Chapter 5

A Cloud Broker for Service Adaptation Based on Interface Localization

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ABSTRACT

The aim of the Cloud “as-a-service” concept is provisioning of software services to facilitate access to resources to a range of different users in different locations. Service adaptation through localization in this context can facilitate the internationalization and localization of services by allowing their adaption to different locales. Three localization dimensions are investigated: (1) lingual localization by providing service-level language translation techniques to adopt services to different languages; (2) regulatory localization by providing standards-based mappings to achieve regulatory compliance with regionally varying laws, standards, and regulations; and (3) social localization by taking into account preferences and customs for individuals and the groups or communities in which they participate. The objective is to support and implement an explicit modelling of aspects that are relevant to localization and runtime support consisting of tools and middleware services to automating the deployment based on models of locales, driven by the two localization dimensions.

INTRODUCTION

Software services, particularly in the cloud computing context, can support users on a global scale (Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I., & Zaharia, M., 2009; Buyya, Broberg, & Goscinski, 2011). In economically tightly integrated regions like Europe, where a multitude of languages are spoken, services are often only deployed to support a single language or region (EU Commission, 2010). Often, smaller organisations do not have the capacity or capability to do multi-lingual and multi-regional development. Localisation
is the process of adapting digital resources like services and associated data and content to a locale, i.e. the lingual, regulatory and social environment (restrictions, rules, settings) of a location or region. With the emergence of Web and cloud services and a trend towards end-to-end personalisation of service offerings (451 Group, 2010), the need to address this wider understanding of locale and localisation in a dynamic service context is evident.

Cloud Service Brokerage (CSB) is a mediation approach between users and providers of services. Brokers can integrate services offerings or adapt these to the specific needs of users. This adaptation can be in the form of functionality adaptation, e.g., selecting relevant features only. However, interface-level adaptation is another option that will be address here. The aim is to localise interfaces, i.e., adapt these to different locales.

The objectives of service localisation are, firstly, to introduce service-based localisation techniques that localise software and the interaction at the service interface level, and, secondly, provide localisation techniques at runtime for dynamic service localisation and end-to-end personalisation as an adaptation technique. As there are only a very few related works, the focus here is on defining a conceptual information model as the backbone of a wider localisation solution (Pahl & Collins, 2015). Based on this, further challenges will be outlined and possible architectural solutions for this cloud service brokerage (CSB) presented context (Pahl & Jamshidi, 2015; Pahl, C., Jamshidi, P., & Zimmermann, O., 2018). A significant part here is dedicated to illustrating service localisation as a new concept.

In the literature, localisation often refers to either languages or physical locations only. Three different locale dimensions are the focus of our investigation that embrace these and widen the concepts of localisation and locale for services:

- **Lingual Localisation**: By enabling service-level language translation techniques to adopt services (including API, description, models) to different languages,
- **Regulatory Localisation**: By realising standards-based mappings to achieve regulatory compliance with laws and regulations that might vary regionally (business rules, standardised name/value mappings, currencies and units, and legal governance/compliance rules in relation to different locations or regions),
- **Social Localisation**: By considering preferences and customs for individuals and groups or communities in which they participate (preferred media, forms of interaction and communication).

These localisation features are embedded into an adaptation broker architecture (Elango, D.M., Fowley, F., & Pahl, C., 2017; Elango, D.M., Fowley, F., & Pahl, C., 2018) that suits the needs of a cloud service broker.

Progress beyond the state-of-the-art in *service adaptation* with respect to the following aspects is aimed at:

- **Localisation at the Service Interface (API) Level**: Classical concepts of software localisation will be repurposed to address internationalisation at the interface level. Model-driven development including model-based mapping and translation are the techniques to develop a coherent and integrated solution across the locale dimensions here. The challenge is to define a semantic model integrating heterogeneous translation, mapping and adaptation needs within one dynamically processable format.