Software Service Adaptation Based on Interface Localisation

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ABSTRACT

The aim of Web services is the provision of software services to a range of different users in different locations. Service localisation in this context can facilitate the internationalisation and localisation of services by allowing their adaption to different locales. The authors investigate three dimensions: (i) lingual localisation by providing service-level language translation techniques to adopt services to different languages, (ii) regulatory localisation by providing standards-based mappings to achieve regulatory compliance with regionally varying laws, standards and regulations, and (iii) social localisation 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 localisation and runtime support consisting of tools and middleware services to automating the deployment based on models of locales, driven by the two localisation dimensions. The authors focus here on an ontology-based conceptual information model that integrates locale specification into service architectures in a coherent way.

Keywords: Governance, Language, Service Internationalisation, Service Localisation, Social Localisation, Web Services

INTRODUCTION

Web-based software services, particularly in the internet of services or cloud computing context, can support users on a global scale (Armbrust et al., 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.

The objectives of service localisation are, firstly, to introduce service-based localisation techniques that localise software and the interac-
tion 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 is very few related work, we focus here on defining a conceptual information model as the backbone of a wider localisation solution. Based on this, we outline further challenges and possible architectural solutions for this context. 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).

Progress beyond the state-of-the-art 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.
- **Adaptation and Integration:** Software adaptation at service-level can be considerably improved by integrating linguistic and regulatory dimensions. This is a significant new direction as the current adaptation concern is on functional and software quality aspects, which are software-technical in nature.
- **Semantics-Enhanced Brokering and Mediation:** The matching of services is equally improved to encompass linguistic, regulatory and social aspects included in a locale-centric negotiation process and infrastructure, which requires respective coordination processes.

We motivate service localisation in the next section. The following section introduces a conceptual information model and a supporting architecture. Then, we define the localisation techniques, before looking at their implementation in the form of locale-specific process adaptation. We evaluate our solution and discuss future challenges. Finally, we end with a discussion of related work and some conclusions.

**LOCALISATION-BASED SOFTWARE SERVICE ADAPTATION**

The Internet of Services and Cloud Computing are two current technology trends expected to greatly impact the use of software online (Fingar, 2009). The focus here is a platform for software service localisation that makes a step from one-size-fits-all services towards end-to-end personalised service offerings based on different locales. Current service computing for international settings has limitations for localisation and adaptability for multiple but different users (Mietzner et al., 2009; Wang,
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