Concepts and Challenges in Service Composition

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Teaching and Research at HPI
- Great emphasis on scientific excellence, practice orientation, and cooperation with industry
- National and international research projects, e.g.,
  - PESOA: BMBF funded; 6 partners, 4 M€, 3 years
  - ASG: EU FP6 funded; 21 partners, 11.5 M€, 2 years
- Teaching activities associated with research
  - SAP Research, BPEL ext to SAP BPM Suite: Canguru (2005)
  - Master thesis projects with SAP SI

Service Oriented Computing
- Services
  - Loosely coupled computing tasks communicating over the net
- Service-oriented Architecture
  - Organizing principles that facilitate dynamic automated discovery and use of services
- Roles
  - Requestor, Broker, Provider

HPI at a glance
- Founded by Hasso Plattner in 1998 as public-private partnership with University of Potsdam
- Bachelor and master university programs in IT Systems Engineering
- 356 students (275+81)

Service Definitions
- There are many definitions existing, samples:
  - Everything providing an WSDL-complaint interface is a web service. (W3C)
  - A service is the non-material equivalent of a good. (Economics)
  - E-business services are loosely-coupled computing tasks communicating over the Internet. (IBM)

=> We need to agree on what a Service is.
OOP vs. SOC

Object Oriented Programming
- Everything is an object
- Objects have attributes and methods
- Methods are invoked by messages
- Stateful, fine granular communication

Service Oriented Computing
- Every functionality is a service
- Services provide an interface and operations
- Services are requested by messages
- Ideally stateless, document oriented

Sample-Scenario: Without computing

```
send me your product catalogue
```

Sample-Scenario: OOP

```
send me an offer on products x, y and z
```

Sample-Scenario: SOC, improper impl.

```
I accept offer 4711
```

Sample-Scenario: SOC, proper impl.

```
I accept offer 4711
```

Intermediate Conclusions

In this context:
- A service is a well-specified unit of work offered by a provider, which can be performed on demand.
- Services...
  - should be high level, document oriented
  - should be tailored by business needs
  - should represent elementary business capability
- Simply using SOA does not lead to “proper” service tailoring and SOC.
- Every functionality can be seen as a service. However it is not always useful to do so.
Concepts and Challenges in Service Composition

1. Spirit of SOC
2. Service Composition: Adaptive Services Grid
3. Challenges and Conclusions

Service Composition
- Service composition realizes business process
- Is a laborious and costly tasks
- Requires many steps: discovery, binding, data type mediation
- Continuous adaptation needed

Static Binding
- Service impl. bound at design time
  - Providers register their services
  - Ambiguities in description resolved by programmer during application implementation
  - Appropriate for rather static service landscape

Semantic Service Specification
- Provides a formal specification of service semantics
- Specifications need to be based on a common understanding, realized by domain ontology

Dynamic Discovery and Binding
- Selection of proper service implementation at run time
  - Optimization possibilities: e.g., take the cheapest service
  - Failure recovery: choice of alternative service impl.
  - New services can be used without changing the application
- Requirement: Semantics
  - Formal specification of service semantics is required
  - Specifications need to be based on a common understanding, realized by domain ontology

Additional value of semantic specifications: Semi-Automated Service Composition
- By using semantic service specification process modelling tool can help user in
  - Discovery of proper services
  - Data type mediation
  - Validity checking
Additional value of semantic specifications: Automated Service Composition

- Automated service composition by AI planning
  - Significant reduction of composition costs
  - Run-time adaptability and failure recovery

Adaptive Services Grid

- Prototype of open development platform for
  - Services specification, registration, discovery, composition, negotiation, and enactment
  - Services Grid Paradigm
  - FP6 IST-2 IP

ASG Vision

Service Provider
- Register

Service Requester
- Request
  - App
- Reply
  - App

Challenge in connecting systems

- Technical interfaces suffer n-square problem
- Reduced effort when agreeing on an ontology

Grounding and data type mediation

ASG: Service Delivery Lifecycle
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Challenges on Ontologies
- What is a proper level of granularity?
  - Fine granularity vs. coarse granularity
- How large should be the modelled domain?
  - Narrow domain model vs. broad domain model
  -> need for Practical experiences

Conclusions
- Semantics enables exploration of SOC
  - by dynamic service discovery and binding
  - by automated service composition
  -> reduces costs by rising efficiency of adaptation processes
- Need for tight cooperation between industry and science
  - to solve open challenges
  - to learn best practices for implementation