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Services Engineering:

Guided composition,
adaptive architecture/workflow,
interoperability, security, and registry

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Overview

Services Engineering (research): methods, techniques & tools for

- Packaging and publishing services
- Developing service-oriented systems/compositions
- Deploying services and service-oriented systems

(Engineering philosophy: assisting humans, rather than fully automatic)

Project Areas

- Guided service composition
- Adaptive service-oriented systems
- Service interoperability
- Service security engineering
- Rich service registry



Guided service composition (1/2)

Service space: a collection of services for a given domain

- Active service space:
service space + temporal business rules
- Personalised active service space (PASS):
active service space + personalisation rules (selection & temporal)

Guided service composition with PASS:

- Step-by-step service composition (business workflow/BPEL)
- Firing of rules ... validity of composition (wrt rules)
- Guidance feedback (for next steps, or correction)



Guided service composition (2/2)

Research work/outcomes:

- Temporal business rule language
- A formal checking system of intermediate compositions wrt rules
- Guidance generation

- SCC'06, WISE'06, ICSOC'06?

Adaptive service-oriented systems (1/2)



How to build service oriented systems that adapt to changing requirements and changing environments?

- Introduce a management layer (on top of the application/function layer)
 - control-theoretic, viable system theory
- An SoS is an “organisation” consisting of roles (service types) and inter-role contracts
- Roles are played by actual players (specific services)
- The SoS (or organisation) has an organiser, controlling roles, contracts, and role-player bindings ... to achieve adaptability
- (organiser: role & player)
- Changeable organisation/composition is super-imposed on existing players/services

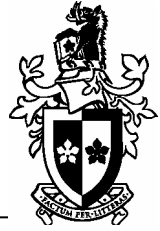
Adaptive service-oriented systems (2/2)



Research work/outcomes:

- Theoretical framework: roles, contracts, players, organisers, self-managed composites, ...
- Implementation framework

- 11 papers (7+4), inc. Coordination'05, AAI'05, SCP, CSSE



Service interoperability (1/2)

How to use a service properly? ... interaction protocol

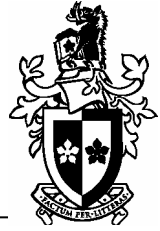
- Beyond WSDL
- Better than OWL-S service/process model
- A declarative, constraint-based notation, eg, leadsTo, precedes, exists, absent, ... with "scope"
- Formal semantics: temporal logic, FSA
- Automatically checkable: consistency, compatibility, interoperability
- Run-time monitoring and reporting



Service interoperability (2/2)

Research work and outcomes:

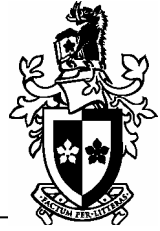
- A interaction protocol specification language
 - Formal semantics
 - Protocol consistency checker
 - Protocol compatibility checker
 - Protocol interoperability checker
 - Run-time protocol monitor
-
- Many papers, inc ICSOC'05, APSEC'05, QSIC'05, ICCBSS'05 ...



Service security engineering (1/2)

What are the security properties of a service? How to specify/describe? Are interacting services compatible wrt security? Are system-wide security policies satisfied?

- Characterisation and description of service security properties
- Formal semantics
- Compositional security analysis
 - Inter-service security compatibility
 - Satisfaction of system-level policies/properties



Service security engineering (2/2)

Research work and outcomes

- Security characterisation/description language
- Compatibility checking techniques & tool
- Checking techniques for system-wide properties/policies
- Ontology for system/service attacks and defence
- Ontology for system security properties
- Security-oriented system architecture patterns
- Incorporating into OWL-S ...

- Many pubs, inc IEEE Software, COMPSAC'03, SKG'06, ...



Rich service registry

Beyond UDDI: How to maintain, manage and leverage enterprise systems/services and other resources dynamically?

“The rich service registry is the enterprise!”

- Rich service description: semantics and qualities (eg, security, business characteristics, ...)
- Rich registry capability: diverse resources, pattern-based matching, compositional matching,
- Service lifecycle management
- Run-time dynamic registry-service/composition interaction
- Service audit and compliance checking
- Extensible registry framework



Summary

- Guided service composition
- Adaptive service-oriented systems
- Service interoperability
- Service security engineering
- Rich service registry