

# An Ontology-based Telephony Service for the Provision of HIV/AIDS Information

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**Abstract**—Convergence of telephony with computer networks has made creation of new and innovative services an imperative for gaining a competitive edge within the communications industry. Hence, there has been a substantial effort in ensuring that created services are deployed in a timely and cost-effective manner. In this paper, we present work in progress exploring the use of ontologies in adding value to the process of service creation. The intention is to create a knowledge-oriented telephony service on iLanga, a converged platform developed at Rhodes University.

**Index Terms**—Convergence, Ontologies, Service creation, Telephony.

## I. INTRODUCTION

OVER the past few years, work has been done in the Department of Computer Science at Rhodes University on the creation of services within a converged platform. Much of this work has involved the use of Asterisk, an open source telephony engine and toolkit that supports both traditional and voice over IP (VoIP) telephony services [1]. In this paper, we report on current research involving service creation on an Asterisk-based platform called iLanga; a system developed at Rhodes University to leverage on the convergence of telephony and data networks [2].

The goal is to create a service that moves beyond the use of traditional database systems for the storage and processing of data. Specifically, the goal is to create a knowledge-driven service built using formal knowledge representation techniques. The proposed service will provide HIV/AIDS information to users via telephony. The importance of choosing such a service is two-fold. Firstly, the service emulates a typical real-life example of a service that could be created on a converged platform such as iLanga without use of knowledge representation techniques. Secondly, the service addresses the problem of HIV/AIDS as a social problem facing the Rhodes University's community whilst creating a synergy with ongoing efforts by the Institution under the Higher Education HIV/AIDS (HEAIDS) Programme to reduce rates of infection and increase better management of the disease.

Dragan *et al.* [3] assert that there cannot be one single technique which is deemed best for the structuring of data in knowledge based systems. However, they believe ontologies

are versatile enough to be used for knowledge management, integration of information resources and databases. Further, they can be used to allow intelligent information retrieval.

The above suggests that ontologies can be used to add value in the creation of converged services. The question is, however, whether their use can help providers in creating services quickly and cost-effectively. The answer to this question will be explored in our ongoing research.

## II. RELATED WORK

As suggested in the previous section, an ontology will be used to represent knowledge for the proposed service. Ontology is defined as “a formal, explicit specification of a shared conceptualisation” [4]. The use of ontologies has been popularised by the Semantic Web. Their use, however, extends to a number of fields in, and related to computing [3]. For example, Lam and Lee [4], suggest that the use of ontologies in the modelling of information resources aids both humans and computers (software agents) to have a shared understanding of the problem domain. This allows searches to be effective.

In our research, making searches effective will aid both the processing and retrieval of data. Thus when a user calls for information, the responses will be within the context of the requested information. The reasons being that the “shared conceptualisation” ensures that:

- the vocabulary for the domain is defined, so that an ontology provides “logical statements that describe what the terms are, how they are related to each other, and how they can or cannot be related to each other” [3].
- a taxonomy (concept hierarchy) is provided.

The taxonomy together with the vocabulary provide a conceptual framework for the retrieval of information [3]. However, according to Dragan *et al.* [3], the main purpose of an ontology is not to serve as a vocabulary and taxonomy, but to serve as a medium for facilitating knowledge sharing and automated knowledge reuse by applications.

This is also important in the context of our research, since the goal is to develop an automated voice-enabled application which will behave like a traditional interactive voice response (IVR) system - albeit with additional features. This will be achieved by leveraging on the work done from past research; in particular the work by King [5] which resulted in the construction of a VoiceXML gateway built over iLanga.

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Figure 1. Service Architecture

The VoiceXML gateway is simply a VoiceXML browser with one of the audio channels interfacing with the public switched telephone network (PSTN) [5]. The VoiceXML gateway comprises of both speech recognition and text-to-speech software. Therefore, using this gateway, telephone users will be able to interact with the built IVR system over iLanga.

### III. SERVICE ARCHITECTURE

Figure 1 depicts the core architecture for the proposed service. Although interactions with iLanga and the ontology knowledge-base have been abstracted, the architecture is representative of how the service will work. An interface that will transparently allow iLanga to interact with the knowledge base is required and will be built during the research activity. This will ensure that user queries are answered as accurately as possible based on the contents of the knowledge base.

The proposed service will operate as follows:

- A user makes a request for information by calling a specified number. The details of processing the call that involve interactions with PSTN, the IVR and the VoiceXML gateway are handled by iLanga.
- The request from iLanga is forwarded to the ontology based back-end for information retrieval.

### IV. RESEARCH STRATEGY

We will develop the service using some of the principles of extreme programming (XP). Specifically, the principle that encourages development based on incremental and constant changes. The process of modelling ontologies implicitly requires constant and incremental changes to ensure shared understanding of concepts within a domain and so, a hybrid methodology that infuses techniques of ontology development and XP will be used.

Using this methodology, we will start by modelling the ontology using structured information from relevant knowledge repositories particularly in the form of websites. Websites to be used will include a website that will be developed (as part of the HEAIDS project) following the content design phase done in collaboration with colleagues in the Department of Education at Rhodes University. Other HIV/AIDS related websites such as UNAIDS [6] and loveLife<sup>1</sup> [7] websites will also be used. Through the use of these websites, terms from the structured information will be obtained and analysed with the intention of filtering out terms with similar meanings.

Available ontologies on diseases, and in particular HIV and AIDS, are intended for communication of specialised

<sup>1</sup>South Africa's national HIV prevention programme designed for the youth

information to healthcare professionals. In order to make it accessible to the layperson, we will model our ontology almost from scratch. As noted by Lam and Lee [4], modelling any ontology from scratch and without an expert in the domain area can be a daunting task, which can be improved by the use of structured information.

In using this information we will follow a process that includes three major phases: coding, instantiation and evaluation of the ontology. The coding and creation of instances of the ontology will involve the use of standard industry tools. The evaluation will, however, rely on the tools used to code the ontology and on proper instrumentation of the service to collect data on the use of the ontology.

### V. OUTCOMES

The key outcome of the research will be a functioning voice-enabled application with an ontology driven knowledge base. This application will act as the core of a service designed to provide HIV/AIDS related information via the telephone. It is hoped that this will further increase access to information about the disease.

### VI. CONCLUSIONS

In this paper, we present the basic idea behind the ongoing research on the use of ontologies in service creation. Although our research is in its infancy, we hope that the cited benefits of ontologies demonstrate that knowledge-driven approaches in service creation may provide a viable solution in terms of effort and cost for the developer as well as, accessibility and relevance to the user.

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