Semantic description and discovery of Cloud Resources and Services for portability and interoperability

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Project mOSAIC: Open-Source API and Platform for Multiple Clouds
http://www.mosaic-cloud.eu

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(Some) Portability and interoperability issues

The process of developing, deploying, executing cloud applications is strongly influenced by the specifics of the cloud providers.

Application Programming Interfaces

- Syntactical differences
- Differences in programming models
  - Object oriented
  - REST based
  - Event driven
- Differences in API semantics
  - Different functional abstractions (especially at PaaS level)
  - Linked to application domains (especially at SaaS level e.g. enterprise patterns)
(Some) portability and interoperability issues

Resources and services

✓ Different resource semantics (especially at PaaS: e.g. stores)

✓ Different resources’ configurations and templates

✓ Different linkages of resources and configurations to provided services

✓ In order to interoperate, resources and services need to be retrieved and accessed; a Resource/Service Catalogue is needed, where the resources and services are (semantically) described, together with their groundings
(Some) portability and interoperability issues

Non-functional requirements and service levels

✓ Differences in semantics of Service level offerings and their level
✓ Mismatch between nonfunctional requests and offers
✓ No linkage of provided services and resources with service levels (especially at PaaS and SaaS)
✓ No standard or common KPIs and mechanisms to measure them
Semantic technologies can help
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Semantic technologies can help

To define a common, machine readable, dictionary, able to express resources, services, APIs and related parameters, SL requirements and offers, and related KPIs

To support code portability, by aligning and reconciling different APIs and resources

To bridge the gap between the domain related functionalities and cloud resources and services

To support interoperability, by matchmaking Service interfaces

To support (semantic based) resource and services discovery
Semantic technologies can help

To support Brokering, Negotiation and Service level Agreement, by matchmaking nonfunctional user requirements and provider offers

To support dynamic resources reconfiguration, by monitoring SL parameters and reacting with applying heuristic rules
Portability, Interoperability and Semantic technologies in the mOSAIC project

- An Agnostic, vendor neutral, API at PaaS level and an Open Source Platform, with adapters to most notable Cloud Providers’ APIs
- A Cloud Agency for Services brokering and SLA monitoring and resource reconfiguration
- A Cloud Ontology
- A Semantic Engine, for finding mOSAIC API components and resources, driven by functional and Application domain concepts, patterns and rules
- A Dynamic Semantic Discovery Service, for discovering Cloud providers’ resources and services, aligning them with mOSAIC API components and resources
Semantic technologies in the mOSAIC project

A Cloud Ontology able to provide a common definition of concepts related to Cloud domains and to describe Cloud components like infrastructures, platforms and services.
Semantic technologies in the mOSAIC project

The Semantic Engine:
overcomes syntactical differences representing and annoting the API semantically, independently from programming model.
offers a catalogue of functionality related to Cloud domain, representing specific services in agnostic way.
offers semantic full text search with the use of semantic thesaurus.
Semantic technologies in the mOSAIC project

The Semantic Engine:
Links together services and resources and maps them with grounding implementation.
Helps to express non functional requirements and supports construction of SLAs depending on concepts related to patterns and heuristic rules.
Semantic technologies in the mOSAIC project

- A Dynamic Semantic Discovery Service, for discovering Cloud providers’ resources and services, aligning them with mOSAIC API components and resources. Together with Semantic Engine, the discovery service helps to enrich the catalogue of services and automatically classify them, abstracting and annotating them.

- Support to mOSAIC’s Cloud Agency to express brokering policies and to find best fitting provider according to SL requests. Semantic based rules can be defined in Cloud Agency to express Service level monitoring and reconfiguration rules.
Cloud Agency

Cloud Agency is a multi agent system (MAS) that accesses, on behalf of the user, the utility market of Cloud computing to manage always the best resources configuration that satisfies the application requirements.
Vendor Agents

- The overall goal of the Vendor Agents (VA) inside the Cloud Agency is to mediate the relationship of their clients with the specific cloud providers they are connected to.
- VAs create a separation layer between the Cloud Agency and the Cloud Provider and hide the user applications and other agents from the details of the cloud provider, the resources they use and the infrastructure they run on.
- Vendor Agents provide *resource provisioning* and *resource management*. 
Vendors' specifics addressed

- **The resources types they provide:** compute and storage resources are quite common. But they are sometimes complemented with load balancers, relational databases, map-reduce, elastic IPs, etc;

- **The operations on resources** including the way they are created, destroyed, related with each other, etc;

- **The resource characteristics:** CPU, RAM, prices and the quality of the services

- **Interaction mechanisms:** there are various API types which are available depending on the cloud provider like REST, SOAP or language libraries.

- **Security credentials:** usernames and passwords are widely used. But there are also specific keys which can even differ for accessing different resources types on the same provider.
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Thanks for your attention!

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