Identifying and Specifying Reusable Services of Service Centric Systems through Product Line Technology

Position Paper

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Outline

- Introduction
- Approach Overview
- Service Identification
- Service Specification
- Summary

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Context

- "Service-oriented architecture (SOA)" is an emerging concept for the development of information systems
  - Not for a statically configured system
  - Service providers/consumers may join in and leave from a system dynamically (i.e., at run time)
  - Some examples include Web services, ebXML, etc.
- One of the challenges for the development of SOA based systems is the *dynamic management of services* such as:
  - Deployment of a new service
  - Modification of current service behaviors
  - Removal of an unavailable service
  - Management of available resources

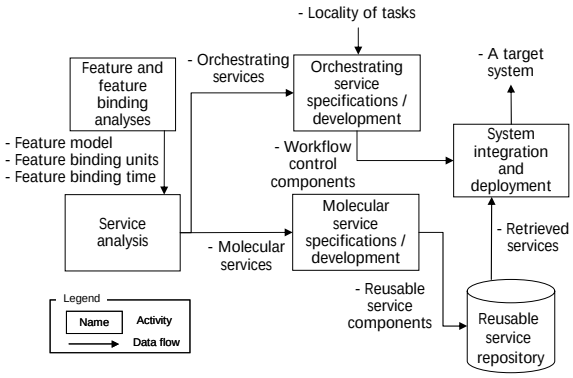
Some challenges for developing service oriented systems in product line engineering

- While taking advantages of "service-orientation" (e.g., scalability), variations of a product line should be also managed.
  - Selection and customization of service features with or without users' interventions
    - Operating context relevant services should be provided.
  - Provision of dynamic adaptivity
    - Depending on available resources at a certain situation, available service features and their quality may vary.
  - Management of change impacts from dynamic addition / modification / removal of service features
    - Incorrect coordination of services features after product reconfiguration may result in system failure.

Application Domain – "Virtual Office of the Future"

- General definition: virtual office
  - A type of telecommute in which workers are equipped with the tools, technology and skills to perform their jobs from anywhere the person has to be – home, office or customer's location. [Wikipedia]
- Research areas
  - Document management (i.e., efficient management of heterogeneous document types)
  - Workflow modeling (i.e., capturing and optimizing office workflows)
  - Workflow management (i.e., tool support for workflow artifacts)
  - **(Product Line) Software Engineering Methods**
    - **Efficient generation of solutions supporting diverse organizations, roles, and infrastructures**
    - **Ensure system dependability**
      - **Anywhere => Focus: Adaptivity,**
      - **Anytime => Focus: Availability**

Activities of the approach



Key Concepts

- Molecular Service (MS) Identification as for a Unit of Orchestration
  - Self-contained (control + computation)
  - Stateless from service user's point of view
  - Taxonomies for services (ontology information; domain-specific!)
  - Pre/post conditions and invariants for each MS
- Quality of service for each MS
  - Quality attributes in terms of features
  - Contextual information to determine one of the attributes (who makes the decision? what factors affect the decision?)
- Workflow based Service Behavior Specification
  - Dependable orchestration of molecular services
  - Pre/post conditions and invariants for each workflow
  - Connection to operational context for the selection of QoS attributes at run time

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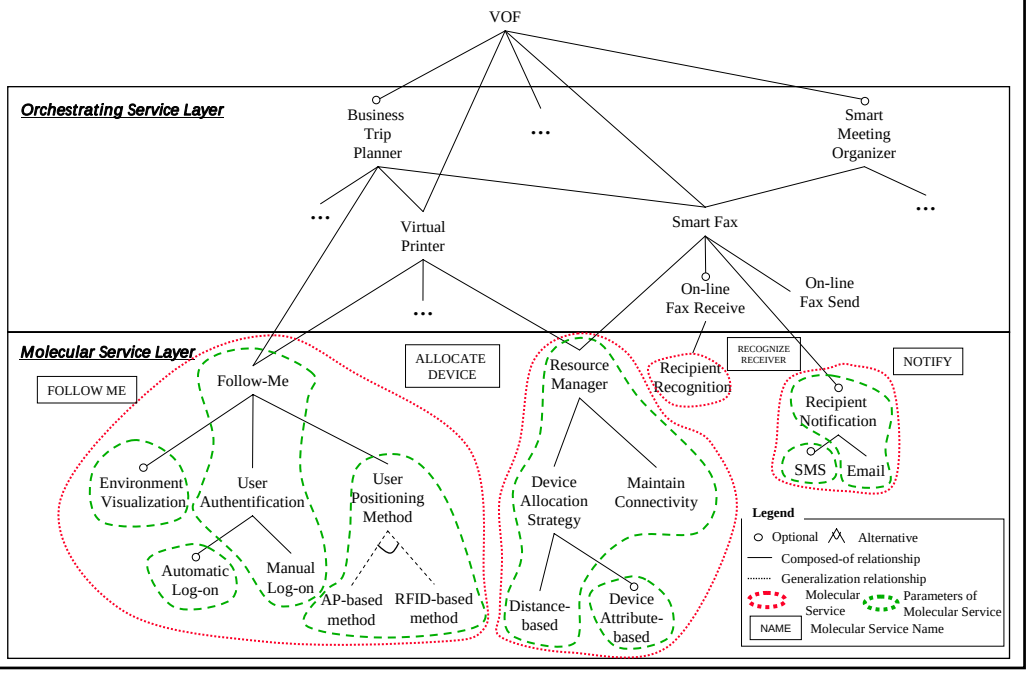
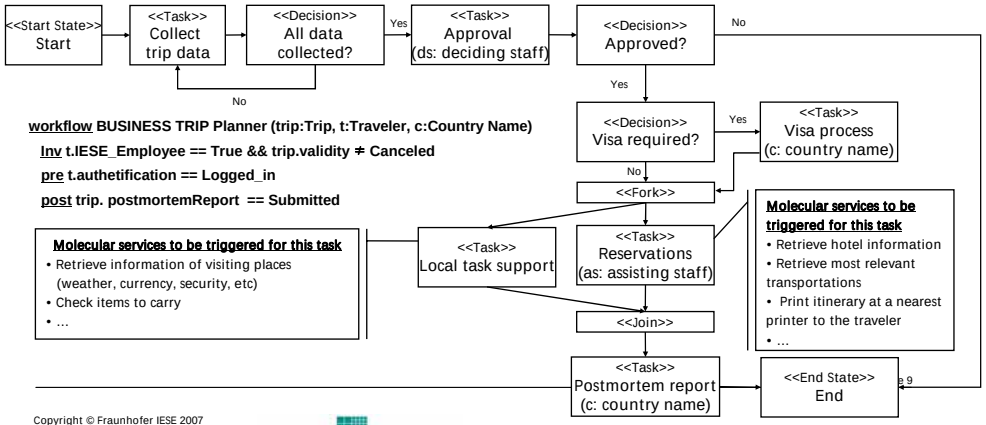
Molecular Service Identification



Workflow Specification: Dependable Orchestration of Molecular Services

- Example of Business Trip Planner



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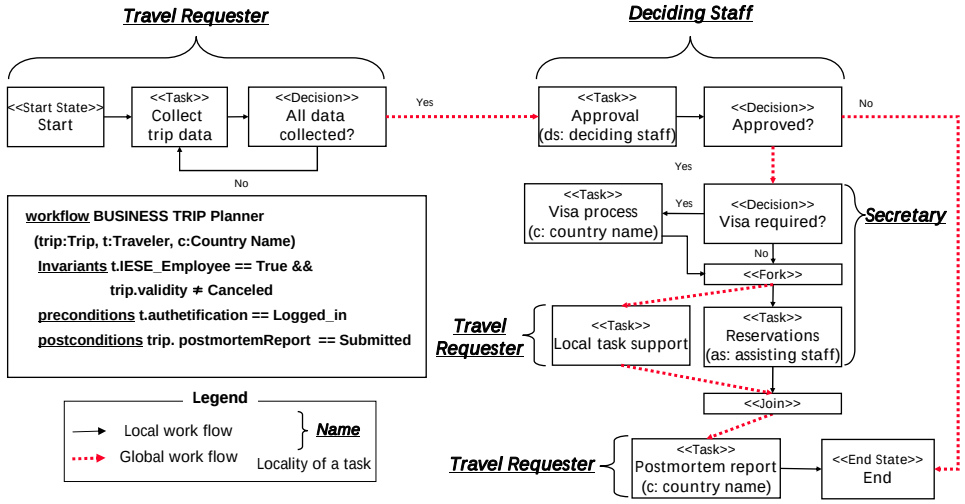
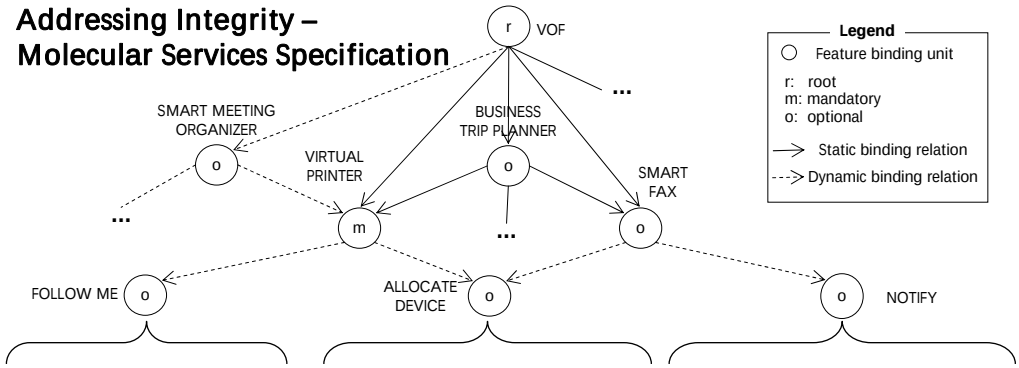
Identification of Localities of Tasks from a WF Specification

- Example of Business Trip Planner



Addressing Integrity – Molecular Services Specification

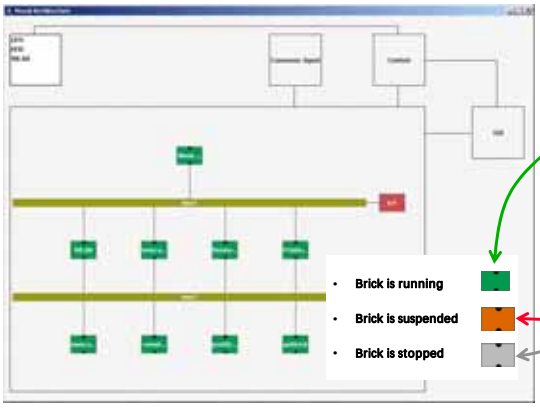


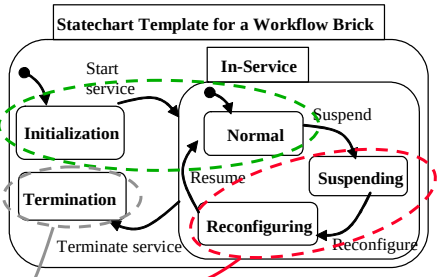
molecular service FOLLOW ME (user User)
invariants user.IESE_Employee == true
precondition user.authentification == logged_in
postcondition none;
option Environment Visualization
binding time run time
precondition user.device == desktop ∨ notebook
postcondition none;
option Automatic Log-on
binding time run time
precondition user.rank == director ∨ manager and
RFID bases user location method == available
postcondition user.access == granted ∨ rejected;

molecular service ALLOCATE DEVICE (user User)
inv user.IESE_Employee == true
pre user.authentification == logged_in
post user.device_allocation == success ∨ failure ;
option Attribute based Device Allocation
binding time installation time
pre user.rank == director ∨ manager
post none;

molecular service NOTIFY (sender User, receiver User)
inv sender.IESE_Employee == true
pre sender.authentification == logged_in
receiver.email ≠ null
post none;
option SMS
binding time run time
pre sender.cell_phone_number ≠ null and
sender.message ≠ null and
receiver.cell_phone_number ≠ null
post sender.message == null

Behavioral View – Dynamic Reconfiguration of Workflow Bricks





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Summary

- Feature based identification of molecular services and their quality attributes
- Extension of workflow specifications with pre/post conditions and invariants for dependable service orchestration
- Architectural framework for the systematic integration of multidisciplinary design paradigms: dependability, adaptivity (dynamic variations), and service orientation
- Prototype development to demonstrate the feasibility of proposed approach