

A tool for developing context-aware applications for health systems in data publishing environment

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Abstract

Lariisa is a decision making project for public health systems governance. It integrates patient data from their homes for the construction of intelligent systems capable of supporting the making of decisions in different situations. This project has representation of contextual information to be used by context-aware applications and knowledge representation through the use of ontologies. It has a component named PAOLA, a platform for developing context-aware applications based on ontologies. The new LARIISA's version (Cloud LARIISA) has an architecture that provides for the publication of data in the Web environment, making use of Cloud Computing, Semantic Web and Linked Data. This paper discusses an integration of PAOLA tool in Cloud LARIISA.

Keywords: ontology, knowledge, cloud computing, healthcare management

1. INTRODUCTION

We know that health is one of the most important factors for the development of a society and the systems to manage this area need to be efficient. The Unified Health System (SUS), which is a health systems currently deployed in Brazil, contains the Family Health Program (PSF), which provides care for patients in residence, plus standard of care in health centers and hospitals. For a management consistent with the need to control the PSF, a system is needed to assist the work of several managers in healthcare.

It is in this scenario that arises Lariisa project, which has as main objective to help decision making in governance in healthcare using ontologies for knowledge representation. This project uses the concept of context awareness to retrieve the necessary data for analysis and decision making. The creation and maintenance of the project Lariisa is not a trivial task, since developing intelligent systems that use inference is a complex task. We created a tool that assists in the development of applications targeted for Lariisa to PAOLA (A Platform for developing applications based on ontologies for the project LARIISA).

The Lariisa is undergoing changes in its architecture, targeting a differentiated management, focused on publishing data in web environment. For this, you must insert recent concepts that are gaining a lot of space, both in academia and in business environments. Among these concepts are Cloud Computing, Semantic Web and Linked Data.

Cloud computing has been a tendency in many centers of systems development. The idea of inserting and manipulating data in the cloud attracts a huge diversity of users. This is due to the ease of getting information from anywhere and from any device by simply having an internet connection available to the unit. The data that were previously only stored locally on the user's machine, can now also be stored and accessed remotely. Furthermore, it is also possible to use systems that do not require cloud installation in computers or devices on the machine user. The intention is to use services and systems offered by cloud computing providers to facilitate access to information.

With the immense diversity of applications that meet the needs of increasingly demanding users, increases the dependence of intelligent systems. The Semantic Web (also represented as Web 3.0) is an evolution in the definition of Web 2.0 and has the ability to assist devices in understanding the meanings of information covered by users on the internet. The Semantic Web, Software Engineering and Artificial Intelligence, among others, use ontologies to transform information into knowledge. The ontologies are represented by domains (also called entities), the set of characteristics that make up these domains and the relationships and behaviors related to a domain to another.

Since the Linked Data allows you to use the Web to connect related data that previously had no connections. This idea makes Web applications to communicate with each other. For this, it is necessary interfaces and standards common to these applications. One of the most used for these connections is the use of Webservices, which is intended to provide web services standards for well-known, the use of XML.

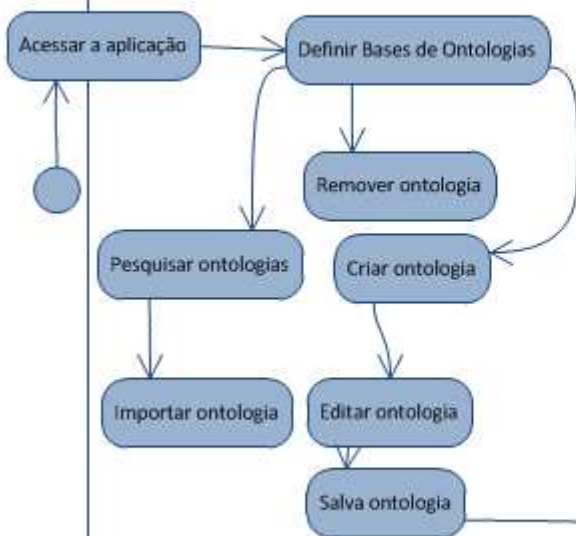
The work in question is intended to investigate the possibility of integrating the tool PAOLA with one of the concepts mentioned above, cloud computing. For this achievement, you need a specialized tool in Xen, which provides aggregation services to a cloud computing environment and virtualization. Xen was chosen because it is an open source platform that uses the Java language, and is quite popular in the academic community and business.

2. LARIISA PROJECT and PAOLA TOOL

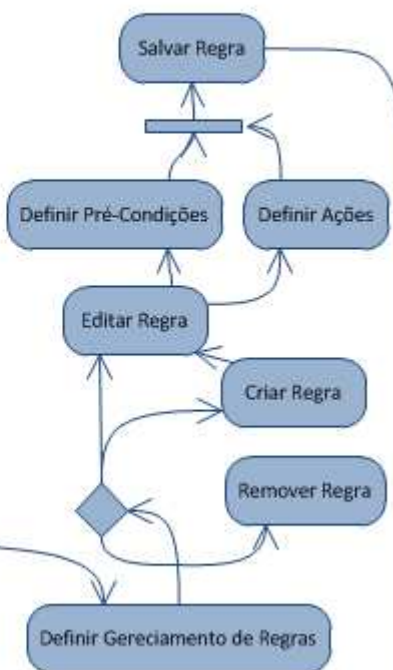
Context-aware applications assist users on decision making. But the development of these applications involves a level of complexity that often complicates the process of creating context-aware systems. This PAOLA proposes an IDE to assist the development of these applications and utilizes a promising modeling method based on contextual ontologies and presents some conclusions.

Lariisa is a decision making project for public health systems governance. It integrates patient data from their homes for the construction of intelligent systems capable of supporting the making of decisions in different situations. The Lariisa project has representation of contextual information to be used by context-aware applications and knowledge representation through the use of ontologies. The application development in the Lariisa project is complex because it involves the knowledge representation (information gathered from diverse actors in the system, represented domain, diverse related data bases, among others) and the gathering of contextual information through hardware mechanisms that feed the existing inference mechanisms. The lack of mechanisms that support the development of these applications makes it difficult to use the Lariisa project in satisfying its objectives, resulting in ad-hoc solutions with specific scopes that take longer and cost more. This dissertation presents PAOLA (Platform for Lariisa Ontological Applications). It is a mechanism that facilitates the application development in the Lariisa project, taking into consideration their specificities. The Paola platform integrates contextual information originating from Lisa architecture (Lariisa Integration System Architecture) with ontological editors and frameworks based on knowledge (ex.: Protégé-OWL). Because of this, it enables the Lariisa project developer to use functions such as searching (in different data bases), the reuse and the edition of ontologies and the definition of rules for the creation of new applications. Of course the Paola platform offers functions inherent to the Lariisa project necessary to new applications sensitive to context as well as other tools that can help to develop the definition of its applications (ex.: contextual examples) and in development (ex.: templates, tutorial).

Definição de Bases de Conhecimento



Definição de Regras e Ações



Geração de Artefato Executável



Definição de Provedores de Contexto

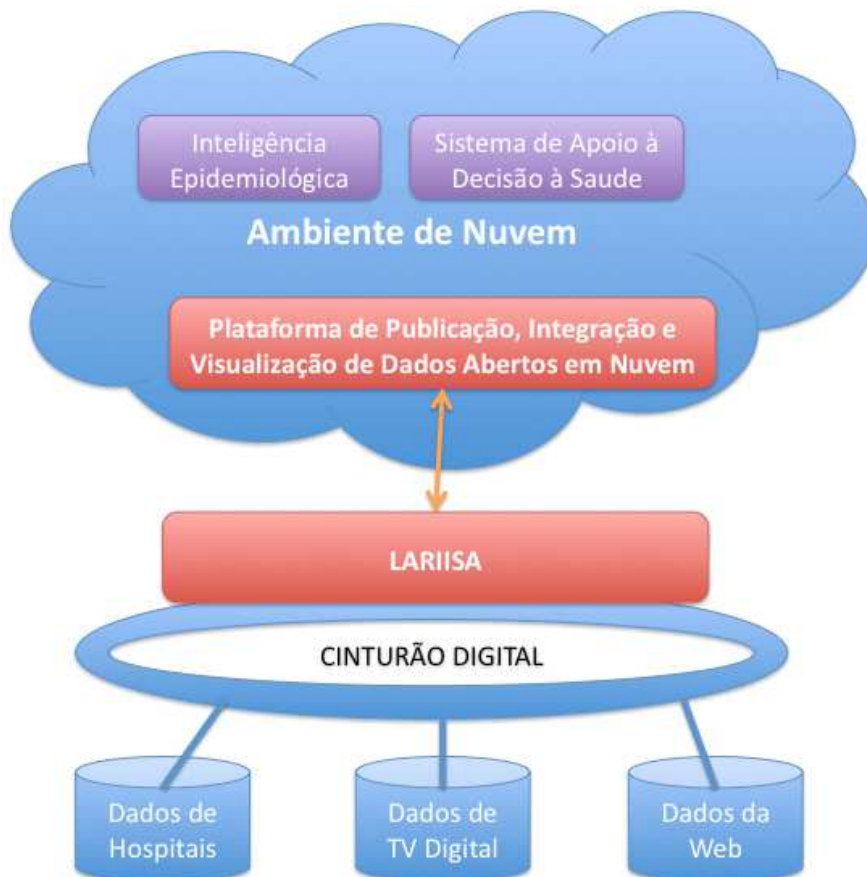


3. CLOUD LARISSA

LARIISA Framework proposed at (OLIVEIRA 2010). Simplified versions of the local and global health context information models for governance decision-making are illustrated in the figures 2 and 3, respectively. The LARIISA defines the basic architecture used for the building of context-awareness applications for governance decision-making in one of the five intelligence domains: Knowledge Management, Normative, Clinical-Epidemiological, Administrative and Shared Management (MONTEIRO 2009).

The main objective of Cloud LARIISA project is to provide a software platform that allows the publication and open data integration related to public health into an environment of cloud computing. This platform will consist in many different services that will provide the necessary functionality to describe, to publish, to discover and to integrate data openly. It is understood by open data the ones which will have their description defined by a common vocabulary stated through domain ontology.

The figure 4 presents the computational model of the Cloud LARIISA. The LARIISA Framework will play a very important function collecting and treating of information related to health, using the digital belt communication infrastructure. The LARIISA will be used as a software platform containing many services oriented to the publishing of open data, which will allow its future integration with data from other data sources. Another objective of this platform is to allow the building of mashup applications, which will be able to make use of others services provide by the platform, particularly services that enable the integration of data from different sources. Additionally, there will be oriented services for data visualization and decision support.



4. MATERIAL AND PURPOSE

There are several tools for developing ontologies, including Protégé, developed at Stanford. It is generally the most used. However, it is the object of investigation in this paper a tool that is able not only to develop ontologies, but take into consideration some aspects intrinsic Larissa such as context awareness.

Within the developments already made in Larissa tools exist that propose the development of applications in its classical architecture. However, this architecture is experiencing today the migration of its concepts to a more modern involving Linked Data, Cloud Computing and the Semantic Web.

In this approach, we define the overall goal of this work is that the specification and implementation of a tool for the development of context-aware applications for systems dedicated to the area of health management in data publishing environment.

The specific objectives of the research were divided into:

- Analyze the tool PAOLA used in the first version of LARIISA;
- Evaluate intelligent platforms for application development decision-making environments in data publication;
- Check the documentation for using Xen API for integration with PAOLA;
- Develop prototype that uses PAOLA integration with Xen

5. CONCLUSIONS

To integrate data in a cloud environment creates many opportunities and challenges. According to the characterization of the earlier proposal, this project addresses the as:

- Which is the percussion of the usage of the cloud computing in the process of data integration?
- How shall be specified a process to publish governmental open data through the framework of the W3C Linked Data?
- How shall be defined the requirements for services for publication and integration of governmental open data in cloud environment?
- How shall be specified a cloud architecture of applications or services for publication and integration of the governmental data?
- How the data bases of governmental applications must be mapped to the data model supported by cloud infrastructure?
- How shall be published governmental data, particularly data relating to healthcare, according to protocol security and access control?

With the integration of the Xen PAOLA tool, developers can encode focused on cloud computing. For Larissa, the tool is already included in the new architecture that aims to publish data in the Web environment with development aimed at facilitating the cloud, spending the funds will be smaller. It also aims to project acceptance. It is also hoped a prototype developed in the proposed model of the new architecture.

As a research project, this work will help the project Larissa taking the form of a new architecture for applications in embedded design to communicate in a more intuitive way, in the context of published data using concepts of Semantic Web and Linked Data Cloud Computing. This work is being carried out in parallel with the validation of the new architecture Larissa. This provides some degree of risk, since the architecture before being validated, is already implementing tools that use this architecture.

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