Multi-Agent Based Semantic Web Service Model and Ontological Description for Medical Health Planning

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Abstract- Semantic Web Services (SWS) focus on developing a machine understandable approach where different sub-services or we can say that small services are combined to form a complex web application. It uses various component services to satisfy a client's request which cannot be satisfied by any single available services. Here we try to full fill clients request by using Agents capability and for this we try to develop an agent based SWS composition method with two sets of agents i.e. one for Service Requester and other for Service Provider. The agents in SWS are used as clients, service provider and middle agents. The multi-agent based approach presented is further applied on Medical Health planning domain as an application of semantic web technology. The difficulty to achieve the patients' requirements is a result of availability of large number of consulted doctor on the web and is increasing continuously. This paper presents a model for Semantic web services composition mainly focuses in Medical health planning domain. In this model agents are able to understand the requirement of the patient and interact with him like a human expert. It focuses on how patients request is proceed to provide information at patient location as a composition of different aggregated web services.

Index Terms- Agents, Adviser Agent, Composition, Medical health planning (MHP), Semantic web Services.

I. INTRODUCTION

Semantic web service is the logical extension of current web service in semantic dimension to provide information in well-defined meaning so that machine can understand it and human can work easily in cooperation with system [1]. Semantic Web Services (SWS) provides a machine understandable and common conceptual framework by which we can share different web service resources to meet a particular objective. Semantic Web Services (SWSs) can be defined as self contained, reusable software components. These components are named as agents, that can be used independently to fulfill clients request or combined with other SWSs components to carry a complex aggregation through the process called SWS Composition [2]. Multi agent system contains team of software agents which collectively performing a complex task. We know that a single agent is not capable to perform these complex tasks individually. This paper is based

on the understanding that the SWS can be considered as an agent system, where each component service has the agent capability, implemented as self-contained software component. MAS approach in inspired from the work presented in [3] which present a framework for agent-enabled SWS composition. Later on [2] have also presented multi-agent based composition process. Some other work [4] have also done on SWS composition and Medical health planning domain but some issues that have not been discussed we try to discuss those issues in this paper specifically by focusing on Medical health care planning domain. Semantic exchange has been used in healthcare planning systems using (Resource Description Framework) RDF files to reduce the hard coding in the communication in healthcare systems [5].

The paper has been structured as following: after the introduction section, section 2 provides SWS model for Medical Health Planning (MHP) System, SWS composition model of medical health planning system and its ontological description is provided in section 3, and the conclusion in section 4.

II. MULTI-AGENT BASED SWS MODEL

The proposed model is a frame work for semantic web service (SWS) composition based on multi-agent system (MAS) will be presented and work related to that system will be performed. This work will be based upon the understanding that we can consider a SWS composition system as MAS, in which each of the component system is considered as an agent capability. A multi-agent system consists of a team or organization of software agents, collectively performing a task, which cannot be performed by any individual agent. The proposed composition framework deals with some issues and MHP domain related quality of service parameters in service provider system. Multi-Agent based composition work inspired by agent based semantic web service composition by considering the thought that a single agent will not be capable as much as multi-agents to provide semantic web services. This approach is based on fact that whenever a input request is send by user agent the Adviser agent validate it and decompose it into various simple task than service provider for each individual task is selected. Thus various service provider agents are used to fulfill a single request of user. Figure 1 represents a simple model for input request, its decomposition in various tasks by Adviser agent and selection of service providers.
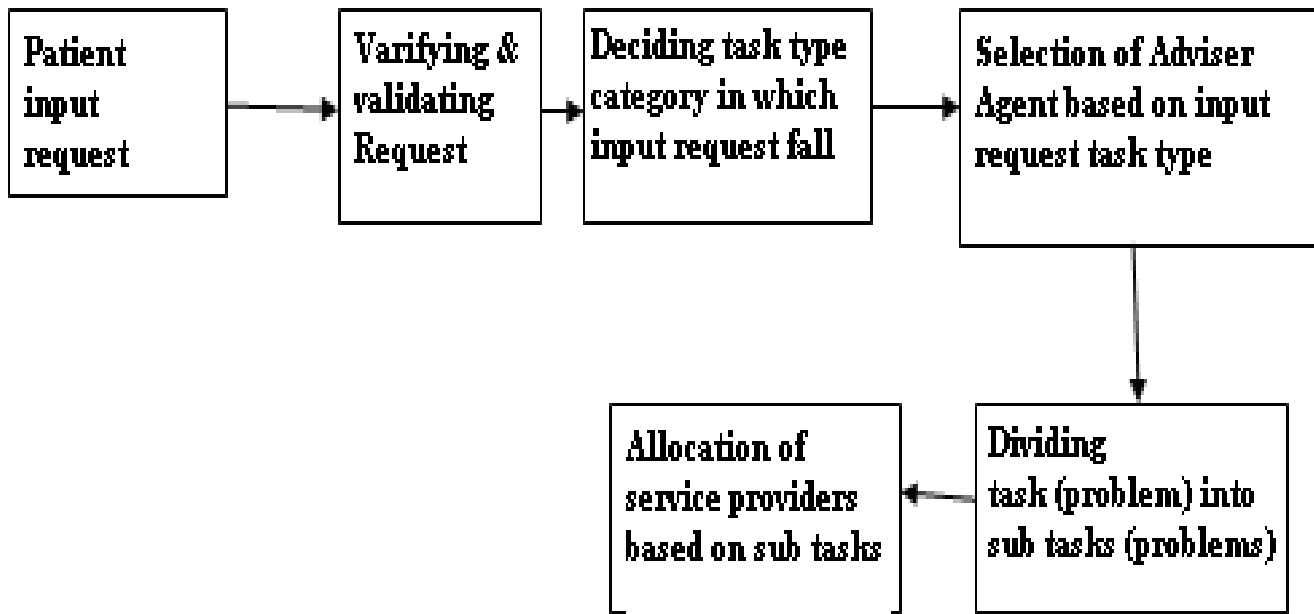
Figure 1: MHP System as SWS

III. MULTI-AGENT BASED SWS COMPOSITION FOR HEALTH CARE PLANNING SYSTEM AND ITS ONTOLOGICAL DESCRIPTION

Health planning is a new problem for semantic web based system. The medical health planning problems are tracking hospital, finding specialists of disease, quality of service, availability timing etc. All these activities can be assigned to different service providers. The profile of all these service agents can be created using semantic web description language like RDF/RDF-S [6], OWL [7] etc. Some of semantic web tools like Protégé [8] [9] provide the support for developing the profile in either RDF/RDF-S or OWL. Here for medical health care planning we use Protégé to develop profile.

Multi-agent based model discussed in section 2 will be applied for medical health care planning in this section. The service calling agent has the responsibility to perform the request to Adviser agent. The request by service calling (requester) agent is the specified in the term of ontology, which is then used by Adviser agent. An intelligent Adviser Agent is a modular, self-contained software component wrapping coordination services, with ontological service description. It has the capability of validating the constraints, preferences and other high level parameters of Service requesters input request.

Adviser agent decompose complex request in various atomic tasks that is complex task into small problem according to their ontology description. After decomposition it evaluates service providers using their cognitive and quality of service parameters. Adviser Agent has the capability to negotiate with both service calling (requester) and service provider to adjust activity input, service caller (requester) performance and constraints, and to obtain matching common input, output, pre-condition and effects in order to satisfy the ultimate request. In health planning domain patient request or say query is decomposed in various sub tasks by Adviser agent according to their ontology description as shown in figure 2. For each separate task (problem) one Service provider is selected. Figure 2 show the agent based composition model for medical health planning. On the basis of input task type category the ontology is then decided.

Different hospitals information is developed in form of RDF-Schema (Resource Description Framework) [10] files which consist of a number of consulted doctors with the *isSpecialistof* property for specialization, *hasHospital* property for hospital name, *hasServiceTime* property for doctor timing. The hospitals have the property of *hascityofservice* and *hasQualityofService.*
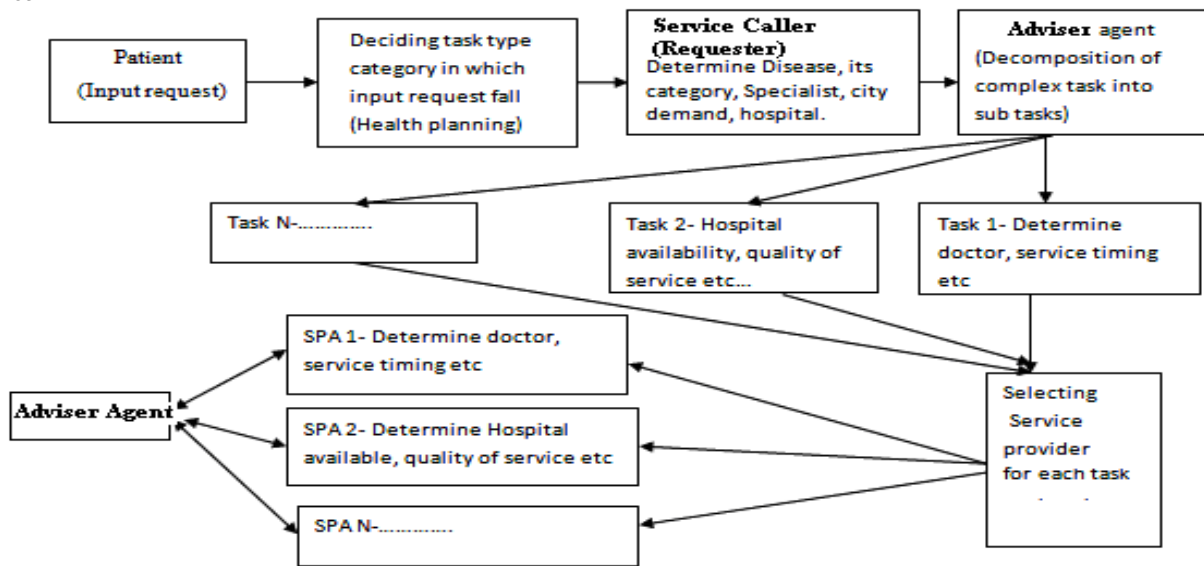
Figure 2: Multi-Agent Based SWS Composition for Medical Health planning system

Figure 3 shows the object properties in which various classes lies for health planning system. Figure 4 shows the class hierarchy for health Planning system and its description. Health planning domain is sub-divided in various classes like disease, disease specialist, hospital, city of service, doctors availability timing, quality of service for hospitals. Figure 5 ontology graph shows the pictorial relation among above mentioned classes. The graph shows how classes are interrelated with each other and characteristics of class like functional, inverse etc.
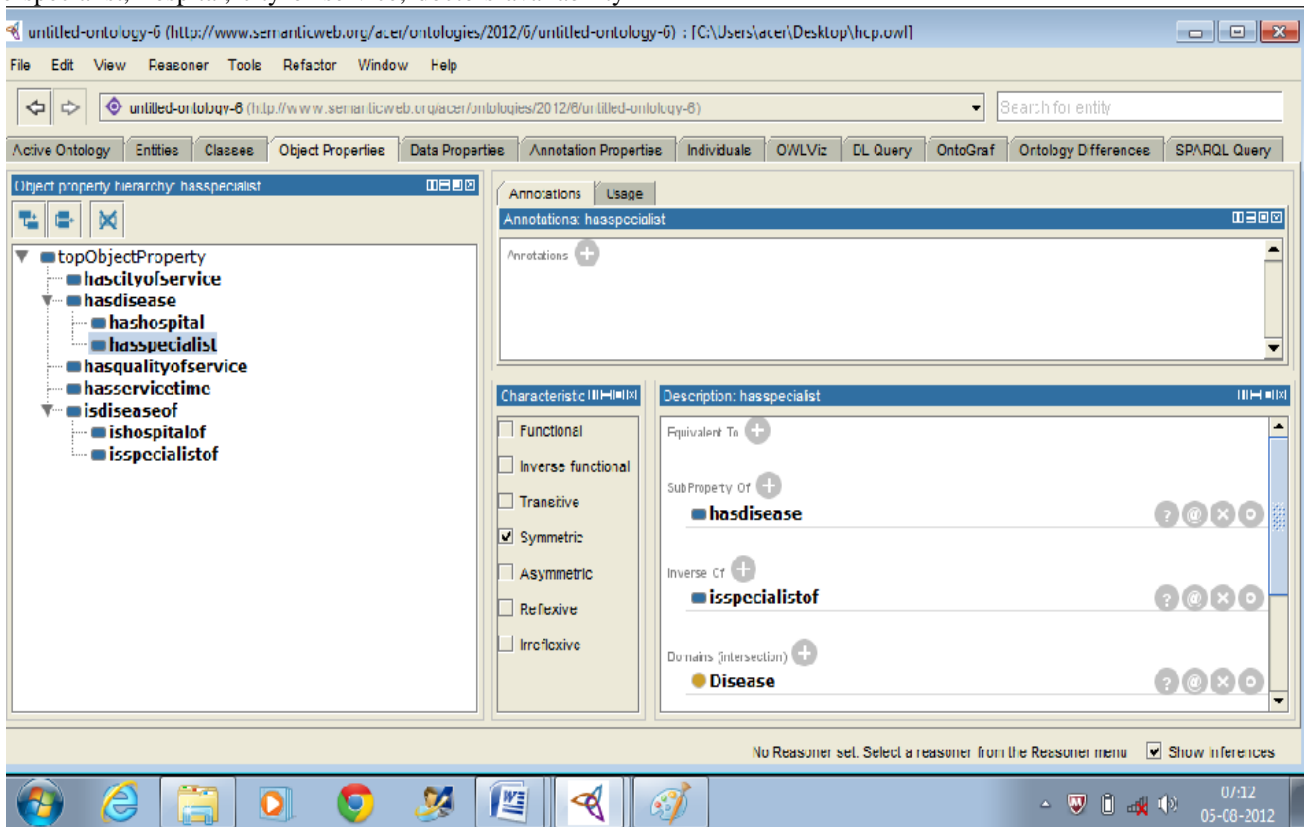

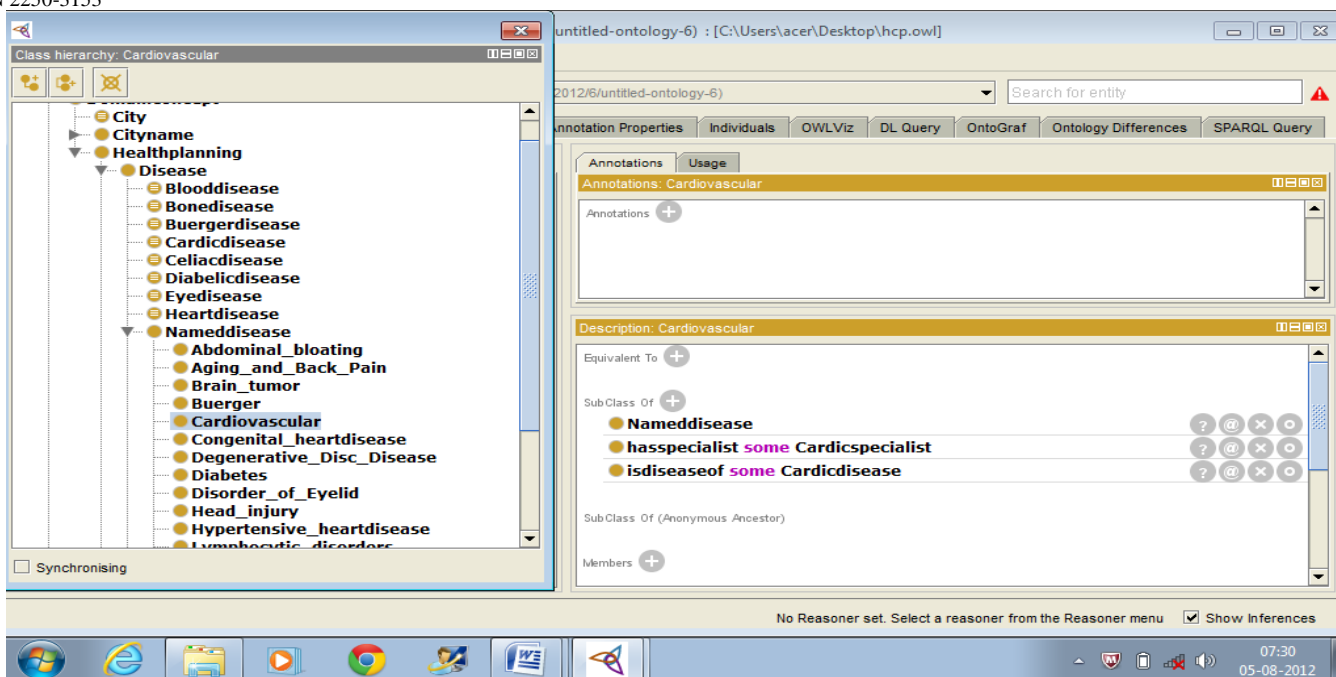**Figure 3: Object Properties in Medical Health planning System**

Figure 4: Class hierarchies and its description in Medical Health planning System
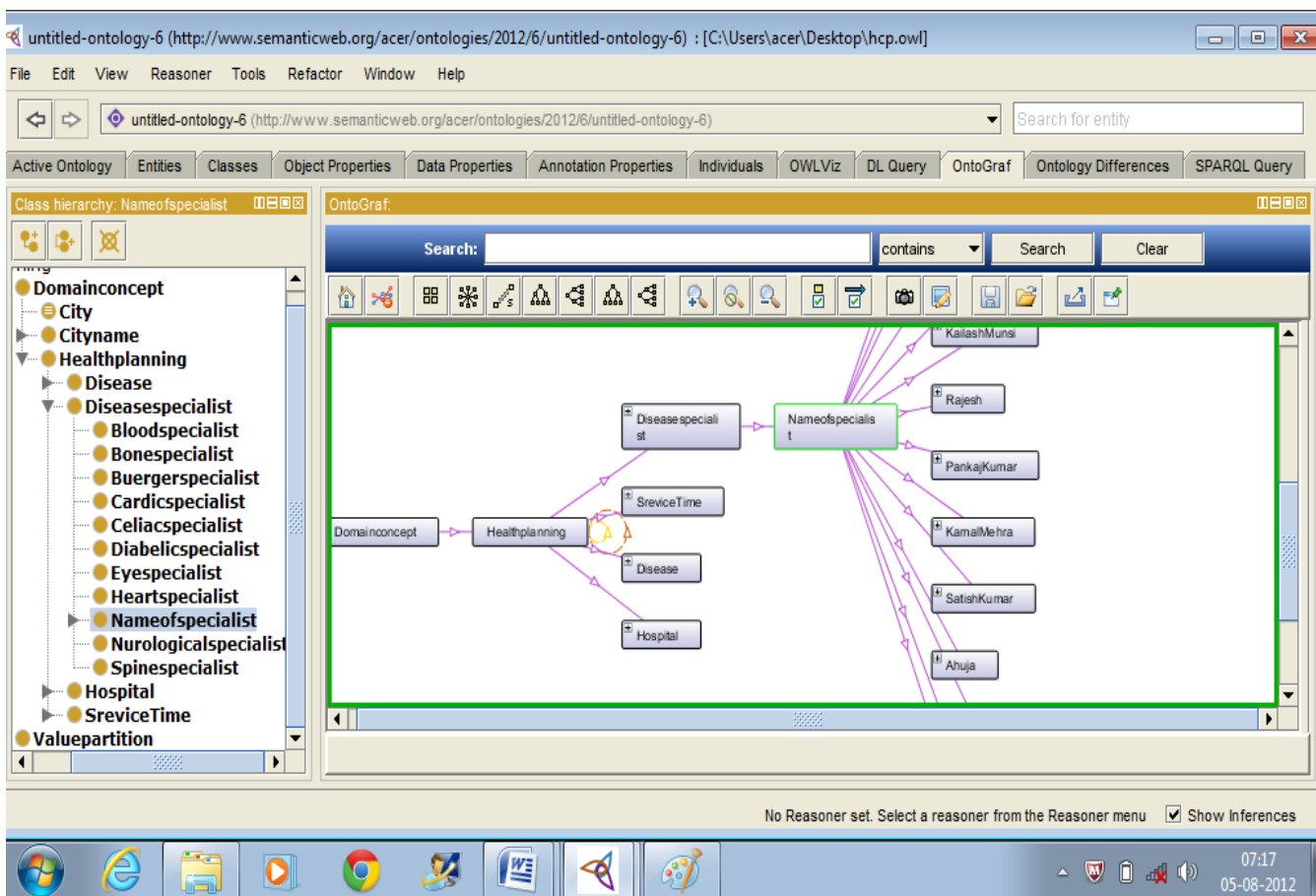

Figure 5: Ontology graph in Medical Health planning System

IV. CONCLUSION

Multi-Agents based model is presented for focusing mainly on medical health care planning domain. Here we utilize the capability of software agents and selecting agents based on task type category to fulfill the request. Web based environments play an important role in Medical Health plan. The difficulty to achieve the patients' requirements is a result of availability of

large number of consulted doctor on the web and is increasing continuously. This paper presents a model for Semantic web services composition and mainly focuses in Medical health planning domain. In this model agents are able to understand the requirement of the patient and interact with him like a human expert. Behind the scene the agents handle the search and retrieval process in different hospital information structures from different places. In future work we will enhance this model to include the more requirements of the patient and variety of consultations as an application of semantic web services composition.

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