Intelligent Resources Dispatching System of Urban Emergency Based on SOA and Cloud Computing

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***Abstract*—Quick and efficient resources dispatching is the core of urban emergency processing system. In the traditional urban emergency processing system, there is a problem that resources could not be dispatched in time between all departments. In this paper, an intelligent resources dispatching system of urban emergency based on SOA and cloud computing is proposed to solve the problem. The structure of the intelligent resources dispatching system of urban emergency based on SOA and cloud computing is given and an intelligent resources dispatching component based on SOA is proposed. An algorithm is given to realize services optimization. The intelligent dispatching process of services request and response is discussed. The realization of the system based on cloud computing is also given in the paper.**

Keywords-intelligent resources dispatching; urban emergency; SOA; cloud computing; services optimization

I. INTRODUCTION

In the traditional urban emergency processing system, there is a problem that resources could not be dispatched in time between all departments. Resources dispatching confusion often can have serious consequences. If resources are too much it will cause the waste of resources. If resources are too least it will cause serious consequences. During the process of resources dispatching between all departments, it will always spend much time. It will cause the problem that could not save in time. So it is necessary to get an intelligent coordination resources dispatching system of urban emergency to solve above problems.

In recent years service-oriented architecture (SOA) technology has attracted much attention. SOA is able to share and reuse of existing information of all departments in the form of services. A new organizational process could be rebuilt by services, and a flexible organizational process could be re- structured and optimized, therefore the reaction to agility of the organization is enhanced.

Cloud computing is a kind of calculation form which uses all the server cluster resources on the internet. The resources include hardware and software, such as server, memory, application software and so on. Its computing processing is to send demand information through internet. Then thousands of remote computers will provide resources for you and return the result to the local computer. It makes complex calculation can be realized[1].

On cloud computing platform, a huge number of calculations of services in SOA architecture could be realized. So in this paper an intelligent resources dispatching system of urban emergency based on SOA and cloud computing is proposed to solve the above problems. The structure of the intelligent resources dispatching system of urban emergency based on SOA and cloud computing is given and an intelligent resources dispatching component based on SOA is proposed. An algorithm is given to realize services optimization.The intelligent dispatching process of services request and response is discussed. The realization of the system based on cloud computing is also given in the paper.

II. STRUCTURE OF INTELLIGENT RESOURCES DISPATCHING SYSTEM OF URBAN EMERGENCY

Urban emergency system is consisted of three parts. There are urban emergency early warning system, urban emergency decision and processing system and resources dispatching system. Resources dispatching is the core of urban emergency processing system. In this paper, we propose the intelligent resources dispatching system of urban emergency based on SOA and cloud computing, and give the structure of the system, as figure1.

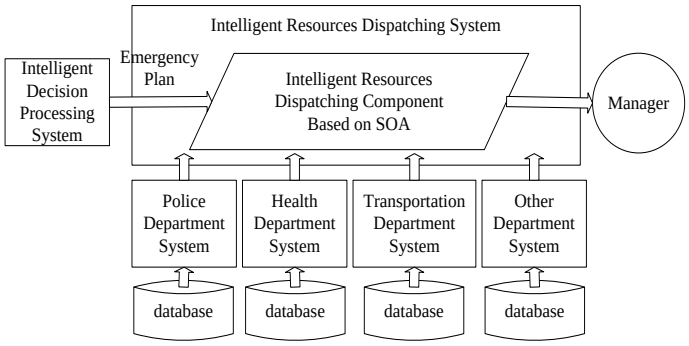

Figure 1. Structure figure of intelligent resources dispatching system of urban emergency

1) Intelligent decision processing system: in this system, we extracted decision rules based on the decision and processing knowledge base and intelligently produced the processing plan for a new emergency, then sent information to managers and resources dispatching system and informed them to process the emergency based on the processing plan informaiton in the emergency plan base.

Higher school science research general project of Liaoning province (L2012491)
Natural science fund plan of Liaoning province (201204796)
Higher school talents support plan of Liaoning province（LR2011037）

2) Emergency plan: Emergency plan is the solution of an emergency. It includes all the resources information needed during the solution process of emergency. We will dispatch all the resources from all the departments according to the emergency plan, as table1.

TABLE 1. An emergency plan table about snowfall emergency processing

plan(NO.)	type	snowplow	snow-dissolving	worker
1	snow	30	250(T)	150
2	snow	20	150(T)	100
3	snow	10	90(T)	70

3) Intelligent resources dispatching componen based on SOA: It is the core of the resources dispatching system. It is consisted of two parts, one is service optimization, the other is service request and response intelligent dispatching, as Figure2. All the services in these system based on SOA are Web services.

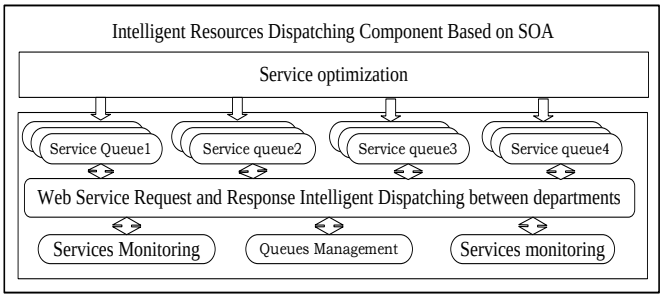

Figure 2. Structure figure of intelligent resources dispatching component based on SOA

4) All the departments: The departments include police, health, transportation and other departments. During the solution process they supply all the resources for manager to dispatch. We need to know the existing quantity of resources from the information system of all the departments and realize intelligent coordination dispatching between departments. On the one hand ensure that sufficient resources on the other hand to prevent waste of resources.

In intelligent resources dispatching component, requests and responses are encapsulated as services. In SOA, we interact with the systems of all the departments by these services. So the intelligent resources dispatching component is the most important part of the intelligent resources dispatching system.

III. INTELLIGENT RESOURCES DISPATCHING COMPONENT BASED ON SOA

In urban emergency system based on SOA, the quantity of services is very large. Before sending services, these services should be organized and optimized.

A. Services Optimization

In SOA, requests and responses are encapsulated as Web services. Web services should be registered in UDDI. There are a large number of services in UDDI. Sometimes many of them are the same, so before processing these services, all the services in UDDI should be organized and optimized.Web s**ervices are defined as follow:**

Definition 1 ([4]). S is a set of Web services. Input is a set of all input parameters of one service. Output is a set of its all output parameters. For any $s \in S$, we have

$$s = \langle Input, Output \rangle$$
$$Input = \{In_1, In_2, \cdots, In_n\}$$
$$Output = \{Out_1, Out_2, \cdots, Out_m\}$$

Definition 2 ([4]). In_i is an input parameter of one service. Out_j is a output parameter of a service. Name means parameter name. Type means the type of parameter. Then the definition of In_i and Out_j as follows:

$$In_i = \langle name, type \rangle$$
$$Out_j = \langle name, type \rangle$$

Proposition. If $Input_1 \subseteq Input_2$ and $Output_1 \supseteq Output_2$, then s_1 is the alternative service of s_2. If $Input_1 = Input_2$ and $Output_1 = Output_2$, then s_1 is the equivalent service of s_2. In above conditions, s_2 could be deleted from S, and keep s_1.

According to Proposition, we delete redundant Web services in UDDI. An algorithm which optimizes Web services is as follow:

Algorithm. An algorithm for services optimization

Input: $S = \{s_1, s_2, \cdots, s_n\}$, the Input and Output of every service s_i.
Output: new S.
1 for i=1 to n do
2 for j=1 to n do
3 if $Input_i \subseteq Input_j$ and $Output_i \supseteq Output_j$ then
4 delete s_j from S.
5 end
6 if $Input_i = Input_j$ and $Output_i = Output_j$ then
7 s_i and s_j keep only one.
8 end
9 end
10 end
11 rerurn new S.

According above algorithm, the efficiency of system could be improved. So service optimization is an important part of intelligent resources dispatching component.

B. Web Services Request and Response Intelligent Dispatching

Now, there are no redundant Web services in UDDI. We will realize intelligent dispatching of Web services.

Business processes in SOA can be encapsulated as reusable components which could be independent of the calculation platform of application program. In the intelligent resources dispatching system of urban emergency, we define the research process of resources as Web services. Through the request and response and dispatching mechanism of web services, we can get the usage of resources from the information systems of all the departments. The resources dispatching process based on SOA is as Figure3.

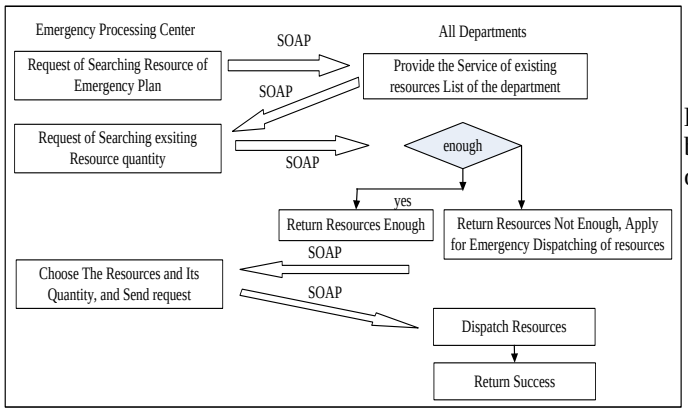

Figure 3. Resources dispatching process based on SOA

A dispatching process of Web service of searching resources from information systems of all the departments is showed in figure3. The request of searching resources is encapsulated as a Web service. The Web service is sent to the information systems of all departments through the request and response and dispatching mechanism of web services. All the searching results also are encapsulated as Web services and returned to server.

C. Resources Dispatching Realization

The core technology of realization information interaction and collaboration of Web services between different departments is realized through the UDDI. Any part of the emergency system could register their applications as Web services to UDDI. In the emergency processing system, the intelligent resources dispatching component is the request department and the information systems of such as police department and other departments supply services for the request department.

The process of supplying services is as follows:

- Get the metadata through the XML file of resource description.
- Send to the J2EE to process.
- Define EJB as Web services.
- Build WSDL file, and produce distribution service description.
- Deploy Web services on Web server.
- Published Web services to UDDI.

The process of requesting Web services is as follows:

- Find and download files of service description (WSDL).
- Produce Java agency and call on services by agency method.
- Wait for confirm messages and send confirm messages bys JSP or Email method.

Intelligent resources dispatching component based on SOA realize the intelligent resources dispatching by defining Web services and dispatching mechanism of web services.

IV. INTELLIGENT RESOURCES DISPATCHING SYSTEM BASED ON CLOUDING COMPUTING

The intelligent resources dispatching system is built on large-scale data and computing. So we build the system based on cloud computing platform. The physical structure of cloud computing platform is as Figure 4.

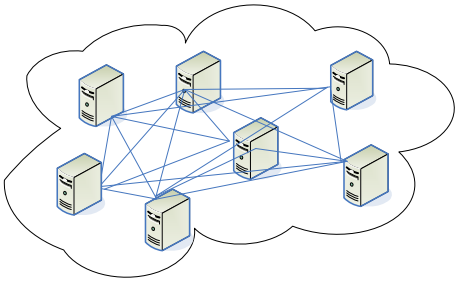

Figure 4. Physical structure figure of cloud computing platform

Based on cloud computing technology, we put calculation into several parts, and send them to many computers on the internet as service form. The computers return result to server. By cloud computing platform, the large number of calculations in the intelligent resources dispatching system of urban emergency can be realized.

V. CONCLUSION

In this paper, an intelligent resources dispatching system of urban emergency based on SOA and cloud computing is proposed to solve the problem. The structure of the intelligent resources dispatching system of urban emergency based on SOA and cloud computing is given and an intelligent resources dispatching component based on SOA is proposed. An algorithm is given to realize services optimization. The intelligent dispatching process of services request and response is discussed. The realization of the system based on cloud computing is also given in the paper. The intelligent resources dispatching system of urban emergency based on SOA and cloud computing could solve the problem that resources could not be dispatched in time between all departments in the traditional urban emergency processing system.

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