



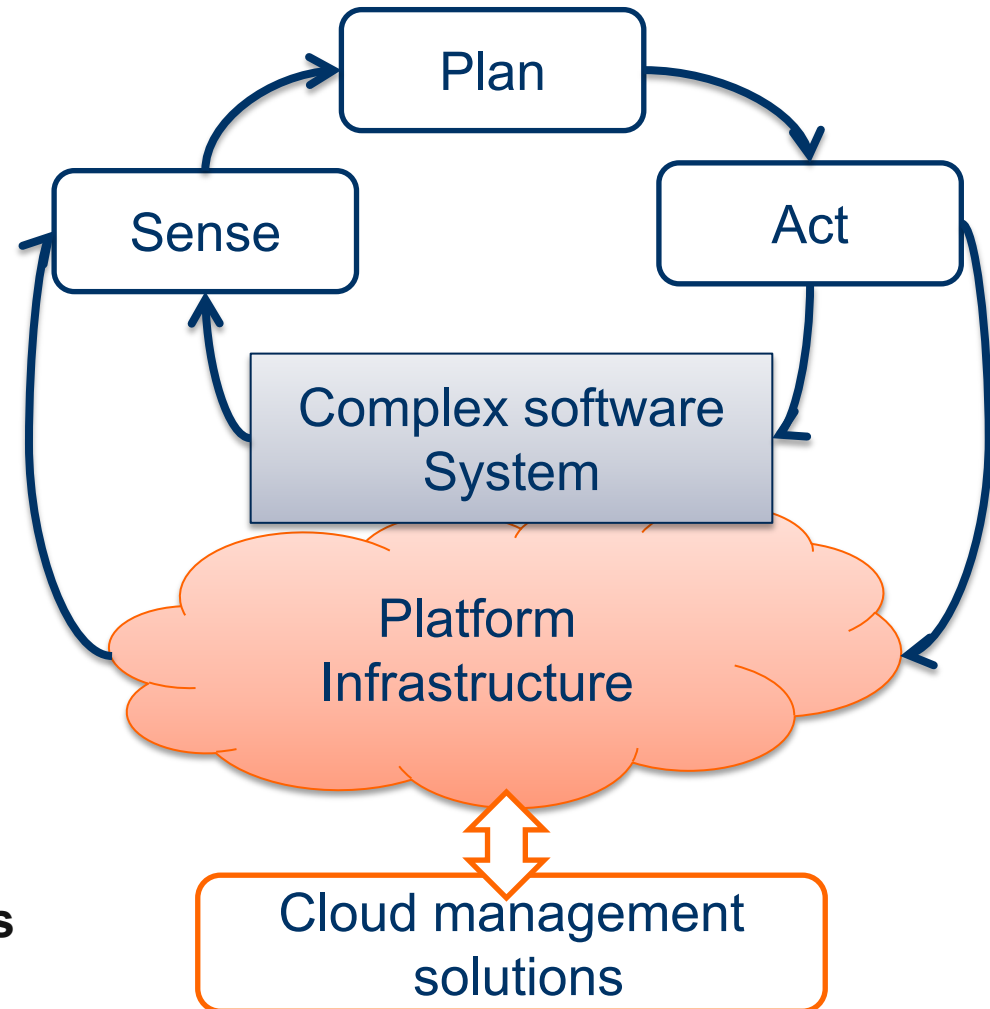
Managing Multi-Cloud Systems with CloudMF

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Introduction

- Complex software systems
- **DAS** to tame complexity of managing complex systems
 - Focus on the software
- **Cloud-computing** allows the management of the complete stack
 - Infrastructure, Platform, Software
- **Lack of integration between**
 - Cloud management solutions
 - DAS technics and methods



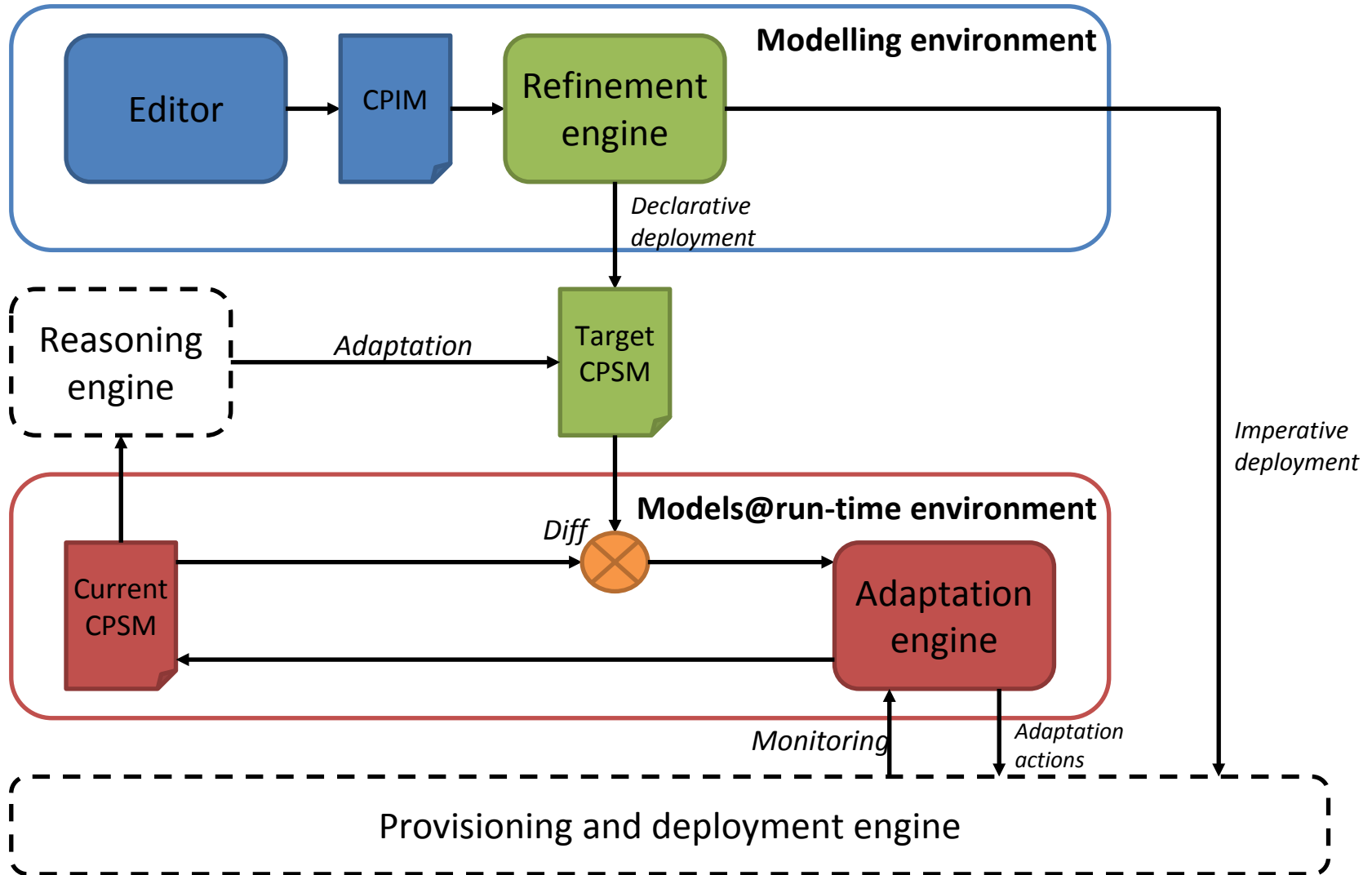
The Cloud Modelling Framework (CloudMF)

- Two main components:
 - A **modelling environment** with a tool-supported domain-specific modelling language (**DSML**) to model the provisioning and deployment of multi-cloud systems
 - A **models@run-time environment** for enacting the provisioning, deployment and adaptation of these systems

DAS architectural pattern

Relies on solutions for cloud management

CloudMF architecture

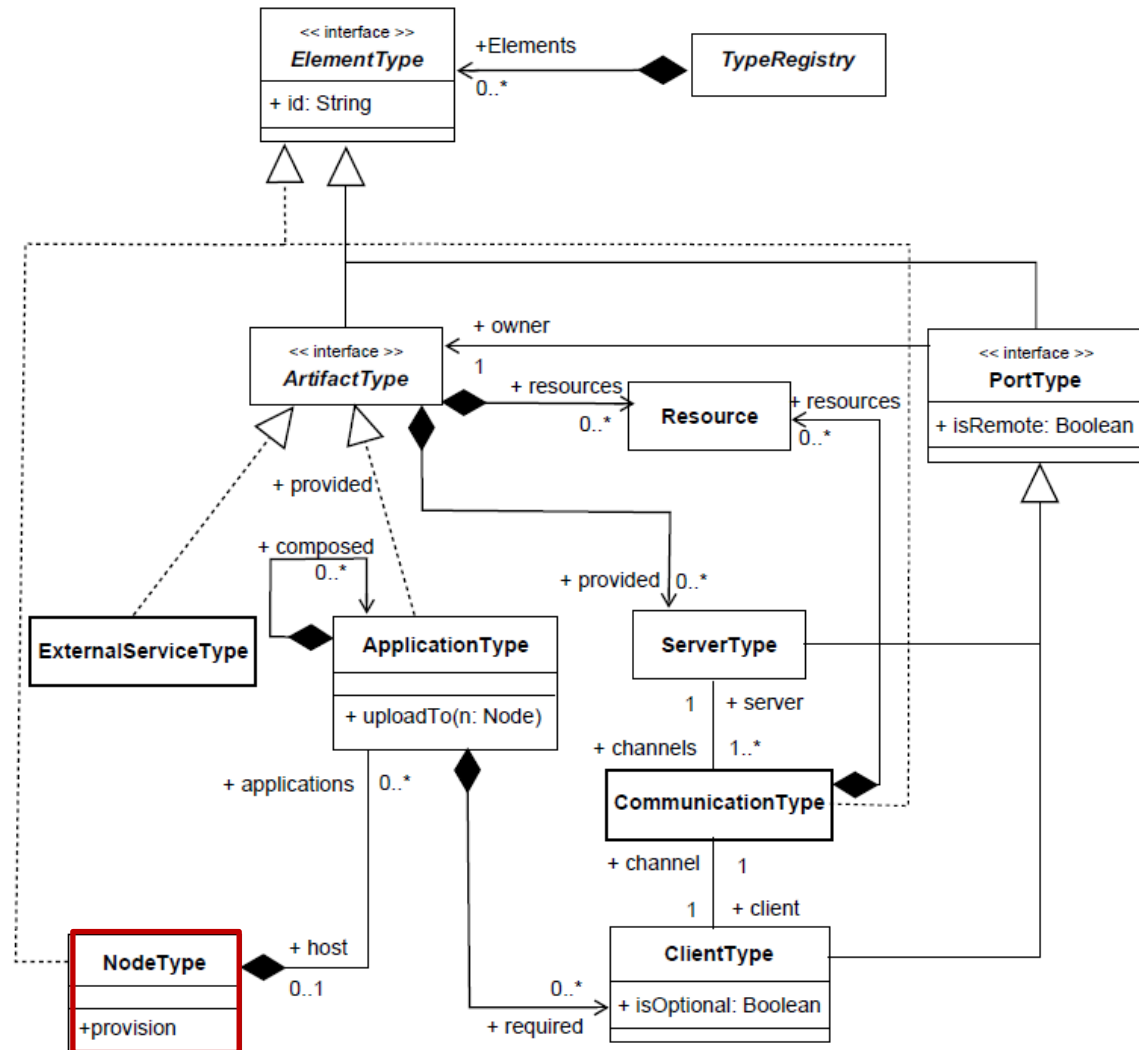


The Modelling environment

- A Model-driven approach with two levels of abstraction
 - Cloud Provider-Independent Model (**CPIM**)
 - cloud concerns related to the application in a cloud agnostic way
 - Cloud Provider-Specific Model (**CPSM**)
 - cloud concerns needed to deploy and provision the application on a specific cloud.
- Two main tools
 - A language **CloudML** along with an editor to manipulate the models
 - A refinement engine to **transform CPIM into CPSM** (CPIM enriched with provider specific metadata)

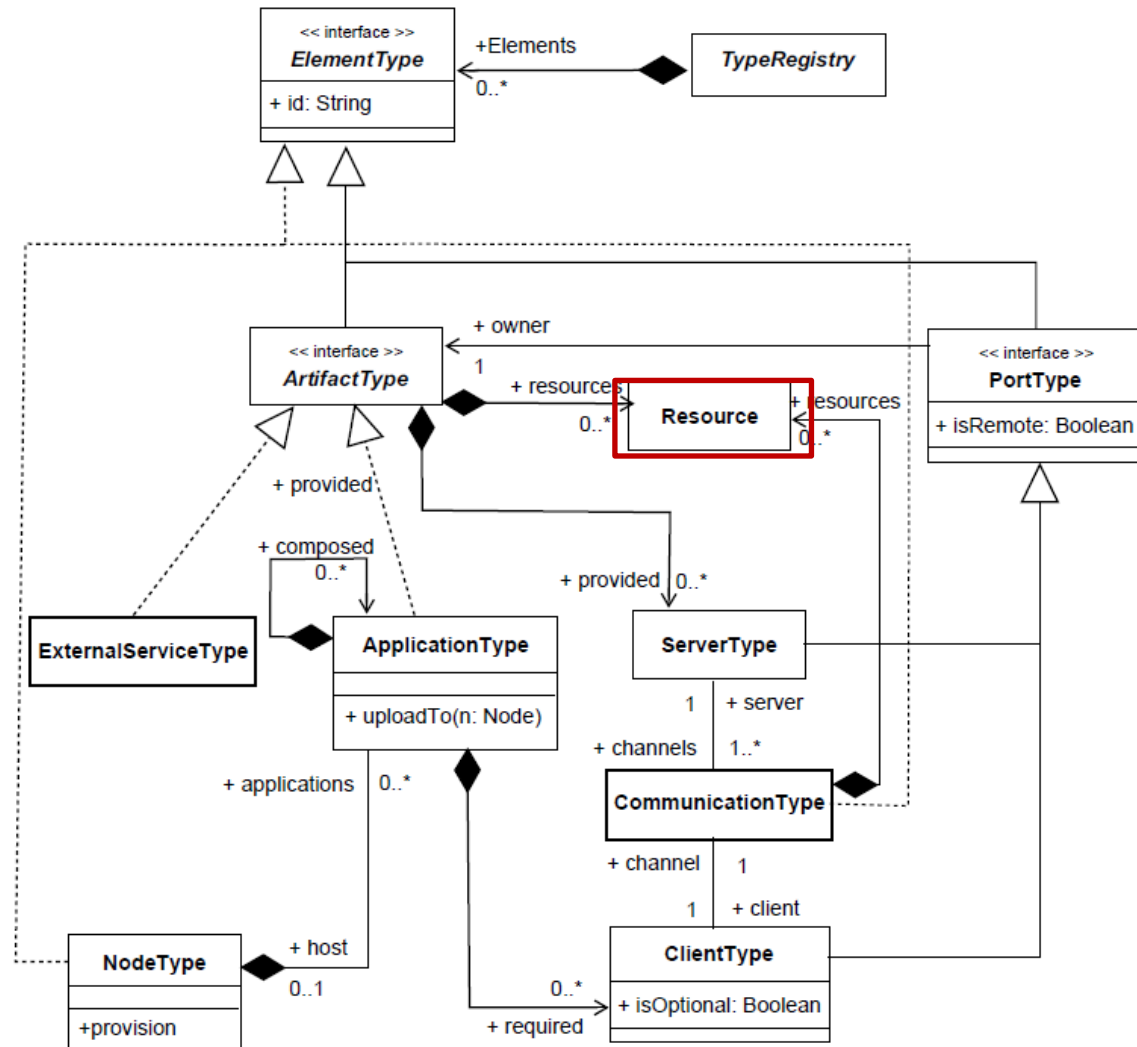
CloudML: main concepts

- Generic virtual machine
- Provisioning requirements
 - $2 \text{ cores} \leq \text{compute} \leq 4 \text{ cores}$
 - $2 \text{ GiB} \leq \text{memory} \leq 4 \text{ GiB}$
 - $\text{storage} \geq 10 \text{ GiB}$
 - $\text{location} = \text{Europe}$



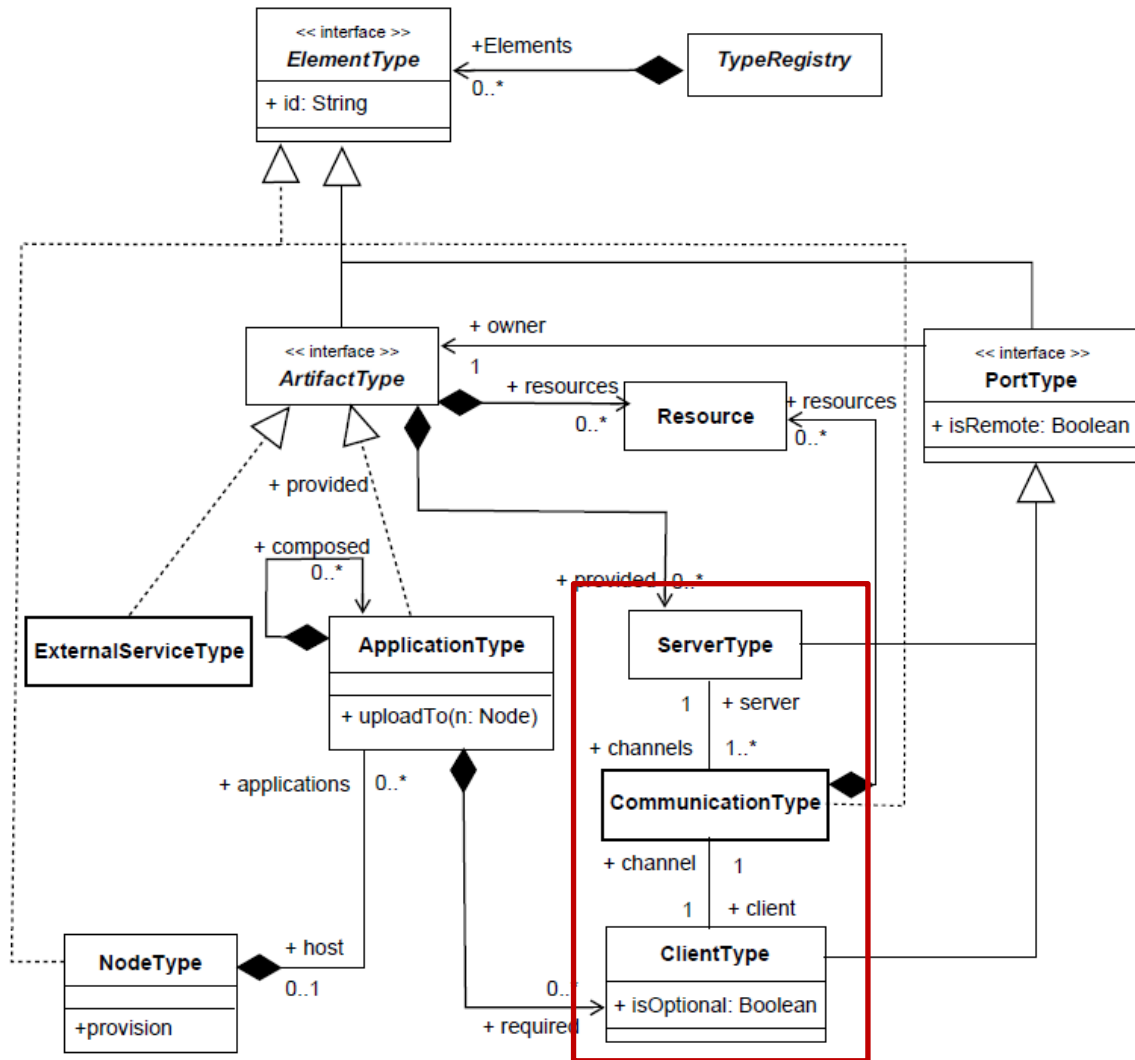
CloudML: main concepts

- Deployment commands
 - retrieve the Java servlet from cloudml.org
 - configure it
 - run it



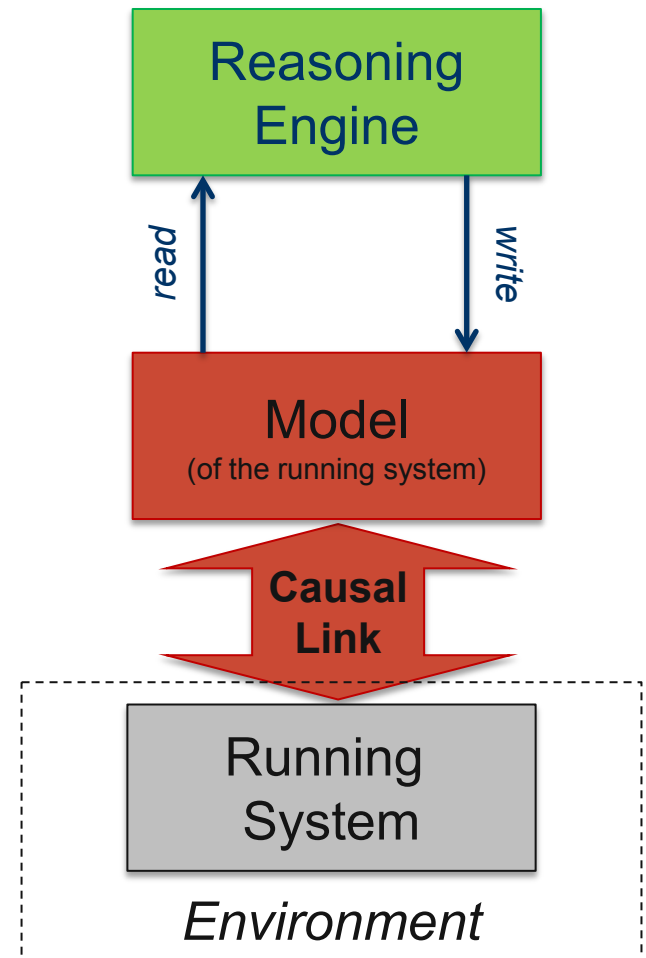
CloudML: main concepts

- Deployment dependencies
 - the Jetty container and the MongoDB database have to be deployed before the servlet
- Communication channels
 - a servlet communicates with another servlet through HTTPS on port 443

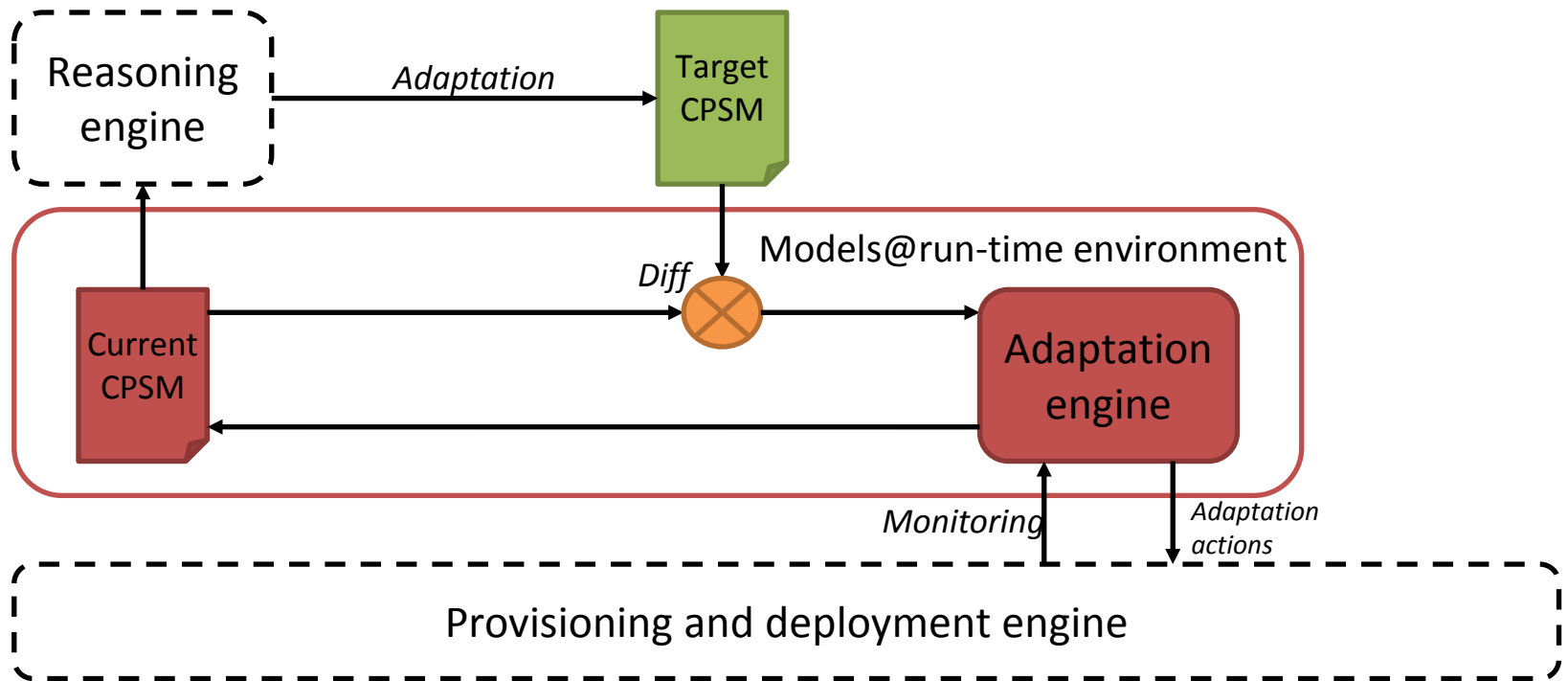


Models@runtime

- Architectural pattern for DAS
- Using a Causal Link
 - Bidirectional Synchronization
- Benefits
 - Separation of Concerns
 - Reuse of MDE tools for free
 - Free testing space



The Models@runtime environment



- CPSM causally connected to the running system
- A change in the CPSM is reflected on-demand in the running system
- A change in the running system is automatically reflected in the CPSM

Summary

- A framework to **provision, deploy and adapt** multi-cloud systems
 - Bring together DAS technics and classical cloud solutions
 - **Model-driven** approach at runtime and at design-time
- Focus on the IaaS level

Status

■ Resources

- <http://cloudml.org>
- <https://github.com/SINTEF-9012/cloudml/>

■ Used in several EU projects



■ Future works

- Introducing PaaS concepts
- Distributed models@runtime

Thank you !



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Demo

- Templates for SensApp:

