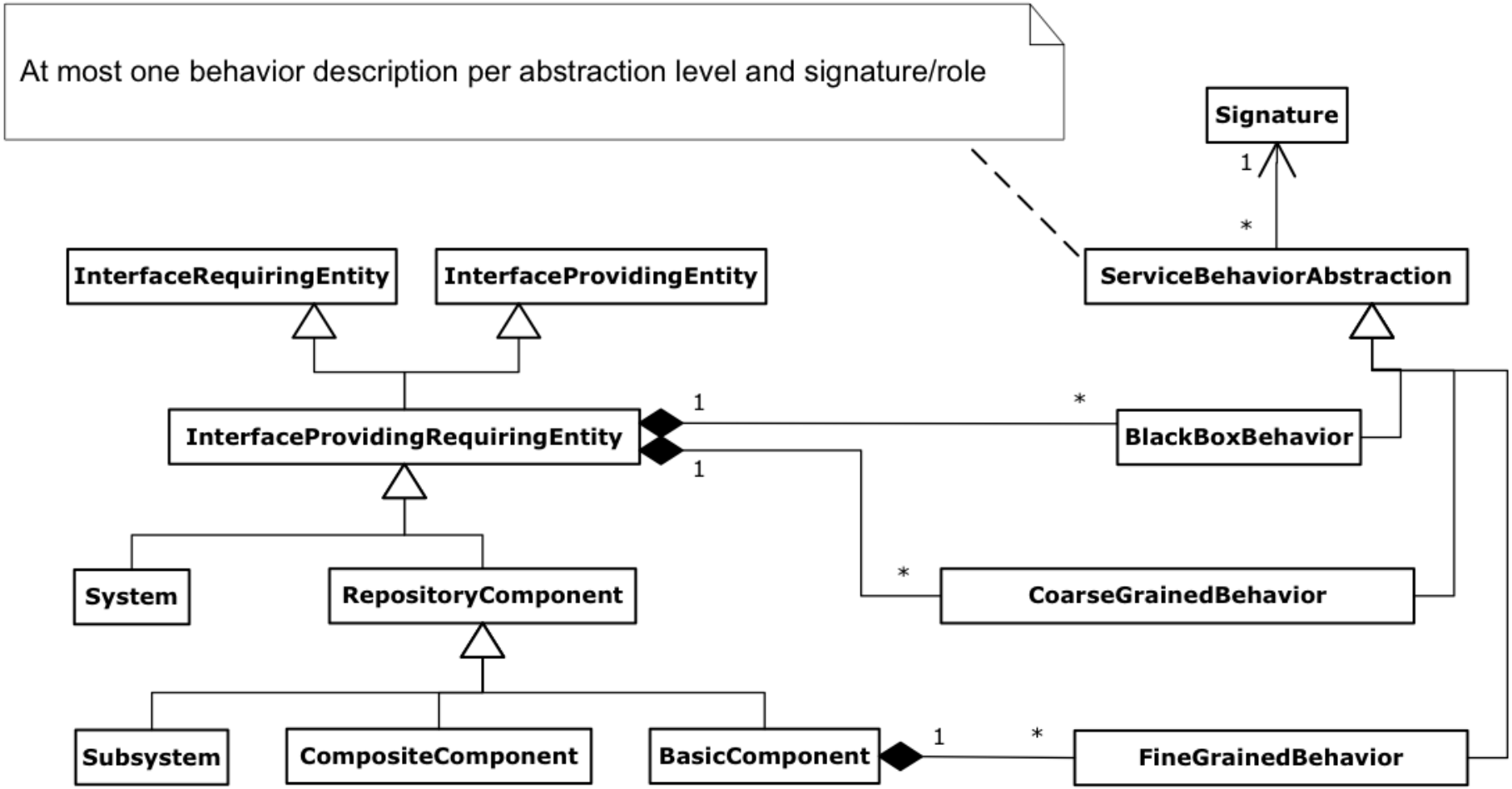
Modeling the Application Level

- Service Behavior Abstractions for Different Levels of Granularity
- Deployment-Specific Resource Demands / Response Times
- Probabilistic Parameter Dependencies

Service Behavior Abstractions

- BlackBoxBehavior
  - No information about resources, resource demands, control flow, call frequencies,…
- CoarseGrainedBehavior
  - Information at component boundary level (external services, resource consumption,...)
- FineGrainedBehavior
  - Information about component-internals (control flow, resource demands, parametric dependencies,...)

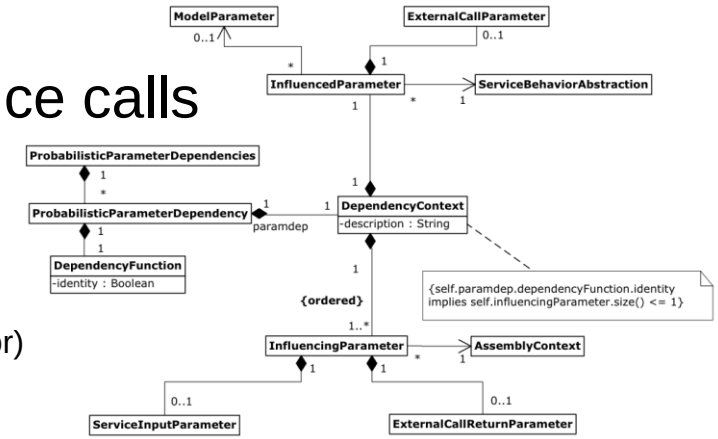
Service Behavior Abstractions



Probabilistic Parameter Dependencies

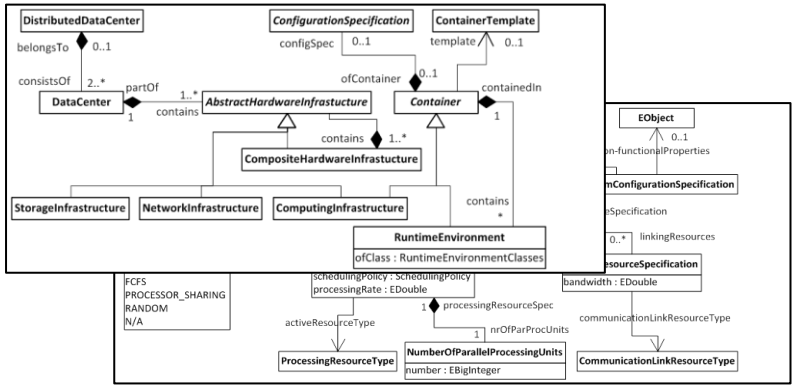
- Characterize dependencies statistically

- Influencing parameters
  - Service input parameters
  - Return parameters of external service calls



- Influenced quantities
  - Loop iteration numbers (FineGrainedBehavior)
  - Branch probabilities (FineGrainedBehavior)
  - Call frequencies (CoarseGrainedBehavior)
  - Resource demands (FineGrainedBehavior, CoarseGrainedBehavior)
  - Response times (BlackBoxBehavior)
  - Input parameter of ext. service call (FineGrainedBehavior, CoarseGrainedBehavior)

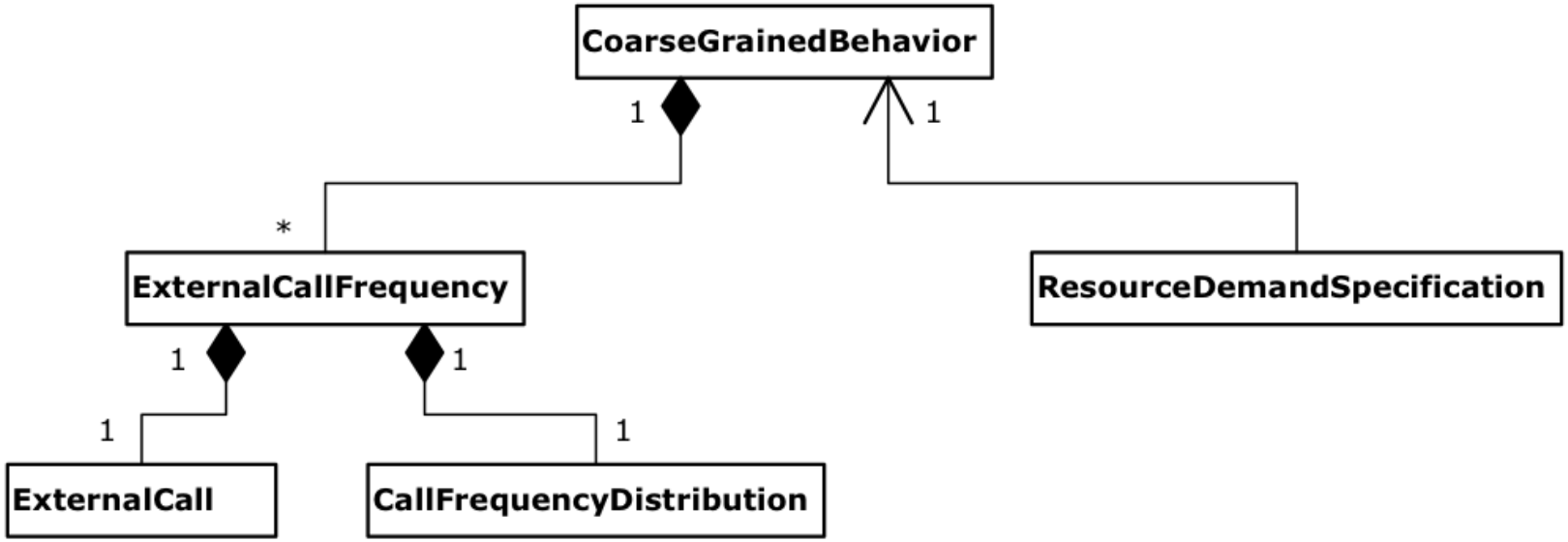
Conclusions and Discussion

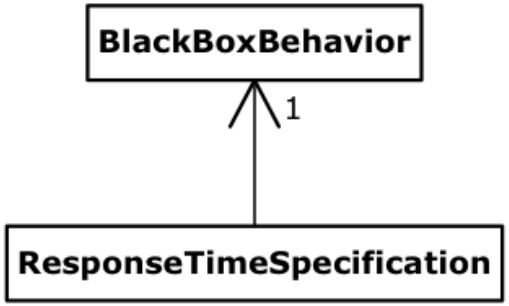


Vision Paper
[SCC2010]

http://www.descartes-research.net/

Service Behavior Abstractions





Probabilistic Parameter Dependencies