iService: Human Computation through Semantic Web Services

Maria Maleshkova, Srdjan Komazec, Bostjan Grasic, and Ronald Denaux

maleshkova@aifb.uni-karlsruhe.de
srdjan.komazec@sti2.at
bostjan.grasic@uni-mb.si
rdenaux@comp.leeds.ac.uk

Abstract. This paper presents iService, a platform which addresses the inferiority of computing technology in certain problem domains (like identifying objects in photos or videos or researching data details), by enabling a simple, scalable and on-demand access to human intelligence in the form of Semantic Web Services by using the Web as a platform and common mobile devices as user interface.

1 Introduction

Despite the continuous improvement in computing technologies, there are still some activities which cannot be effectively completed by a software component. This results in the necessity of enabling ways for more convenient provision of the human computation – especially in the envisioned Web of services.

Amazon's Mechanical Turk[1] makes some initial progress in the area of providing human intelligence services by means of a platform for trading Human Intelligence Tasks. Gentry et al [1] suggest a framework and architecture to provide secure distributed human computation. However, these platforms do not take advantage of important factors such as human mobility, ease of use and the potential of using semantic information. In order to tackle this issues, this paper presents iService, a platform that provides access to human intelligence in the form of semantic Web services. By combining commoditized mobile devices connected to Internet with state-of-the-art Semantic Web technologies (where semantic plays a crucial role in taming the complexities of the Web of services), iService provides a powerful platform, which enables high quality, on-demand workforce.

iService addresses *service providers* by offering a simple user interface on a mobile device. Internet enabled mobile devices allow people to complete simple and short tasks that require human intelligence, while traveling to work or waiting for an appointment. In this way, service providers get rewarded for their spare time. *Service consumers* benefit from iService due to lower employee cost and on-demand workforce. In addition, the quality of work is ensured because only work with acceptable quality is paid for. An additional advantage is that

[1] http://www.mturk.com

the same task can be given to multiple service providers, so that the results can be compared and even reviewed as an additional service (see [2] for a study on data quality when using human reviewers on a internet scale).

The iService platform represents a successful implementation of the Semantically-enabled Service Oriented Architecture[3] relying on the Web Service Modeling Ontology (WSMO)[4] as the prime modeling paradigm.

2 Architecture and Use Case

As presented in Figure 1 the iService architecture comprises three components.

iService Provider Client: enables service providers to access the iService environment. By leveraging on ontology-driven GUIs, users can provide formal descriptions of their capabilities stored in the broker's repository. Personalized services are created and bound to the provider's component so that the broker can push work items to a selected user and retrieve results. The services are specified in WSMO, which is directly generated from the user input.

iService Broker: characterized by strong component decoupling and goal-driven usage, the platform realizes dynamic discovery, selection, composition, mediation and invocation of human provided services where semantic service descriptions play a major role. The services are described in the terms of ontologies originating from the SEEMP[2] project.

iService Consumer Client: provides for a lightweight iService consumer environment, enabling potential customers to formally express the requirements and raw data to be processed. The requirements are automatically transalted to WSMO Goals that the broker needs to satisfy.

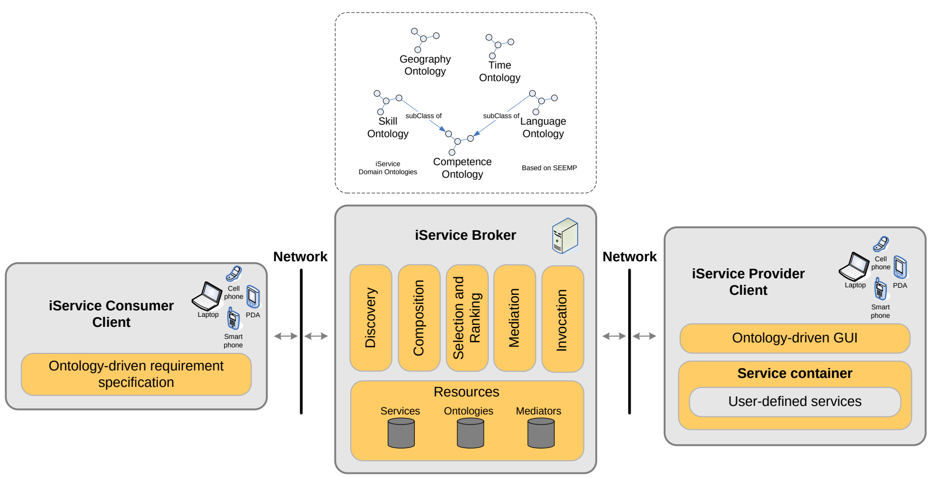

Fig. 1. iService Architecture

[2] http://www.seemp.org

2.1 Use Case

To illustrate how the architectural elements fit together we explain the functionality of iService by a web page translation use case. In this use case, there are two types of users involved:

– a *web page developer* is the service consumer, who wants to have a validated translation of his web page. After an initial user registration step, the user specifies his requirements through a set of ontology-based dialogs. The result is a generated WSMO Goal definition, submitted to the iService broker.
– *translators and reviewers* act as service providers – they perform and validate the translations. Similarly to service consumers, each service provider has to register and specify his/her capabilities. Based on the registration phase, WSMO service descriptions are created that describe capabilities of individual service providers.

Once the iService broker has the consumers' goal definition, it does smantic service description-aided discovery of capable translators and submits work items to them (multiple translators can translate at the same time in order to finish earlier). At this stage, the consumer's goal has not been fulfilled yet, because the translations have not been validated. The iService broker performs service discovery of capable reviewers and sends them the translated materials. After receiving the reviewed translations, the consumers goal has been met and the iService broker delivers the validated translations to the consumer.

The iService platform can be used in multiple domain-independent scenarios. Several approaches have recently been suggested to use human computation to perform tasks disguised as internet games[5]. Google uses a similar approach in its Google Image Labeler[3]. These approaches could be supported by iService. Furthermore, we have identified several other example domains such as: remote teaching, data collection and processing, performing surveys, virtual product launching and crime solving.

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[3] `http://images.google.com/imagelabeler`