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Automated Transformation from Descartes Modeling Language to Palladio Component Model

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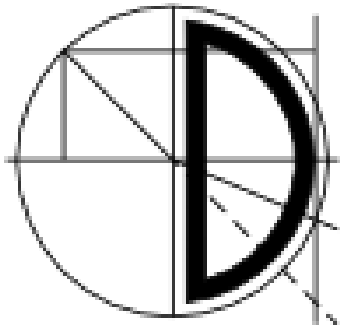
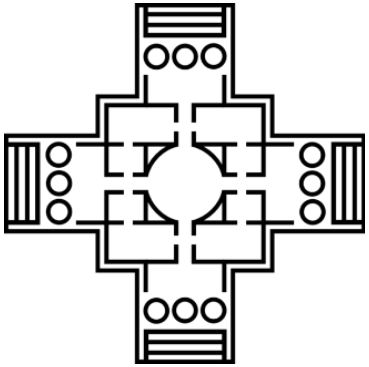




Differences PCM and DML?

Motivation

Benefits Transformation

- Tooling can be reused
- Improves understanding of differences
- Flexibility to change

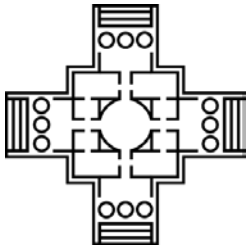
Benefits Automation

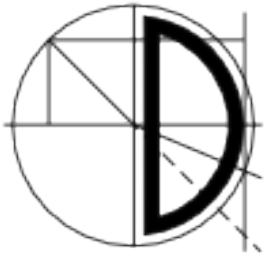
- Automated transformation is faster, less error-prone and less expensive compared to manual extraction

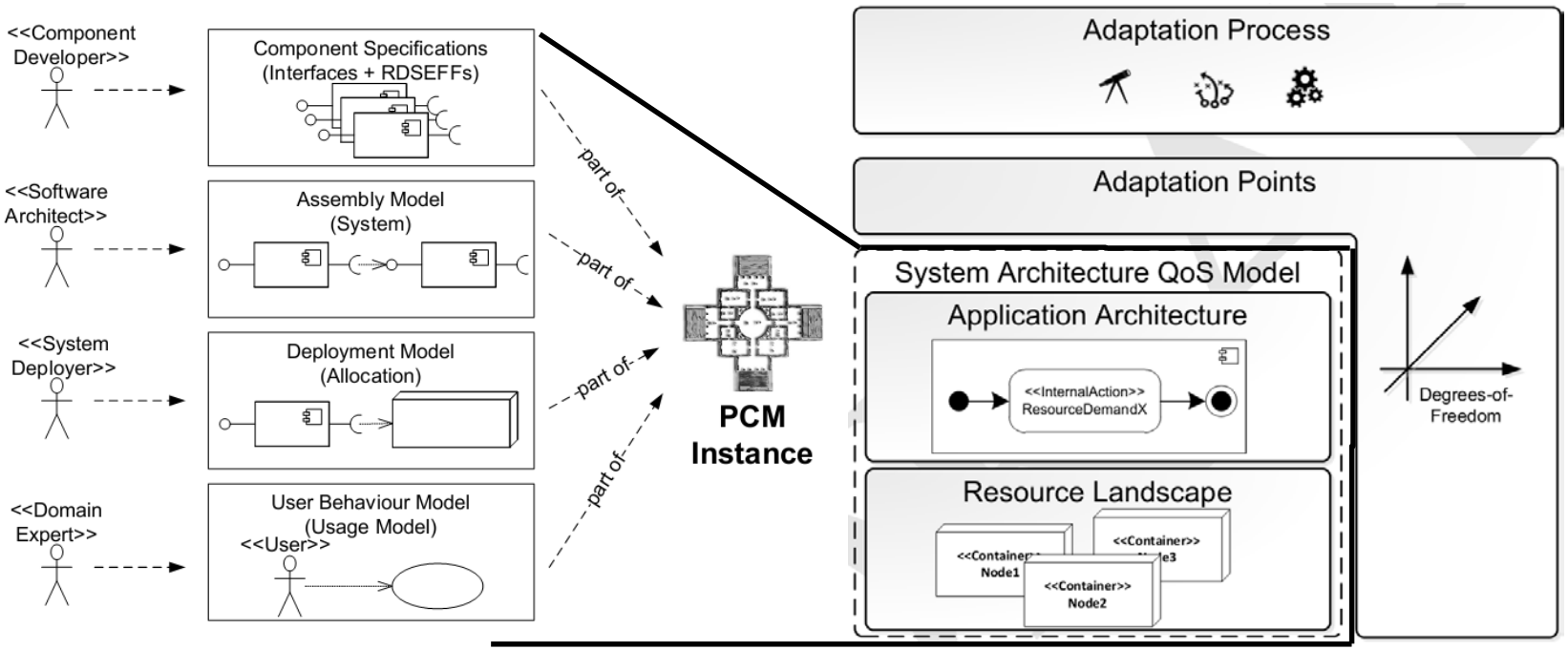
Project Overview

Problem	• Tooling has to be developed for each formalism • Comparison challenging • Manual transformation error-prone and time consuming
Idea	• Model transformation of DML to PCM
Benefit	• Reuse of existing PCM tooling for DML • Improved understanding of differences and similarities • Simplified change of formalism
Action	• Implement a model-to-model transformation

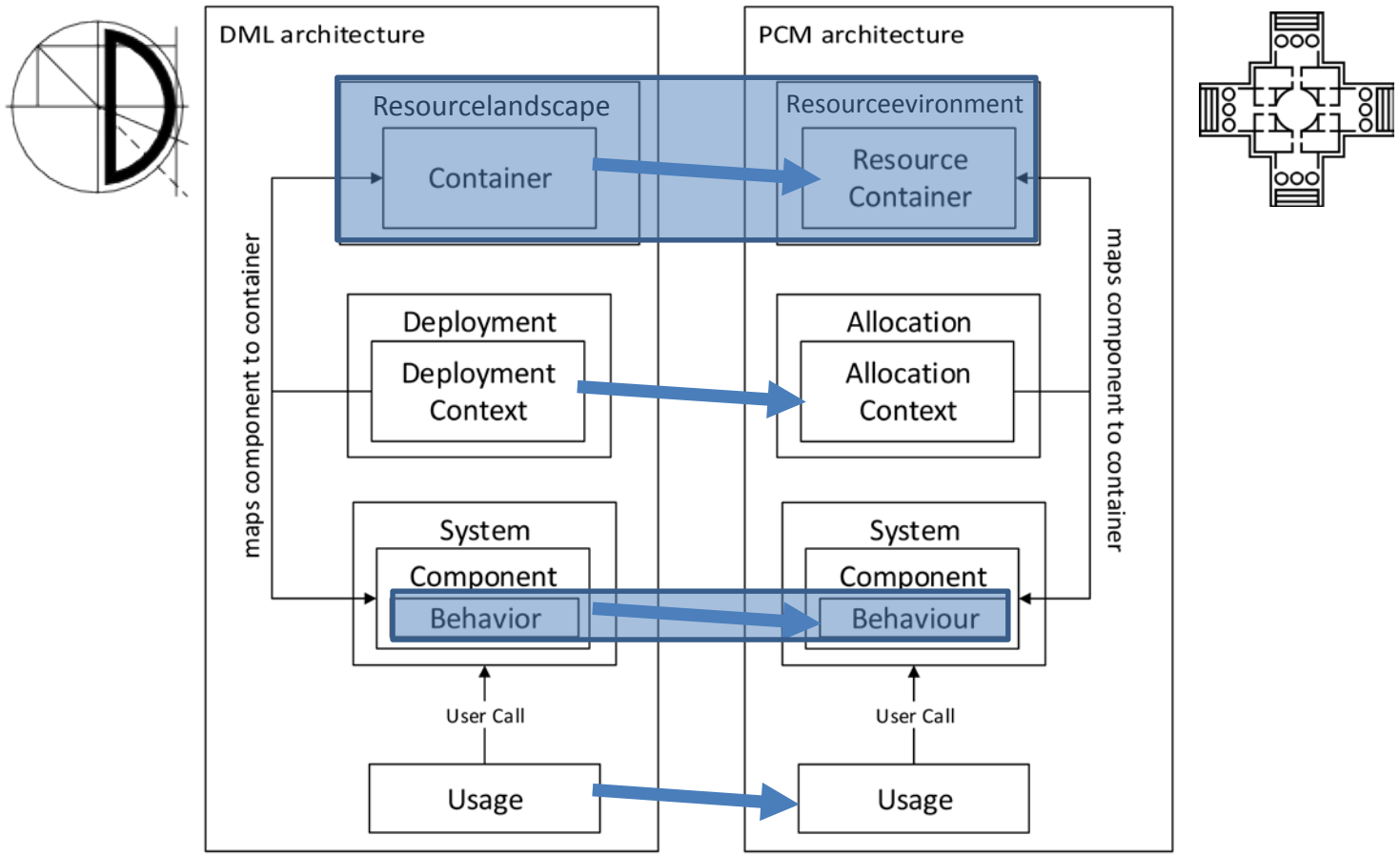
Architectural Performance Modeling







Transformation Overview



Resource Landscape

platform:/resource/MediaStore/default.resourcelandscape

- Distributed Data Center distributedDataCenter
  - Data Center smallDataCenter
    - Computing Infrastructure AppServer
    - Storage Infrastructure DBServer
    - Networking Infrastructure aName

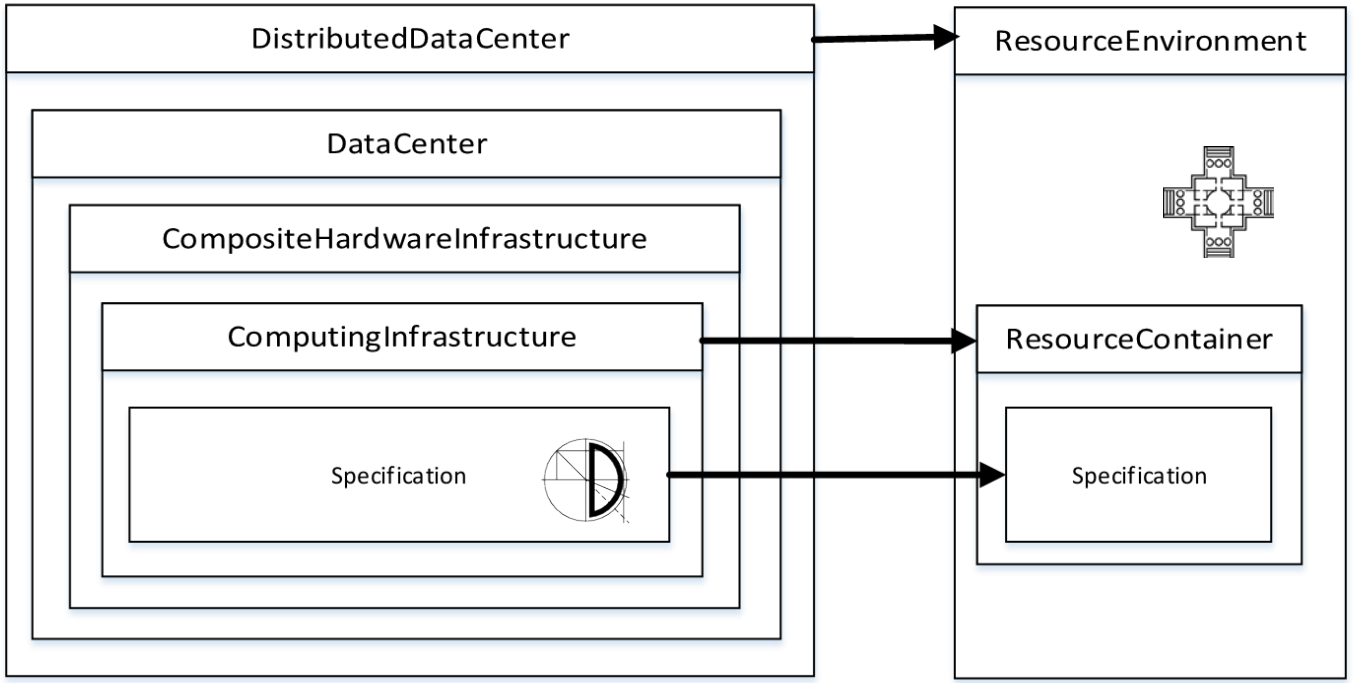
Hierarchical resource landscape

platform:/resource/MediaStoreExample/mediastore.resourceenvironment

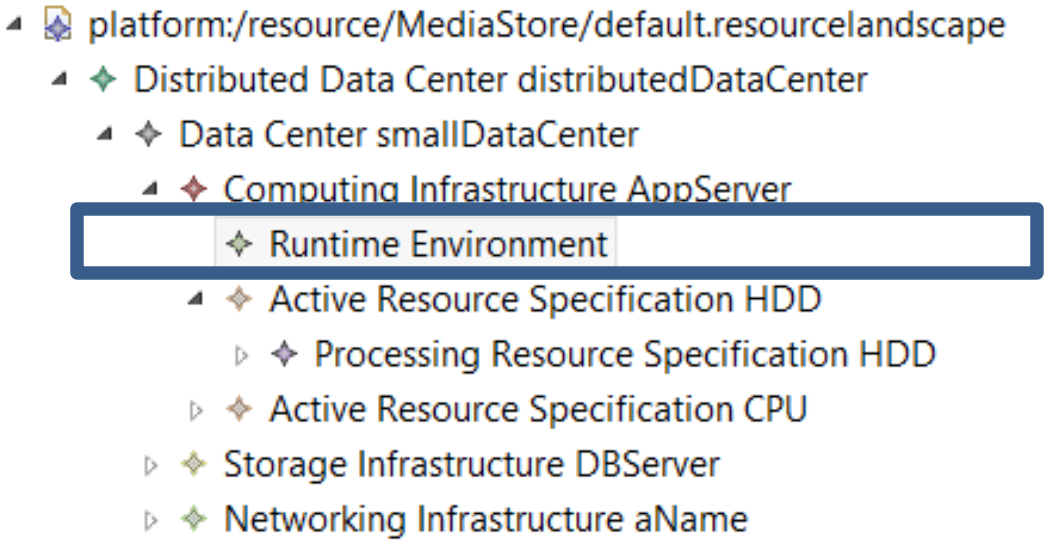
- Resource Environment aName <ResourceEnvironment>
  - aName <LinkingResource> [ID: __oYXADq_EeCCbpF63PfiyA]
  - AppServer <ResourceContainer> [ID: _5uTBUBpmEdyxqpPYxT_m3w]
  - DBServer <ResourceContainer> [ID: _tVi40Dq_EeCCbpF63PfiyA]

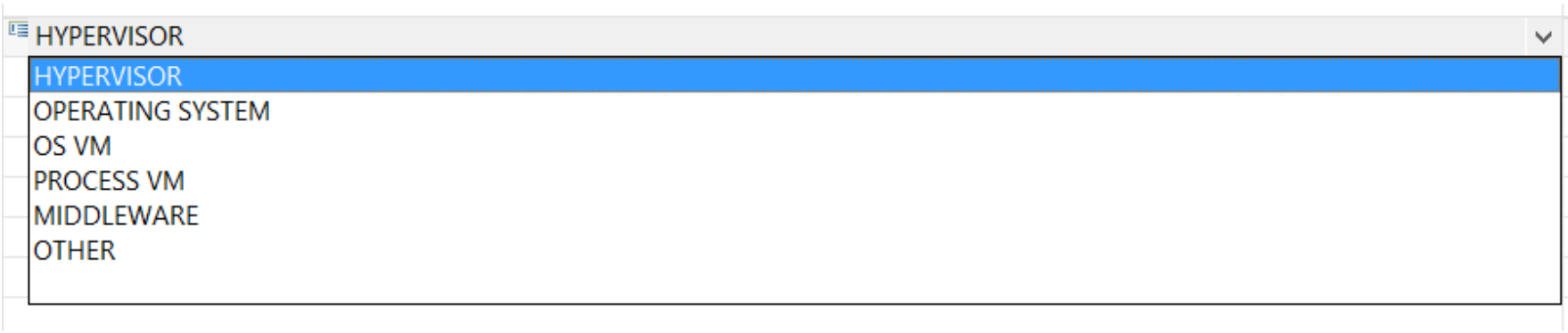
Information loss

Resource Landscape

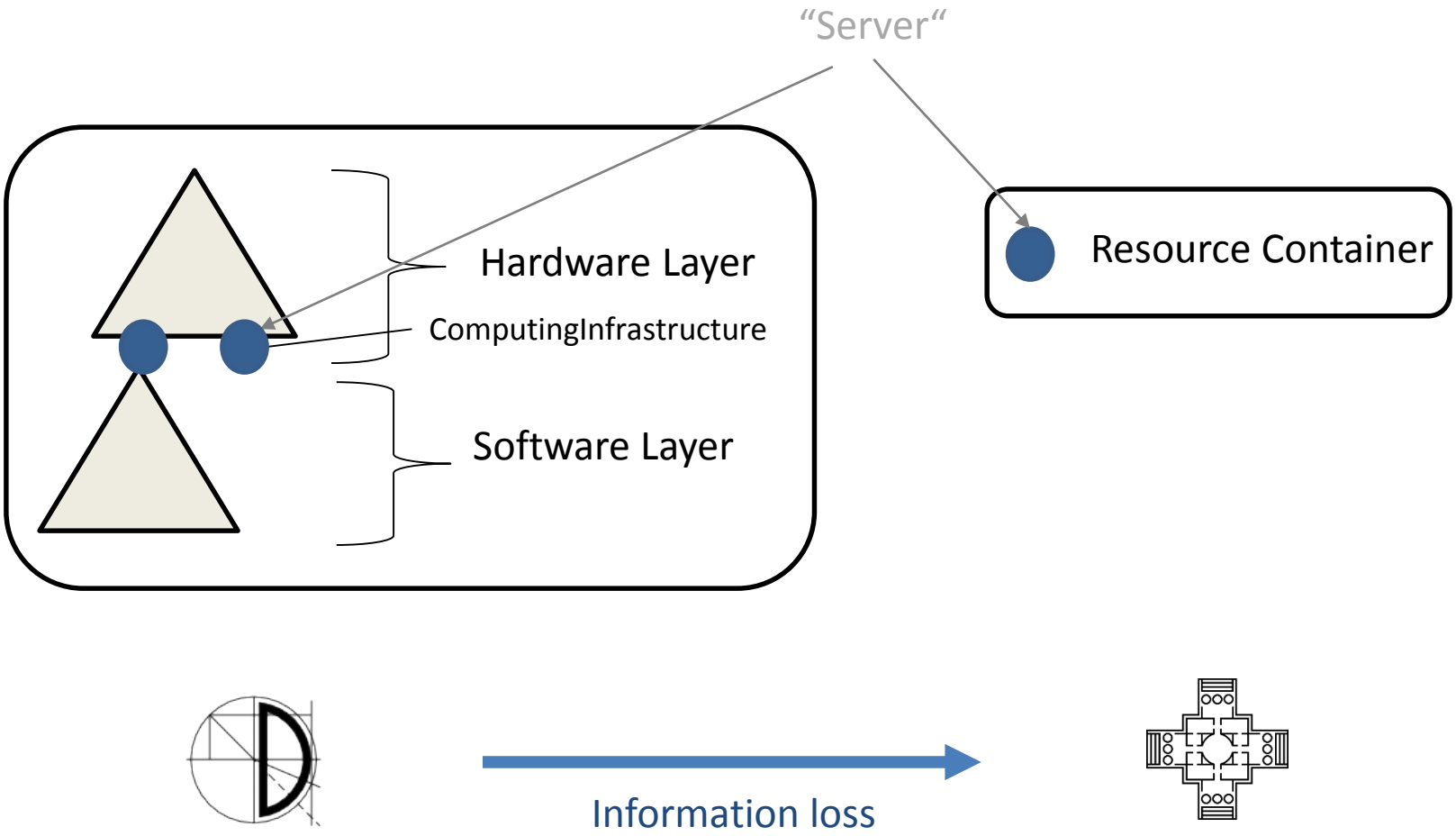


Specification of Processing Resources



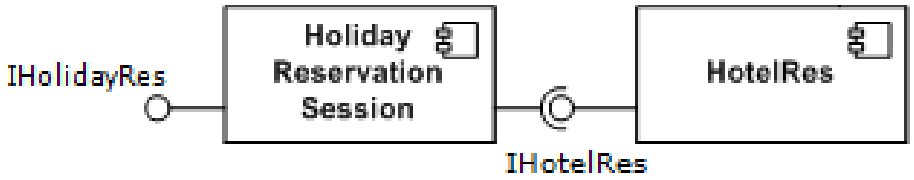


Processing Resources



Service Behavior

Example:

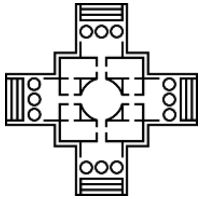


DML Abstraction Layers

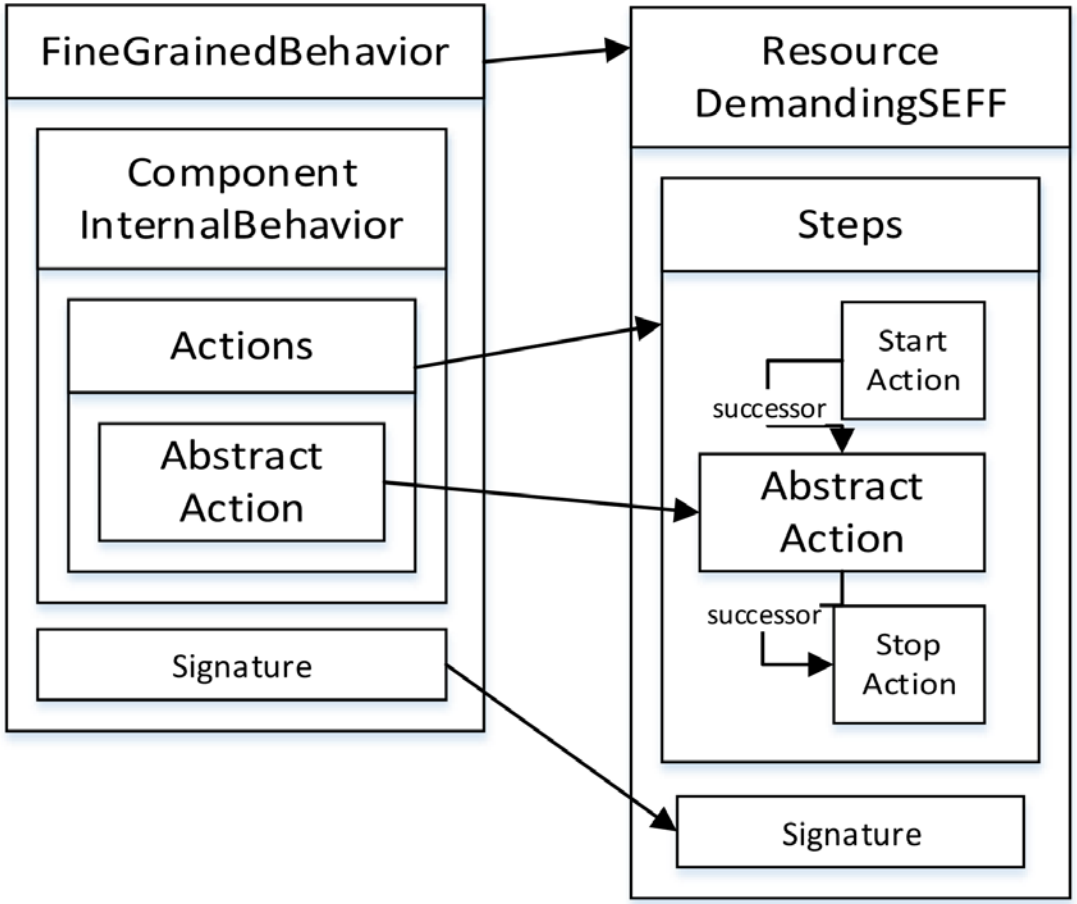
- Fine-grained behavior
- Coarse-grained behavior
- Blackbox behavior

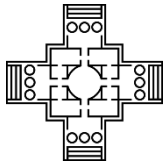
PCM Abstraction Layer

- Fine-grained behavior/SEFF

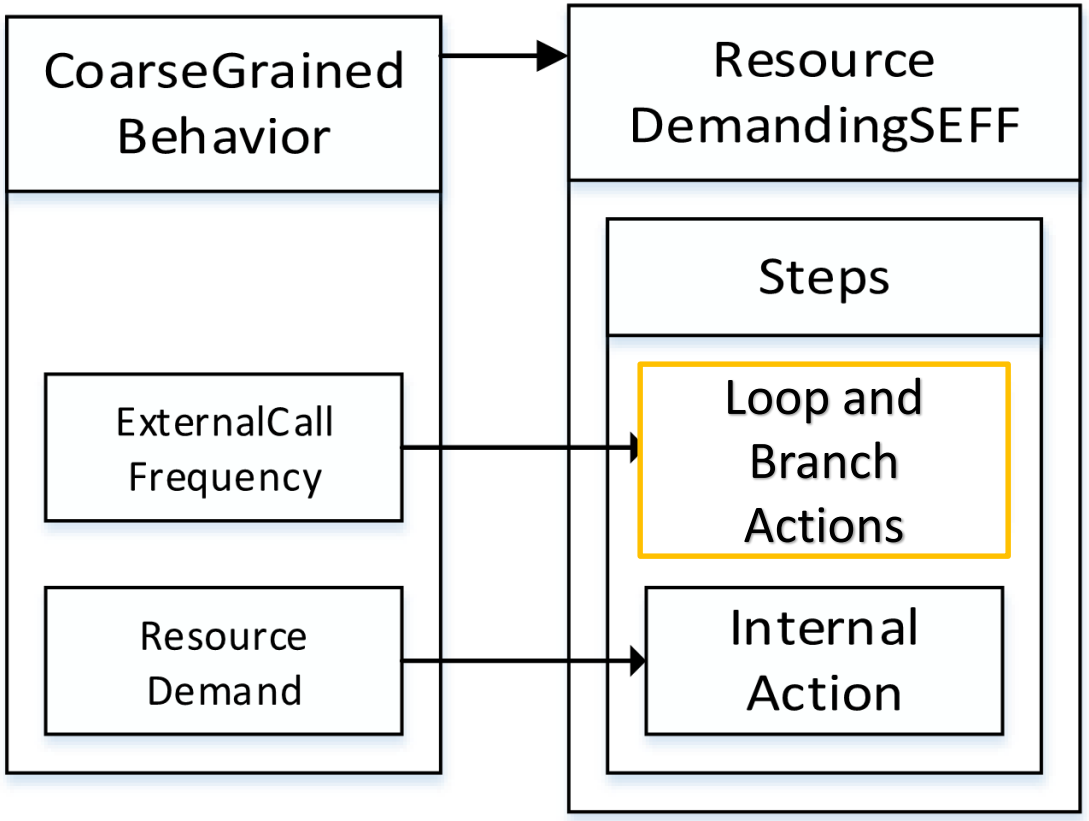


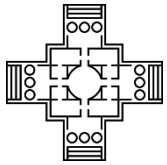
Fine-Grained Behavior Mapping



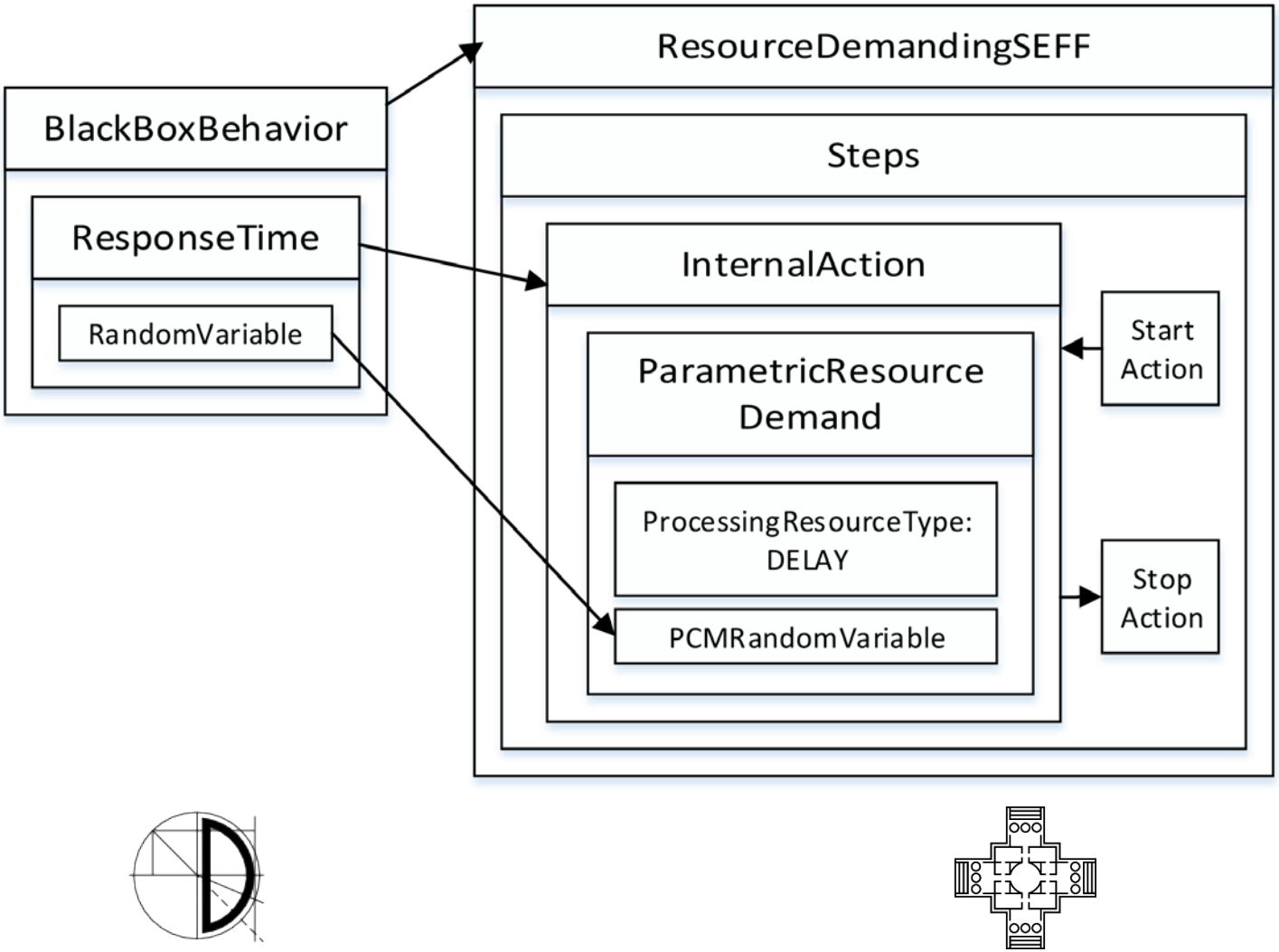


Coarse-Grained Behavior Mapping

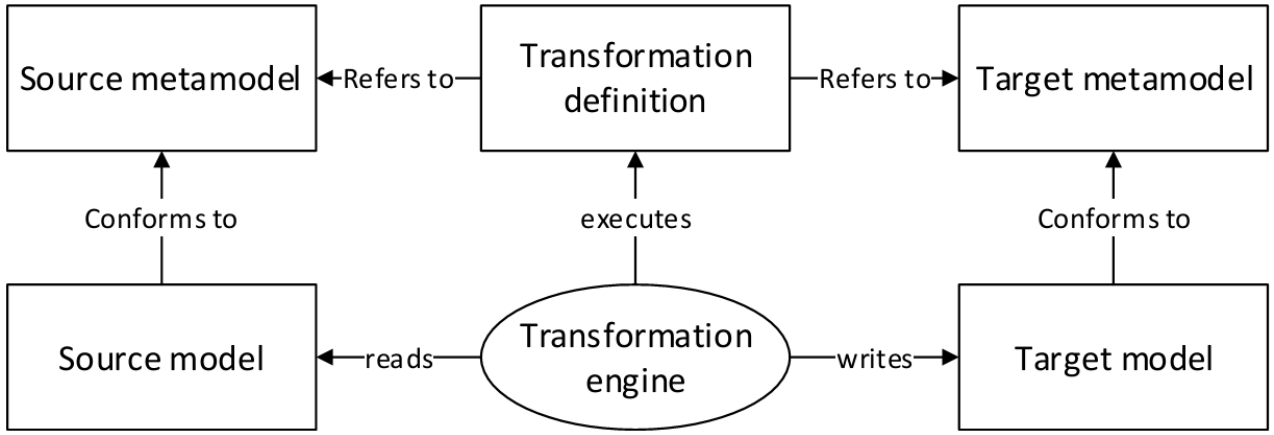




Blackbox Behavior Mapping



Technical Transformation Alternatives



Direct-Manipulation	Relational/ Declarative	Operational/ Imperative	Hybrid
• Multi-purpose programming language • e.g. JAVA	• „Constraint solving“ • e.g. QVT-R	• e.g. Xtend	• Declarative and imperative • e.g. ATL, ETL

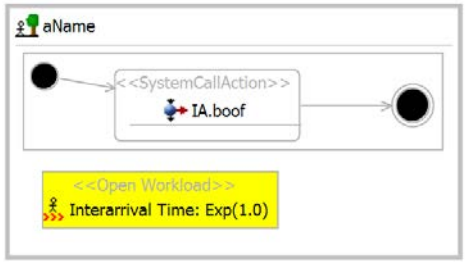
Evaluation

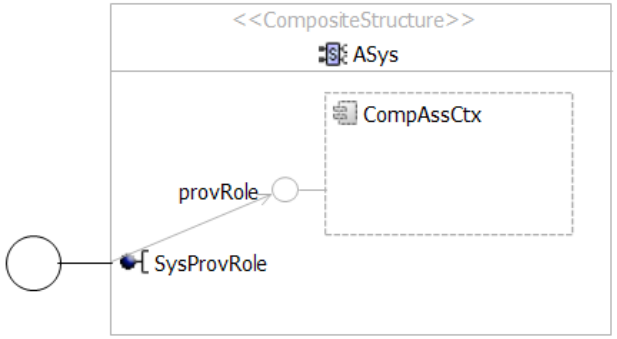
26 Unit Tests

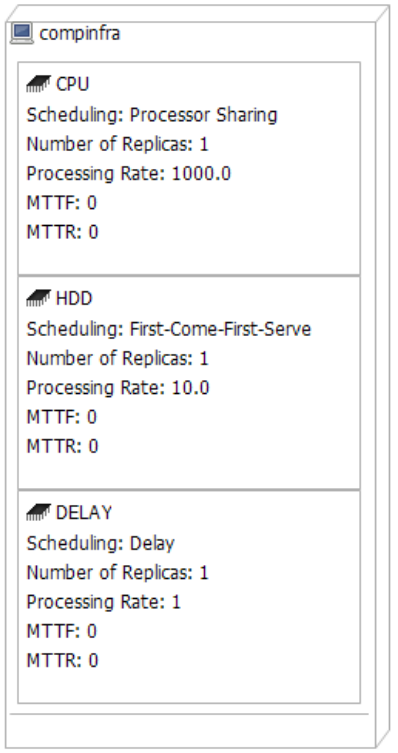
Components	Behavior	Interface	Resource Landscape
BasicComponent	BlackBoxBehavior	Interface	LinkingResource
ComposedStructure	FineGrainedBehavior	Signature	ComputingInfrastructure
AssemblyConnector	ReleaseAction	Parameter	
ProvidingDelegation Connector	AquireAction	PrimitiveDataType	
RequiringDelegation Connector	ExternalCallAction	ComposedDataType	
AssemblyContext	InternalCallAction		

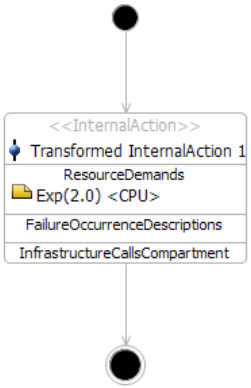
StoEx
BoolPMF, DoublePMF, EnumPMF, BoxedPDF, variableExpression, Term, Multiplication

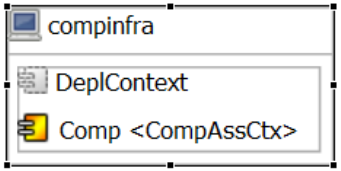
Case-study

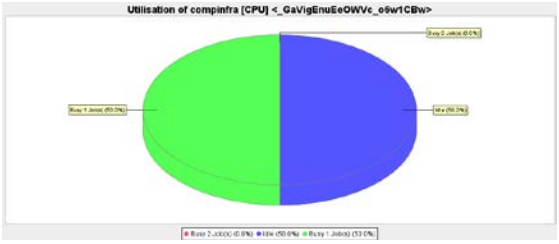

aName
<<SystemCallAction>>
IA.boof
<<Open Workload>>
Interarrival Time: Exp(1.0)


<<CompositeStructure>>
ASys
CompAssCtx
provRole
SysProvRole


compinfra
CPU
Scheduling: Processor Sharing
Number of Replicas: 1
Processing Rate: 1000.0
MTTF: 0
MTTR: 0
HDD
Scheduling: First-Come-First-Serve
Number of Replicas: 1
Processing Rate: 10.0
MTTF: 0
MTTR: 0
DELAY
Scheduling: Delay
Number of Replicas: 1
Processing Rate: 1
MTTF: 0
MTTR: 0


<<InternalAction>>
Transformed InternalAction 1
ResourceDemands
Exp(2.0) <CPU>
FailureOccurrenceDescriptions
InfrastructureCallsCompartment


compinfra
DeplContext
Comp <CompAssCtx>


Utilisation of compinfra [CPU]

Summary

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THANK YOU

https://se3.informatik.uni-wuerzburg.de/descartes/dml2pcm

Literature

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