Semantic Interfaces for Mobile Services

SIMS is about a novel technology, dubbed semantic interfaces, enabling rapid development, dynamic discovery, and composition of mobile services. Compared to the well known static interfaces currently in use, semantic interfaces also define the dynamic behaviour and the goals of the collaboration across an interface. This enables safety and liveness properties to be checked effectively and to support service discovery and service composition at runtime with compatibility guarantees.

At A Glance: *SIMS*

Semantic Interfaces for Mobile Services

Project Coordinator

Richard Torbjørn Sanders
SINTEF ICT
Tel: +47 73 59 30 06
Fax: +47 73 59 43 02
E-mail: richard.sanders@sintef.no
URL: http://www.ist-sims.org/

Partners: *SINTEF (Norway), Amena (Spain), Appear Networks (Sweden), Gentleware (Germany), Gintel (Norway), Norwegian University of Science and Technology (Norway), Warszawa University of Technology (Poland)*

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Further Information

- **IST Research: *Software and Services***
  DG Information Society & Media
  Unit D3
  Tel: *+32 2 296 89 57*
  Fax: *+32 2 296 70 18*
  infso-st@cec.eu.int
  www.cordis.lu/ist/st
- **Europe's Information Society: Thematic Portal:**
  http://europa.eu.int/information_society/

SIMS vision

Picture a handful of people, each with a different mobile device, sharing a common interest or a common task, joined together in an ad-hoc manner. Imagine their devices determine the ways for these people to interact and communicate, based on service capabilities of the devices. Imagine that the devices present service features to each person depending on service goal capabilities, e.g. inform them they can invoke conference calls, send messages, or chat. Imagine that they can learn services from each other, such that if one device has a service capability the other peers lack, e.g. a shared media streaming service, that the latter devices can discover this. Furthermore, if desirable, the devices can download compatible complementary service components to support the new service opportunity. All the users need do is to invoke the services they desire.

Imagine that all this is possible despite the fact that the devices are different, and use different networks with different network operator and different service providers. Imagine that compatible service components for different terminals and networks can easily by made by small innovative companies, based on open source service specifications shared by all service providers.

This is what SIMS seeks to make possible.

Main objectives

SIMS will provide tools for design and validation of service components with semantic interfaces. SIMS will provide middleware that enables discovery and validation of service opportunities between peers in ad-hoc interactions, and efficient deployment of service components through runtime composition of applications from service components.

By making it possible to discover service component interoperability at runtime, SIMS will enable a new model for rapid deployment and delivery of reliable services.

SIMS is based on recent basic research within modelling and validation of teleservices exploiting semantic interfaces and service ontologies. The core idea of SIMS is that semantic interfaces provide new means to specify and design service components and to guarantee compatibility in static and dynamic component compositions. They enable scalable service discovery, selection and composition mechanisms at runtime. Semantic interfaces are instrumental to a rapid and goal driven development process.

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Technical Approach

The core idea of SIMS is that semantic interfaces provide means to discover, compare, and enhance collaborative capabilities at runtime, so that joint service opportunities can be detected and service goals achieved. The enhancement can entail component composition at runtime, so that peer devices can achieve desired service goals when they collaborate.

Many approaches provide partial solutions, such as JINI, Web Services and recently the Service Oriented Computing (SOC) paradigm. All of these are based on *static interface descriptions* of service components. However, the interfaces of collaborating service components must also define interaction behaviour, i.e. the specific order in which feature initiatives can be taken or accepted. This is necessary so that the basic safety and liveness properties of the collaborating components can be validated. This is identified as an open and important research problem, since convergent mobile services will combine aspects of both teleservices and information services. The concept of semantic interface seems to be a promising solution to this problem.

A semantic interface defines the goals and the interface behaviour of a service component in a collaboration. The goals of a component are described in Object Constraint Language (OCL). The interface behaviour of a service component is expressed by interface state machines. These are captured in the Unified Modelling Language (UML) at design time. A service feature is a structure of semantic interfaces defining service roles that components play.

Key Issues

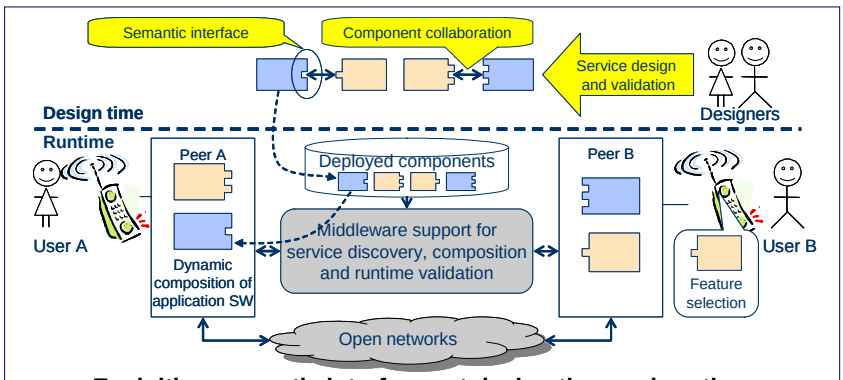
Application composition at runtime accompanied by validation of semantic interfaces means that new service opportunities can arise, while ensuring interoperability between the composed service components. New service opportunities can arise between peers that interact in an ad-hoc fashion; this kind of "automated learning" can support efficient propagation of services.

Existing techniques for service discovery will be extended with runtime discovery of compatible semantic interfaces, and be used to evaluate service opportunities between ad-hoc peers.

Only valid service opportunities will be presented to the end user as available service features. In addition to service opportunities available due to installed service components, service discovery can determine service opportunities by comparing the goals of peers, and support compositions of components to achieve new service goals, with or without end user involvement. Only compatible service components will be used in compositions; validation of this is performed at both design time and runtime. Seen from the end-user, SIMS provides updated services that interact reliably.

The design tool components developed in SIMS will complement existing tools based on the standard Unified Modeling Language (UML), thus enhancing and extending best practice methods and tools for the design of mobile services.

SIMS middleware will extend a state-of-the-art mobile middleware platform, and define a reference architecture that is platform independent. The middleware will support a variety of devices like smart-phones and PDAs.



Exploiting semantic interfaces at design time and runtime

Expected Impact

Service designers will have access to methods, languages and tools supporting a seamless design flow from specification to implementation of service components. This enables them to:

- quickly enhance existing services according to new requirements and new technology;
- validate the impact of changes with respect to behaviour compatibility;
- design software components that are proven to fulfil their behavioural requirements.

Service providers will have access to middleware supporting runtime composition of end user applications from the "latest and greatest" service components. This will enable them to efficiently roll out new services.

End users will have access to new, advanced services on their mobile devices as soon as they are made available. They will experience that they acquire and are presented new service features seamlessly and automatically, with no loss of quality of existing services.