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Role of Ontology with Multi-Agent System in Cloud Computing

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Abstract

Information technology is playing a major role in revolutionizing how organizations operate, manage, as well as automate their processes. However, most of the systems today are not reusable because there is mixing the knowledge of the society and that of the processes. This is because the knowledge of societies is different from each other applications; hence, it is not reusable. This paper will address how dependent the applications are on societies, and it will separately define the processes of ontology, the knowledge of the agent, ontology of society, and the knowledge of the society [1]. This will be an introduction of ontology-based, process oriented, and an agent system that is independent of society that allows most if not all organizations to make use of it. This is by defining, as well as importing the ontology of the society and some process patterns, which may be instantiated from the ontology of the process into the system. This proposed system can be used on the platform of cloud computing. The evaluation is from two different perspectives: the quality of making use of the cohesion and the coupling measures. Coupling measures entails measuring the degree to which the system will focus on solving a problem in particular. Secondly, it focuses on the applicability, which is determined by evaluating how manageable and automobile the seven processes from three different societies are [2].

Keywords: Semantic Web; Ontology; Multi-Agent System; Cloud Computing.

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1. Introduction

According to WhatIs.com, ontology is the working model of entities and interactions in some particular domain of knowledge or practices such as electronic commerce or "the activity of planning." Simply defined, ontology is the set of concepts, for example, things, relations or even events specified in a particular way such a particular natural language. This is such that an agreed-upon vocabulary that will be used to exchange information is created. A multi-agent system either can be defined as "a computerized system composed of multiple interacting intelligent agents within an environment" or "A loosely coupled network of software agents that interact to solve problems that are beyond the individual capacities or knowledge of each problem solver."Cloud computing is defined as storing and accessing data and programs over the Internet instead of one's computer's hard drive. There are three types of cloud services: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS).

When it comes to cloud computing, security is very important, and it is becoming harder to achieve due to the increasing number of users. The present approaches to have control on the cloud have not scaled well to the requirements of multi-tenancy. This is because of the fact that they are based on the user IDs of individuals at different levels of gratuity [3]. However, the number of users can be large, and this leads to significant overhead in managing the security. In order to provide an environment that provides automatic searching of services, resources ontology is used. There are a number of areas where ontology is used in cloud computing. They include the following:

- Intelligent Ontology-based registries are utilized for dynamic discovery of resources of cloud computing across various platforms in the cloud computing world
- Ontology can be used for the benefit of SaaS to provide intelligent customization
- Role based access control using ontology eases the design of the security system.

2. Inter-cloud directories and exchanges that are ontology based

Directories and exchanges that are inter-cloud based are used usually to provide connectivity and collaboration among different cloud providers. This mechanism has a catalogue for the cloud that makes use of ontology in an effort to automate an environment in which software agents will discover and consume services. When this happens, n2 complexity is reduced resulting in one-many, as well as many-many models [4].

3. Ontology-based cloud computing resource catalogue

Many cloud providers advertise the capabilities of their resources in the cloud-computing catalogue. Hence, management needs careful planning in order to achieve the objectives of the business while avoiding errors. To achieve this, semantic web technologies are implemented in in service registries such as UDDI. Tmodel is a taxonomy that was used in UDDI, and it played the role of a proxy in providing a technical solution outside the registry. However, taxonomy just describes a class/subclass type of relationship while ontology, on the other hand, describes the domain entirely. Ontology aids in providing an accurate description of services using their

abilities to define properties for the class. Hence, the catalogue aids in capturing the computing resources across all clouds in terms of "capabilities," "policies," as well as "structural relationships" [5].

There is a need for a semantic model that is declarative to make, which will capture the requirements, as well as the constraints of the resources of computing. The main reason for this need is to make sure that the provided requirements by the cloud provider who is inter-cloud enabled match with the capabilities of the infrastructure in a schematic fashion, which is automated. The semantic model that is ontology-based makes use of RDF/OWL to show the features, as well capabilities in the infrastructure of the cloud provider. The capabilities captured are usually arranged logically, grouped, displayed as a standardized unit to provision and configure, as well as they are to be consumed by another cloud provider. After this is done, there is association with other policies to make sure that there is compliance to access the resources of the computer [6].

4. Ontology-based intelligent customization framework for SAAS

SaaS that has a multi-tenancy architecture is a model used for software deliveries while the software provider ensures to publish a copy of their software on the Internet in order to support multiple consumers in a cloud environment. MTA will allow more that two tenants to share a software service that has been customized so that each tenant may have their own Graphical User Interface, data, as well as user interaction. The consequence of this is that it may appear to each tenant like they are the only ones using the software. For example, it serves keep what is confidential, but it allows multiple tenants to use the same software [7]. The SaaS provider should be able to have customizations to meet a number of goals. For example, he needs to support the tenants with multiple options and variations with the use of a single code base in such a way that every user is able to have a unique configuration of the software. Additionally, he has to make sure that the configuration he used is simple and easy to meet the needs of the tenant without having to incur extra costs for development or operation. This customization not only relates to functionality, but also to the Quality of Service (QoS). A SaaS that is customizable fully has an architecture that is layered.

5. Case study on clinical trials

Clinical Trials are the main way in which medical research is conducted to investigate new medications, devices and other products for medical purposes. Data collected during these clinical trials is very important to organizations carrying out the study. Hence, there has to be careful collection, handling and storage of data while observing and obeying both national and international regulations. The main way to deal with lingual and domain specific issues is by the use of ontologies. In the medical field, there has been extensive use of taxonomies and ontologies in structuring and organizing knowledge. In order to overcome the problems experienced, an ontology-based data integration system is required. The framework described below should be able to cater to these needs.

6. Proposed framework

The proposed framework will have four layers:

6.1. Data Layer

In a domain, different communities define ontology systems that are of multiple data. The integration of ontology is developed in order to solve heterogeneity issues, and this refers to build a larger and complete ontology at a higher level using an already existing ontology systems. The ontology will be represented as a tree and with a tree key words, which bear similar meaning are assigned the value one. The customization of data layers will be guided using the ontology information. After searching for ontology in a domain, the template is located and customized using ontology information.

6.2. Service layer

Services provided can be categorized into two: simple and composite. An Atomic service is a service that carries out fundamental operations whereas a composite service is one that is comprised of atomic services that are related to carry out complex tasks. Every service operates under terms and conditions, and complicated tasks are achieved through ontology [8].

6.3. Business process Layer

This layer has organized its services, as well as participants, in such a way that they are able to achieve very complex business tasks, workflows, which consist of activities, and represent business processes. Tenants are able to search a workflow repository with the help of keywords and get access to the relevant ones depending on their interests. The process of customization is centred on the business domain knowledge in a workflow that is multi-layered using a series of steps or transformations obtained from template objects [9].

6.4. User interface layer

The user interface ontology can be built in such a way that it provides the concepts, relationships, reasoning and searching for elements that are User Interface related. The ontology should be made to accommodate user interface classification information. The information includes data collection and representation, command and control, monitoring, and finally, hybrid, which is a combination of two or more types. The easiest user interface customization is to change and configure the appearance and the UI available to the users, and this includes adding or even editing and deleting the icons, fonts and other issues [10].

7. Conclusion

The most important characteristic that distinguishes Multi-Agent Systems from the traditional distributed systems is that the MAS system paired with its components is intelligent. As time goes by, Multi-Agent Systems are becoming increasingly popular in solving larger and more complex issues so is the need for technology that is adequate to fit into the MAS paradigm. Additionally, MASs are heterogeneous, and this is influenced by the fact that agent interaction, as well as organization is flexible and complex at the same time. A MAS provides an added advantage of a group of agents. It shows an influential and regular analogy for conceptualizing and outlining numerous programming applications, as will be represented with the security area situation. Likewise,

Multi-Agent Systems encourage the interoperability of heterogeneous frameworks. The objective is to "agentify" the heterogeneous segments, that is, to wrap these segments with an operator layer that empowers them to interoperate with one another by means of a uniform agent communication language.

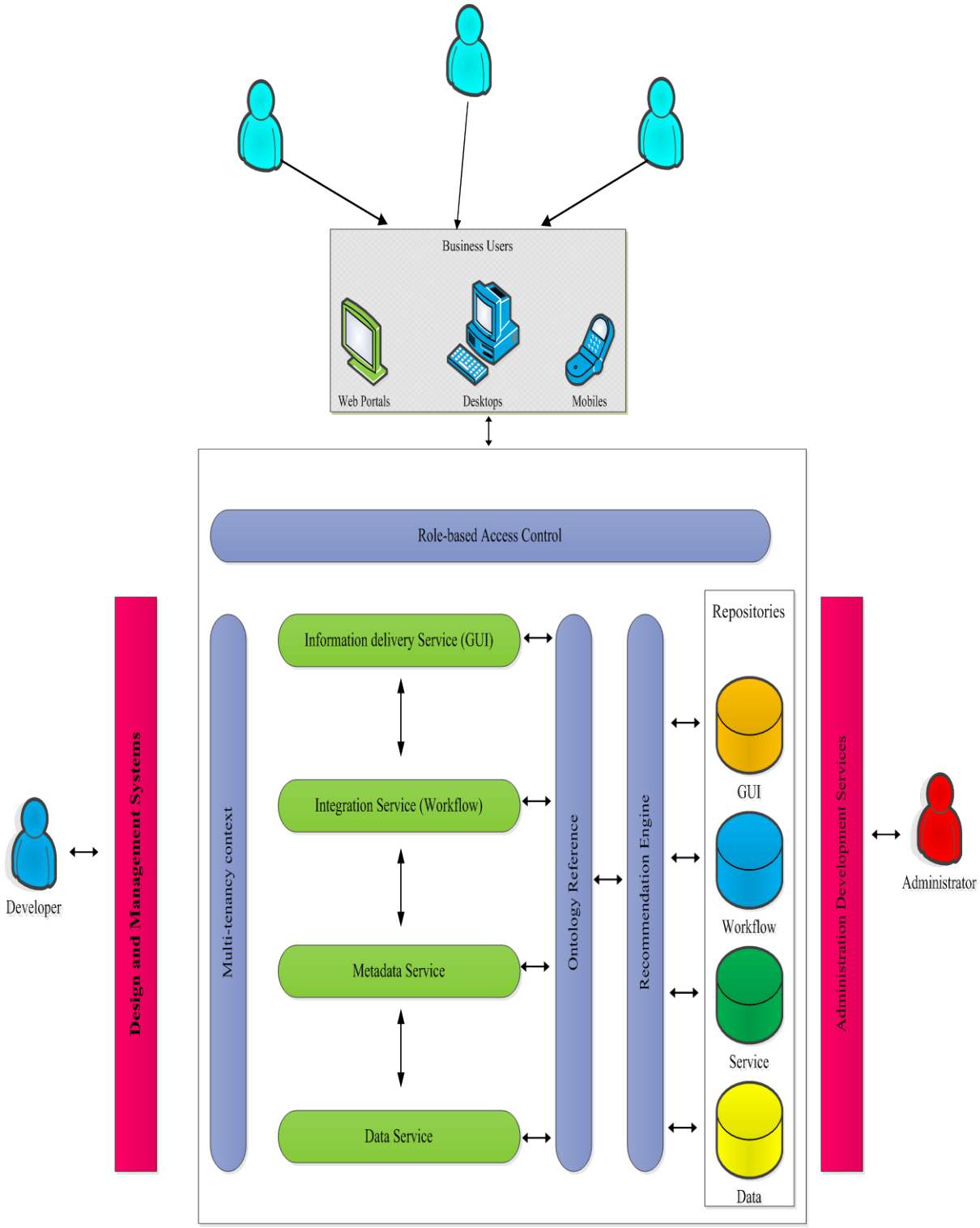

Figure 1: Ontology with Multi-Agent System in Cloud Computing

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