Overview

The evolution of instant messaging (IM) applications provides a valuable insight into the challenges and solutions to interoperability between today's communicating applications. Indeed, the number of IM users is continuously growing -- from around 1.2 billion in 2011 to a predicted 1.6 billion in 2014 (Instant Messaging Market, 2010-2014) -- with an emphasis on mobility -- 11\% of IM desktop and 18\% of smartphones have instant messaging application installed -- and the scope of IM providers is expanding to include social networking such as Facebook that embeds native IM services onto their Web site. Consequently, different versions and competing standards continue to emerge. Although this situation may be frustrating from a user perspective, it seems unlikely to change. Therefore, many solutions that aggregate the disparate systems have been proposed.
These solutions include those based on state-of-the-art approaches to interoperability in distributed systems such as direct bridges, Enterprise Service Buses (ESBs), interoperability platforms, and transparent interoperability approaches. However, these solutions require a substantial development effort, which makes them impractical in the long term as new versions and standards will keep emerging. Achieving interoperability between applications from multiple providers can be a complex and daunting task, especially when integrating legacy systems.Neither developers nor users should be burdened with the task of translation between heterogeneous applications: an automated solution is required. Therefore, a significant challenge is to support interoperability between heterogeneous applications *at runtime* in an *aut omated*
manner.

Mediators perform the necessary translation of the application protocols at runtime based on the semantic compatibility of the data and functions specified using a domain-specific ontology, e.g., an IM ontology to overcome syntactic and semantic disparities of IM messages. Specifically, our work is threefold:

- **Formal modeling of interaction protocols.** We introduce an ontology-based process algebra, Ontology-based Finite State Processes (OFSP), to describe the observable behavior of applications by defining the semantics of the data they exchange and the protocol according to which these data are coordinated. The rationale behind a formal specification are: (i) to make intuitive notions such as 'achieving useful communication' and 'protocol incompatibility' precise and rigorous, (ii) to manage the inherent complexity of concurrent communicating systems; because it involves multiple protocols, mediation is likely to be even more complex, and (iii) to allow the automated analysis of the observable behavior of applications as stressed below.

- **Automated generation of mediators to support interoperability between heterogeneous applications.** Building upon OFSP, we propose an ontology-based

model-checking approach to analyze the observable behavior of applications having compatible functionalities but communicating through different protocols in order to infer the required mediation that has to be performed to allow them to interact successfuly. The output of this analysis is the abstract specification of the mediator.

- **Framework for automated mediation.** We provide a framework that concretizes the synthesized abstract mediator and deploys it in order to translate and coordinate automatically the messages of mediated protocols.

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- IST CONNECT -- ICT FP7 FET IP - Emergent Connectors for Eternal Software Intensive Networked Systems

Related Research Project

- Dynamic Synthesis of Connectors

Downloads

- Demo video
- IM Ontology
- OLTSA: Ontology-based Labeled Transition System Analyzer
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