

Collaboration of multi agent systems and web service in temperature data collecting process

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Abstract. Web service is one of the emerging technologies later which one example of SOA (Service-Oriented Architecture). Therefore Web Service widely used in cross platform communication applications. In addition, in the retrieval of data on the Web Service generally still using the model of synchronization or request at a certain time. This paper will explain how merging multi agent system will help in data retrieval in Web Service autonomous. The intelligent agent-based software was designed using the Prometheus methodology, and developed through the JADE platform using the Java programming language. Model development focuses on how agents can retrieve data on the Web Service, declare data based on metadata and deliver the results of the data retrieval. The concept applied to the agent in the data retrieval is based on the WSDL (Web Service Definition Language), with the type of data is temperature, humidity that is in many rooms at a certain time. Evaluations were performed on 10, 100 and 200 data obtained from the Web Service and sensors.

1. Introduction

The development of technology, especially on the use of the internet has brought many developments in various sectors, one sector that has a very fast development is IoT (Internet of Things). In IoT the thing that often becomes a lot of attention is on the use of data and communication protocol between machines or commonly called M2M Communication [1]. Due to the difference between one machine with another machine then required a global language that is able to bridge the difference therefore proposed Web Service as the bridge [2]. But in implementing it there are various problems that often occur, one of them is kind of order of Language or which is usually called semantic on Web Service that will be used. Web Service itself consists of many types ranging from SOAP to REST, each of which has different characteristics [3].

Due to the difference between one type of web service with another web service then the process of taking data based on meta tagging was finally become one of its own challenges. In addition, the challenge in developing Web Service is the development and retrieval of data that must be fast [4], because the use of Web Service is usually used for small memory applications [5].

To overcome this then required an intelligent system capable of managing data based on Meta tagging contained on the Web Service. Smart and Autonomous agent system is a technique in computer program that can be utilized in terms of Web Service data retrieval automatically. Agent can be used in assisting the system in taking data based on fields or components that have been made to the database that has been provided, in addition agent can work autonomous and can solve problems quickly in accordance with the needs of the system [6] In order to recognize data retrieval, or what has been learned, how much data can be retrieved [2]. To help the agent system do the data retrieval and map the data, it needs a more optimal development approach, there are many approaches that can be applied in this problem. In taking data JSON-shaped web service using a library that will help the agent in doing the



translation so it will be easy to read by the agent, one of the libraries that will be used is JSONViewer. This research will analyze the utilization of Autonomous Multi Agent System for retrieving data from Web Service that has form of tagging which have been conditioned.

2. Research Method

Web Service is a mechanism that used as a bridge between applications or usually called multiplatform integration. Web services are triggered by a stateless process mechanism, which is executed based on requests from other applications or objects. There are several types of web services that are often used in the world such as SOAP and REST, SOAP is an XML-based data exchange protocol by encoding http headers with XML so that it will produce an output that can be read by other programs, while REST or usually called degan RESTfull is a data exchange mechanism that allows the exchange of data between clients and servers simultaneously without any knowledge of the client about the process, the output REST is often generated is JSON.

JADE (Java Agent Development Framework) is a framework for developing software based on multi-agent systems and intelligent agent applications that comply with FIPA standards. JADE is a software development framework for developing multi-agent systems as stated in [4]. The JADE platform is made up of various containers on a single computer, or may be scattered on a computer network. This container is the place of life for agents. Container provides JADE run-time and all services required for agent placement and execution.

JADE provides a platform service called AMS (Agent Mobility Service) so that it can implement intra-platform mobility. This gives agents the ability to move over two or more container in the same platform. Therefore, JADE supports the development of systems that require mobile agents. An agent can have a specific task called behavior [5]. A behavior will present a task to be performed by an agent. An agent can have more than one behavior and an agent can run more than one behavior at a time. JADE architecture is shown at Figure 1.

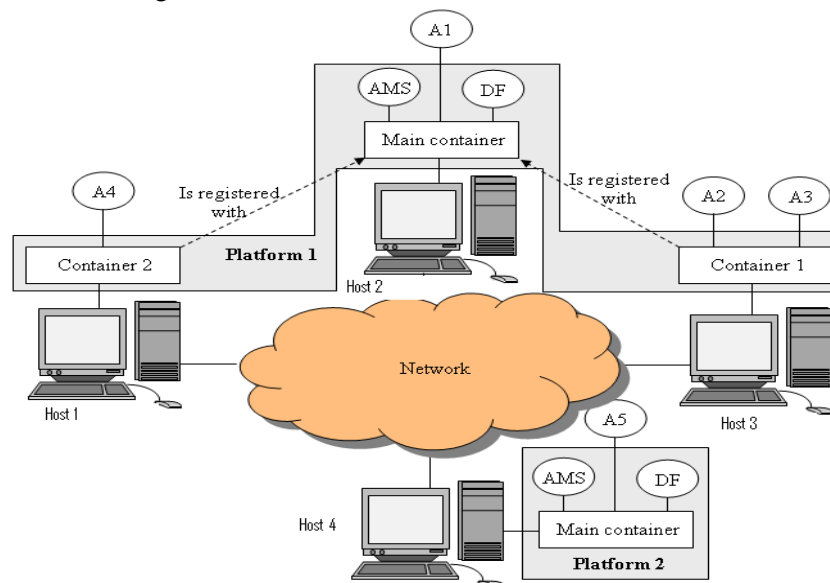


Figure 1. JADE Architecture [4]

Interoperability in a system can be reduced by the presence of a Web Service. Web Services can be used as one of the bridges between one application with another application, both on embeded systems and computer conventional systems [6]. From the results of the analysis that has been done, during this system interoperability is one of the problems that often occur and difficult to overcome. Using Web Service, the interoperability problems can be solved. Data retrieval and data tranmsition will also be more optimal.

Based on the explanation above, to solve the problem, the researcher proposes a system capable on bridging interoperability by combining with autonomous mechanism owned by agent. The system is

used to help overcome interoperability and autonomous delegation of a Web Service with the REST approach, resulting in data retrieval, while the agent itself acts in accordance with the environment created by the user itself [7]. This system works in real time that the system will monitor the activities of the server and will display and perform the mechanism of data parsing from the web server. Data parsing results can later be utilized for many things in accordance with the needs and needs utilization. The agent work system diagram is shown in Figure 2.

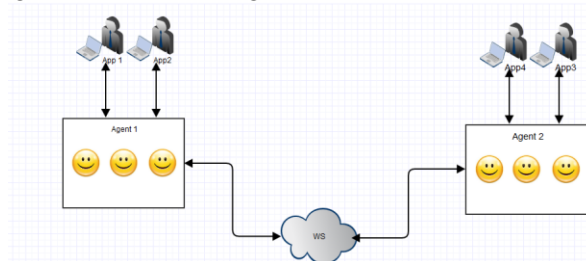


Figure 2. Agent Work System Diagram

Autonomous smart agent is used to solve the problem of how to find out data and parsing data using Agent. The term Agent is well known in many fields, both in the field of informatics and computer science, such as software engineering, artificial intelligence (AI), and distributed systems [8]. As for the proposed method of sending data on the server can be seen in Figure 3.

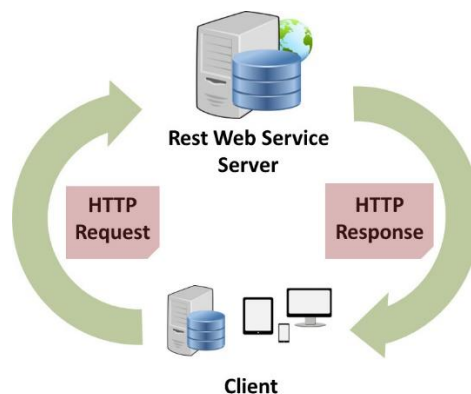


Figure 3. Web Service with REST method

3. Results and Discussion

Modeling an agent system must also do an environmental modeling where the agent will respond. Any changes that occur in the environment will result in changes also to the way of the movement of the agent, the environment used is the activity that occurs in the server environment, in this case the server will be used is a server that will accommodate data from the temperature sensor so it will provide impact on the system Agent. This environment will be modeled into a database that will be updated based on updates that occur on the system that has been made before.

Prior to the process of data retrieval by agents, the first process to do is mapping data. Data to be taken is data stored on the server in the form of humidity temperature data, and other supporting data. Once obtained the data, then the next process is taking metadata in accordance with the metadata that issued by the Web Service as exemplified in Figure 4. After obtained the data then the next process is to process the data retrieval done by agentRetrieval through the mechanism of sending messages by AgentRequester to AgentRetrieval as shown in Figure 5.

After getting the message from agentRequester then agentRetrieval will perform the process of taking metadata generated by Web Service. The generated data will be sent through the mechanism of sending the message with FIPA-ACL to agentRequester. That output will be produced in accordance with the agent needs. After the data obtained then the next process is the process of extraction of information based on metadata. This is obtained by agentRetrieval to be developed into a prediction mechanism for

the temperature needs of a room at a certain time interval. Thus the use of electricity will be more efficient as data resulted. Learning process on multi agent at the time of data retrieval through restful mechanism. The process is done by taking the metadata which will then be done data-solving process. With the structure of the Web Service obtained, then the agent will more easily take the distribution of data and map data based on the distribution of data.

```
{
  - channel: {
    id: 84008,
    name: "Temperature & Humidity",
    description: "Temperature & Humidity of",
    latitude: "50.94498",
    longitude: "-1.425",
    field1: "Temperature",
    field2: "Humidity",
    created_at: "2016-02-03T14:08:38Z",
    updated_at: "2016-12-01T22:22:59Z",
    elevation: "49",
    last_entry_id: 303352
  },
  - feeds: (100) [
    - {
      created_at: "2016-12-01T21:46:10Z",
      entry_id: 303253,
      field1: "21.80",
      field2: "24.40"

    },
    - {
      created_at: "2016-12-01T21:46:33Z",
      entry_id: 303254,
      field1: "21.90",
      field2: "24.50"

    },
  ],
}
```

Figure 4. Web Service example

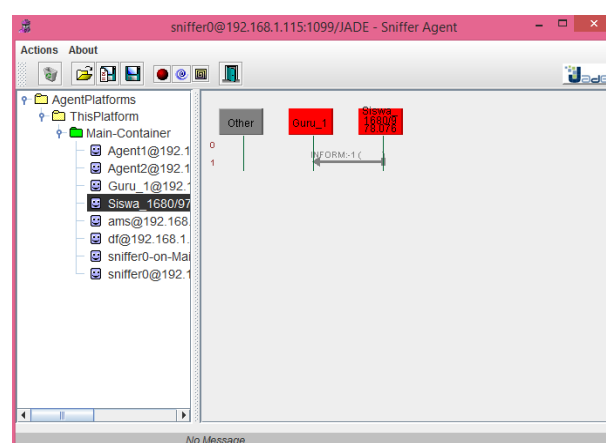


Figure 5. Message passing mechanism

After the process of data retrieval and solving of the data then the next process is to store the clustering results into the database and perform the process of filtering data in accordance with the metadata and characteristics of each data. The results of the filtering data will be sent back through FIPA-ACL to the agent Requester so that Data can be done next process that is predicted temperature at interval time and also certain room. After the message received by AgentRequester, then next is to

display the data retrieval and forecasting process to the data obtained to the next temperature. Delivery questions via ACI Message mechanism is shown in Figure 6.

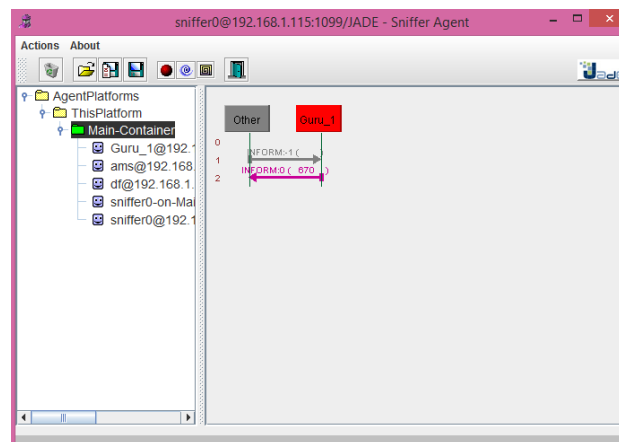


Figure 6. Delivery questions via ACI Message mechanism

4. Conclusion

Based on the architectural model proposed in this research there are two agents that are implemented, namely AgentRequester and AgentRetrieval. Each agent is able to perform tasks in data retrieval and data split in accordance with the given behavior. AgentRequester has successfully retrieved the data through the Web Service and sends it to AgentRetrieval which is tasked with breaking the data using string parser and JSONParser to get the desired data by type and time. By using Multi-agent in data retrieval on Web Service makes data retrieval more flexible, this is because the agent is able to adapt by utilizing data sent by Web Service as object learning from agent.

In addition, agents are able to collaborate with each other so that in subsequent research the results of the retrieval will be used as a basis for forecasting and other research.

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