Research and Design of Network Management Construction Based on Mobile AGENT

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Abstract—The technical characters of mobile agent (MA) originated in the distributional artificial intelligence domain is introduced. A network management construction based on agent (NMCA) is then proposed. The NMCA structure features are elaborated in detail. A prototype design of NMCA is given by using the jKQML programming. The establishment of NMCA platform will be helpful to reduce the correspondence load of network management and improves the efficiency and the expansion ability of network management systems.

Index Terms—Harbor, manage center, monitored node, network management construction based on agent.

1. Introduction

With the rapid development of modern network technology, especially with the constant update of equipments in the communication network and the steady improvement of technology, the network architecture is also continually changing, the network management construction appears more and more important. At present, network management patterns mostly belong to two kinds of patterns. One is the management based on SNMP (simple network management protocol), another is based on CMIP (common management information protocol) [1]. Both these protocols provide central management pattern which are based on C/S (client/server) structure, under the pattern of C/S, there are lots of customer’s application programs on each terminal device. The merit of this way is that the client-side has rich application functions, interrupt handler, and highly effective performance.

However, the maintenance of network management systems based on C/S is extremely complex, and every client-side machine needs to be maintained manually in several days or even in several months when the application is changing or promoting. So the TCO (total cost of ownership) is increasing suddenly, and the system can not be adapt to new need or transfer to new technology, and especially the system is unable to satisfy the mobile customer groups. Next, the C/S network management pattern is disadvantageous to saves network band width, especially when the network overloading. The services on a server and the requests on a client are statically bounded, which will be extremely trouble if management protocol or management information base need to be updated, it is obviously disadvantageous to enhance the expansion flexibility of the whole system.

In order to overcome the limitation of the present network management pattern, further enhance the validity and the flexibility of the network management, a kind of new structure of the network management system need to be designed to replace the traditional pattern of C/S, the network management construction based on agent (NMCA) is precisely proposed under the mentioned background.

2. MA Synopsis

In the artificial intelligence domain, the definition of agent is an entity which moves in the dynamic environment with substantial autonomy ability. In fact, agent is a computer system, it is embedded into a specific environment; it gets the correlated information from the surrounding environment through its sensors, and performs the action to the environment through its effectors [2]. The task which is completed by the agent technology often has the directly explicit goal, but sometimes is possibly implied [3]. The attributes of agent include autonomy, adaptability, collaboration, intelligence, mobility, and sociability [4]. In different application domain, the character which is stressed by the application system based on agent technology is also different. For instance, the network management should stress on the mobility and the autonomy, but governmental business processes should be the autonomy, the adaptability, the intelligence, and the sociality [5]. Mobile agent is a section of procedure; it may independently migrate from a host to another, and interacts with other agent or resources. Mobile agent may migrate to the server and carries on the local high speed data correspondence with it, simultaneously this kind of correspondence does not take any network resources [6]. During the migration process, mobile agent merely carries the essential information, which includes the executing state and the data condition of mobile agent [7]. The migration of mobile agent is different from the long-distance execution, it

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has intelligence routing choice function. Mobile agent will carry on migration according to its own demand, and decide when or where migrates\(^8\).

3. NMCA’s Frame Construction

3.1 Logical Structure

As shown in Fig. 1, the agent level also called the packaging level, it mainly package or load the manage level and the monitor level, and constitutes different functional agents separately (for example: manage agents, monitor agents and so on), the number of such agents can be dynamically defined according to the concrete network management task. The manage level is responsible to produce and dispatch mobile agents to the monitor level where the collected data is processed. The monitor level is primarily responsible to manage the arriving and starting of mobile agents, and it provides the visited resources and technical support for exchanging with other mobile agents.

Fig. 1. NMCA’s logical structure.

3.2 System Structure

In this system structure shown in Fig. 2, agent packaging level package or load manage center and monitor node, which forms the core of the entire network management system. The level uses the agent environment and interactive with each kind of distributional database through the API (application programming interface), finally realizes the network management goal. In the NMCA’s system structure, modules in the dashed line frame constitute true agent, manage center create mobile agent through GUI (graph user interface) according to user demand, and assigns the duty and the strategy for it. But the migration route of mobile agent as well as the security information must be determined before being dispatched. After mobile agent collects the essential information and returns to manage center, manage center will deal with these information and feedback the result to manager. Monitored node provides harbor for mobile agent to land. Harbor is virtual, it is mainly responsible of the arriving and starting of mobile agent, mobile agent can anchor in some harbor or moves among harbors, harbor can be only determined by the DNS (domain name system) name. Monitor node is mainly to provide running environment for mobile agent, which includes safe authentication, resource request and assignment, data communication and so on.

Fig. 2. NMCA’s system structure.

3.3 Prototype

In view of the above NMCA’s logical structure and system structure, we can propose a kind of prototype design of NMCA, as shown in Fig. 3. In this prototype, the packaging level inherit the function of agent and expand it. Loading of user request is completed by GUI (graph user interface). Manage center rarely intervenes the behavior of mobile agent which is once dispatched by manage center, because of the characters of mobile agent’s, it can select the route intelligently, and it can automatically select next possible migration monitor node. When mobile agent lands in a harbor of monitor node, it can keep in touch with static monitor node agent staying in this node and completes the carrying task. The introduction of static monitor node agent in the prototype is mainly to reduce the volume of code and data which is carried by mobile agent during it’s migrating, simultaneously is also advantageous to the network management system expansion.

Fig. 3. NMCA’s prototype.
Then an example is produced (to use the jKQML programming) to simulate the course of communications in the NMCA system.

```java
KQML= msg=new KQML ("ask-one : Sender Networkuser :receiver InformationManagementCenter : reply-with id1 : language standard_prolog : ontology geo-model2 : content (geolocation pudong (? long? lat)))")
public Conversation sendMessage (KQML msg) throws SendFailedException,InvalidMessageSequenceException,InvalidFormatException,JKQMLException
public Conversation handleMessage (KQML msg)
KQMLManager localkmanager;
Conversation onetalk;
KQML achieve=
New KQML("(achieve : sender Networkuser : receiver InformationManagementCenter : reply-with id1 : language standard_prolog : ontology geo-model2 : content (geolocation pudong (? long? lat)))")
try {
    onetalk=localkmanager.SendMessage (achieve);
} catch (JKQMLException e ) {
    message
tell : sender InformationManagementCenter : receiver Networkuser : reply-with id2 : in-reply-to id1 : language standard prolog :ontology geo-model2 : content (geolocation pudong (5000 200)))
}
try {
    Objectresult = onetalk.WaitAndGetResponse (40000);
    System.out.println (result);
} catch (JKQMLException e ) {
    e.printStackTrace () ;
} Catch (InterruptedException e)
    e.printStackTrace () ;
```

4. Conclusions

At present, the agent technology originated in the DAI (distributional artificial intelligence) domain has already become the research focus all over the world. But the research of agent technology is limited in some particular fields. The establishment of network management construction based on mobile agent technology has a great significance of constructing the new network management system, because it can not only reduce the correspondence load, but also greatly improves the efficiency, the scalability, and the flexibility of network management system.

References


Yuan-Hui Yu was born in Henan Province, China, in 1973. He received the B.Sc. degree from the University of Henan, Kaifeng, in 1996 and the M.S. degree from the University of Electronic Science and Technology of China, Chengdu, in 2003, both in computer applying profession. He is currently working with School of Computer Engineering and the Research Institute of Computer Applying Technology of the University of JiMei. His research interests include mobile agent technology and data mining theory.