Dynamic adaptation of middleware-layer protocols for emergent mobile systems

Résumé du projet de recherche (Langue 1)

Given the prevalence of mobile networking environments and systems (e.g., smartphone applications), physical-world sensing and actuation devices (e.g., embedded in handhelds and wearables), and IT systems hosted on global networking and computing infrastructures (e.g., the Internet, the cloud), the possibilities of emergent mobile systems are now vast. Such systems are dynamically composed according to networked resources in the environment, both local and global. Emergent mobile systems integrate system domains – enumerated above – that differ significantly in terms of interaction paradigms, communication protocols, and data representation models, provided by supporting middleware platforms. Specifically considering interaction paradigms, the client/server, publish/subscribe, tuple space, and data streaming paradigms are among the most widely employed ones today, with numerous related middleware platforms. Hence, enabling emergent mobile systems calls for advanced interoperability solutions at the middleware layer. State-of-the-art interoperability efforts are based on bridging communication protocols, wrapping systems behind standard technology interfaces, and/or providing common API abstractions. However, these efforts poorly address cross-domain interoperability, with integration solutions that: (i) lack precise comprehension of constituent systems’ interaction semantics versus end-to-end semantics of the integration; (ii) are typically static, which makes them inapplicable to emergent mobile systems; and (iii) do not offer Quality of Service (QoS) guarantees for the end-to-end integration.

In the MiMove team, we have been working on interoperability solutions for emergent mobile systems. We model and analyze formally the interaction semantics of middleware protocols and paradigms by relying on the connector abstraction from the software architecture field. This enables developing solutions to the composition of middleware protocols. Regarding QoS, we develop modeling and analyses of end-to-end properties of the interconnected systems. While we have focused so far on design-time analysis, our objective is to investigate in our next step runtime analysis. In the above context, this thesis will aim at enabling runtime-adaptive middleware connectors for emergent mobile systems.