

Towards automated deployment of self-adaptive applications on hybrid clouds

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Context

- **Cloud computing: opportunities for cost-optimizing technologies**
 - Virtualization, job scheduling, scalability, availability, orchestration
- **Self-aware and adaptive applications are critical to address complex management challenges in evolving environments:**
 - autoscaling, load balancing, resource allocation and placement
 - safety, reliability, fault tolerance
 - diagnosis, troubleshooting, fail-over, recovery

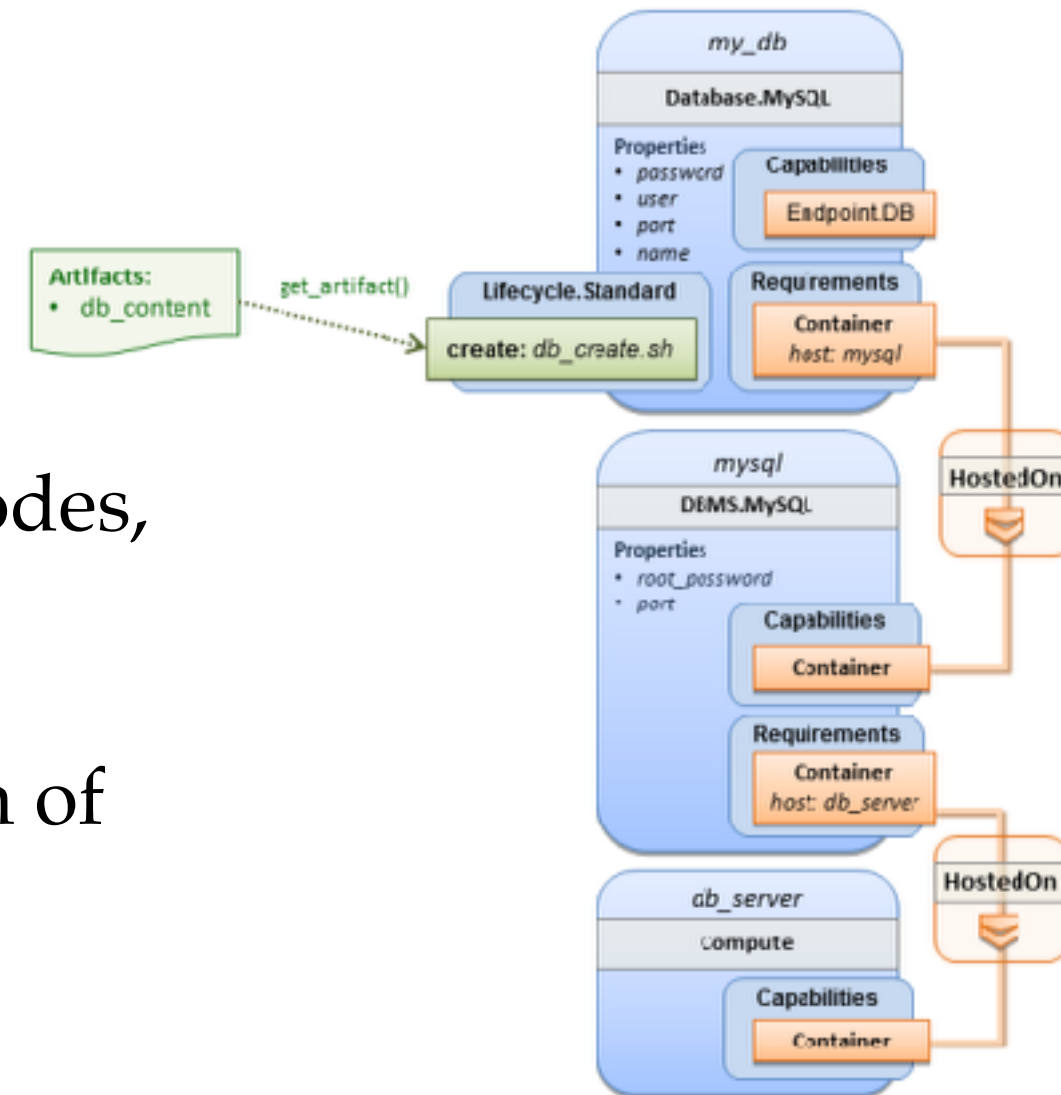
Challenges

- **Elasticity, dependability, security and data protection in multi cloud environments**
 - cope with strong security and data protection obligations
 - design, integrate, deploy, test and check self-adaptive applications on hybrid clouds (heterogeneity and interoperability issues)
- **Architectural framework for applications operational management**
 - enable self-configuration, monitoring, self-healing, self-protection

Background: TOSCA

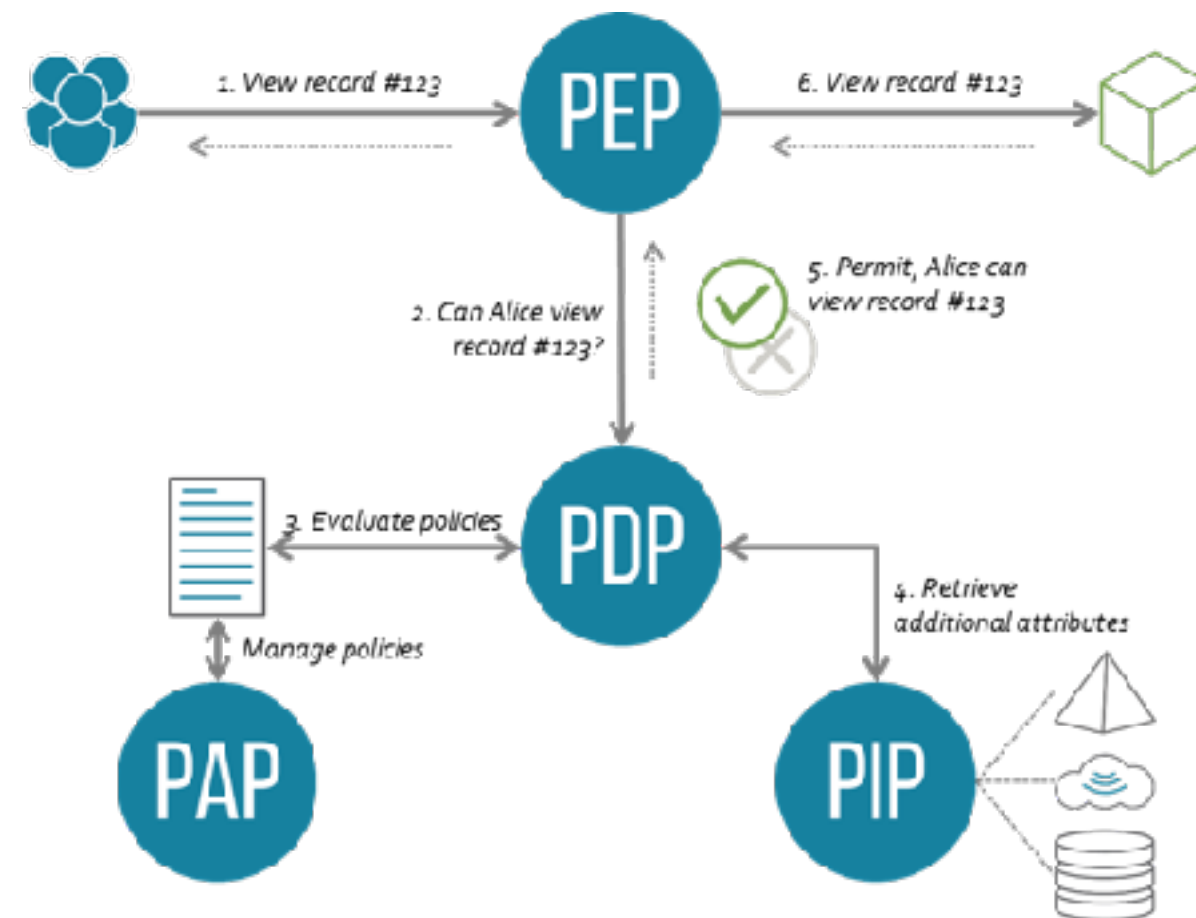
❶ OASIS Topology and Orchestration Specification for Cloud Applications (TOSCA)

- ❷ topology of distributed applications: nodes, relationships, implementing artifacts,
- ❸ cloud-agnostic automated orchestration of installation, configuration, startup, and management of applications
- ❹ Topology + orchestration : service templates



Background: XACML

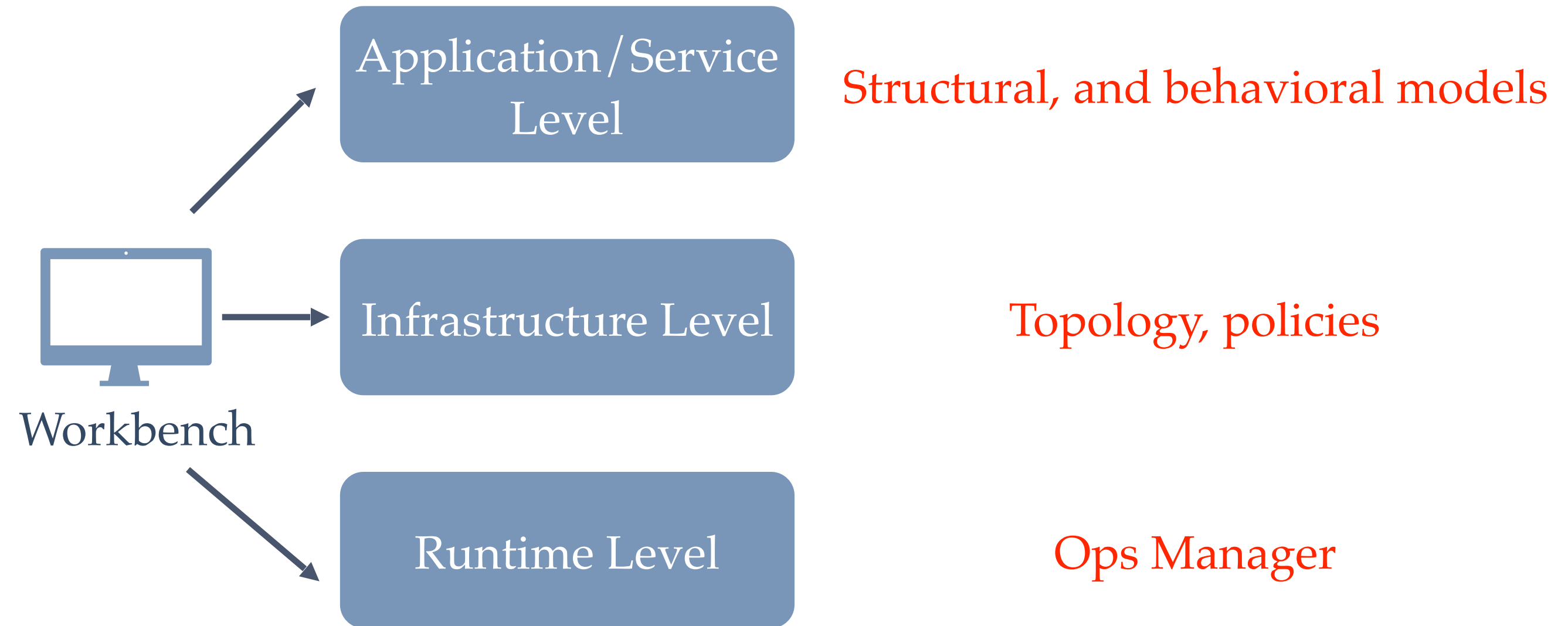
- OASIS extensible Access Control Markup Language (XACML)
- Attribute-based access control policy language
- Separates access decision from point of use
- Obligations from PDP to PEP, bridges formal requirements with policy enforcement

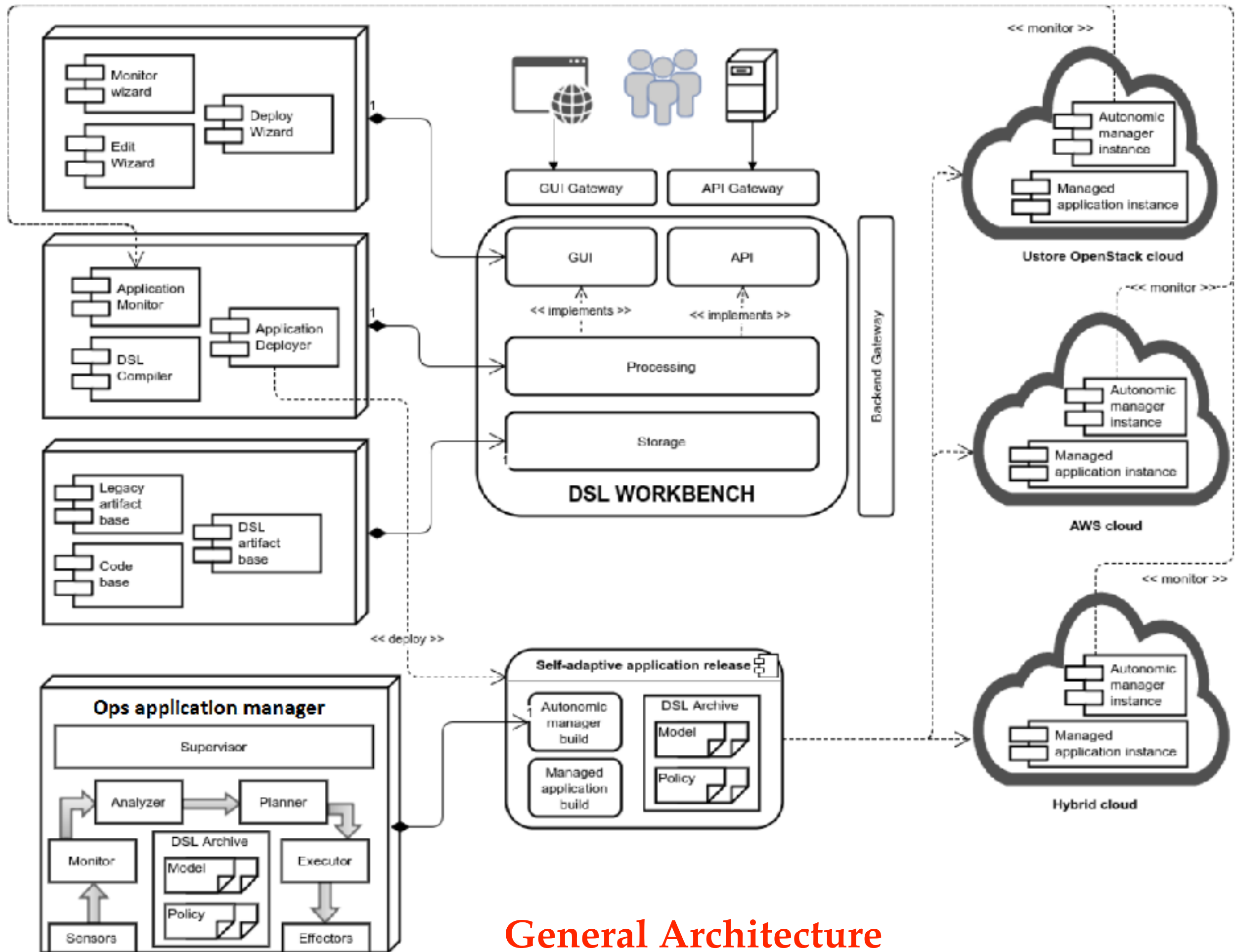


Our Approach

- **Cross-referencing language traits for:**
 - structural and behavioral modeling beyond infrastructure level, to application / service level (e.g. SCA, SCXML)
 - policy expressing security and data protection provisions, and enabling self-* policies to be fulfilled at runtime
- **Architecture for integrating an autonomic ops application manager**
 - supervisor, and collection of concurrent feedback loops
- **Language Workbench (as a Service)**

Layered Overview





General Architecture

Targeted capabilities

- **Non intrusive logging at infrastructure and application levels**
- **Non intrusive monitoring / asynchronous passive testing**
- **Non intrusive active testing in staging environment**
- **Intrusive active testing in production to check robustness and fault-tolerance**
- **Runtime installation, config. and setup without interruption**
- **Elasticity, self-recovery, circuit breaking, timeout management**

Candidate tools & infrastructures

- **TOSCA implementations: Cloudify, OpenTosca, Alien4Cloud,...**
- **XCREATE (CNR): automated derivation of test suites from XACML**
- **GLIMPSE (CNR): flexible monitoring based on Publish/Suscribe**
- **SimplyTestify (SEF, foreground of EU FP7 MIDAS)**
- **AWS, Ustore OpenStack, ...**

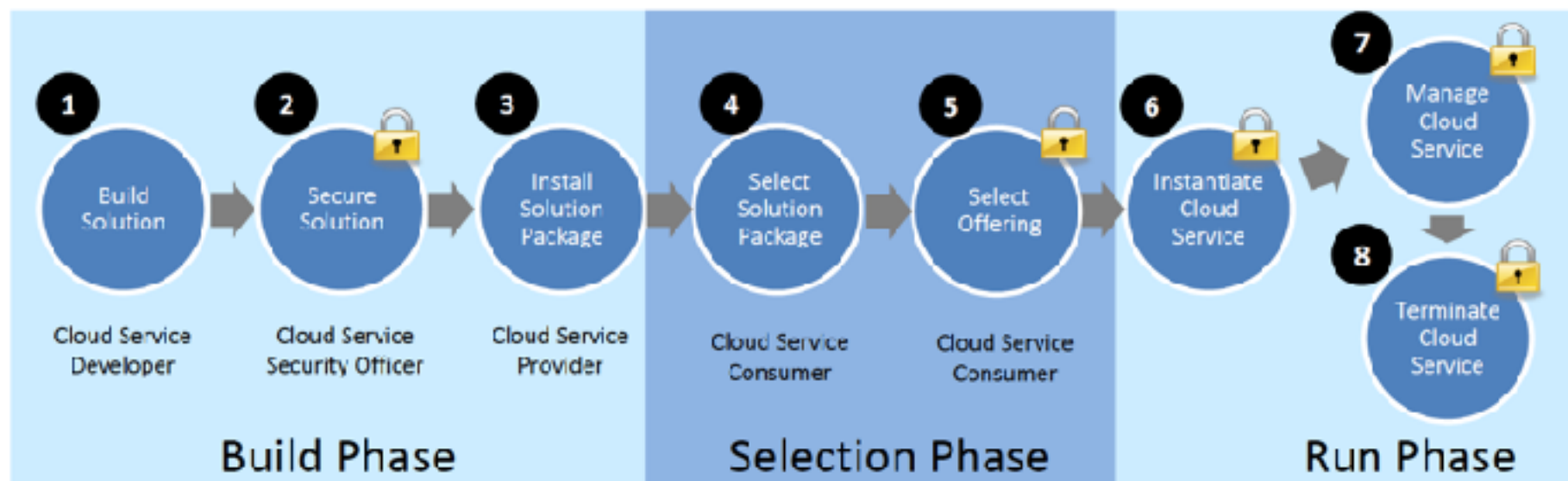
Threats & Opportunities

- **TOSCA-based language extension could collide or overlap with others**
- **Model-based: modeling effort, discrepancies, management,...**
- **Practical integration within all available cloud providers**
- **Integrate EU General Data Protection Regulation**

Related work

Policy4TOSCA (Waizenegger et al., 2013)

policy-aware service provisioning for secure cloud computing



Semantic Access Control Policy Language (Hu et al., 2009)

XACML-based: Ontology for Subject, Object, Action, and Attribute

Conclusion

- **Language for describing self-adaptive cloud apps**
 - topological, structural and behavioral modeling at infrastructure and application/service levels
 - policy for security and data protection provisions, and enabling self-* policies to be fulfilled at runtime
- **Architecture for integrating an autonomic ops application manager**
- **Language Workbench**

Perspectives

● Application to logistics

- distributed and autonomous decision making

- cloud-based logistic platform for inter organizational operations, processes, and management

● Coordination of cross-organizational distributed applications autonomic ops managers

● Model consistency wrt. runtime adaptation

● Policy change at runtime

● (Provision of Assurance)

Thanks!

