

Modeling Probe-Agent Distributed System by Goal-oriented Approach

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Abstract. We propose a kind of agent called probe-agent, which is responsible to collect and monitor the data and information according to its goals. On the other hand, it can summarize the collected data and information into the reports and forward to the higher level agents or the manager automatically. In this paper, goal-oriented approach is applied to model the probe-agents and the architecture is given to show the probe-agents in the MAS (Multi Agent System).

1 Introduction

Nowadays, there is a growing demand for the management information system to actively report strategic information according to the detected and collected data. Managers hope that the system is not merely a data processing system. They are reluctant to browse the collected information passively because the amount of the data is too large and the task of finding knowledge just by browsing is not easy for them. Traditional system is passive-management system and the analysis function must be activated by the manager. We adopt 'probe-agents' to realize the active-management. In the distributed monitoring system, 'probe-agents' are used to detect, collect and analyze data according to the different system goals. And on the managers' perspective, goal-oriented approach can follow the managers' requirements (goals) to help realizing the system model and assign responsibility to the agents.

The remainder of this paper is structured as follows. Section 2 gives the model of probe-agents based distributed system. In section 3, a case of telecommunication network management system is described for modeling probe-agents in distributed system. Conclusions and further work are presented in section 4.

2 A Model of Probe-Agents Distributed System

The monitoring management system is a hierarchical distributed system with two main functions: monitor and management. Monitor is used to detect the changes of the

monitored object, to collect the data reflecting the attributes of those changes and to control the object in some degree. And the data collected by the monitor gives the clue to the management. The collected data forms the information or decision to direct the manager. There are many real-world systems that can be called as monitoring management systems, like telecommunication transmission network monitoring and management system, company finance monitoring and management system, agroecosystem monitoring and management system.

Active-management is demanded and more autonomous software is needed which means agents should be used. Such agents work as probes to access the “front” with their own task and they know what should be reported to the manager according to his goals. We call them probe-agents. Each probe-agent may have more than one probe which could be used to detect the multi-sources, a goal receiver to acquire the manager’s goals and a reporter to report the information or suggestion to the manager (Figure 1).

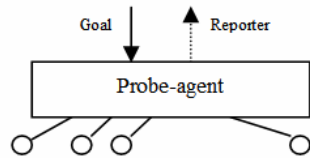


Figure 1: probe-agent model

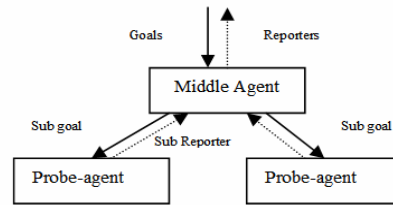


Figure 2: Hierarchical model

Goal-Oriented approach is applied to model the probe-agent. A goal is an objective the system under consideration should achieve. Goal formulations thus refer to intended properties to be ensured; they are optative statements as opposed to indicative ones, and bounded by the subject matter [1]. The identification of goals naturally leads to the repeated asking of “why”, “how” and “how else” questions [2]. During the process of requirements acquisition, stakeholders often do not know how to explain their concrete requirements however they can answer what goals they would achieve.

Formally, the probe-agent is defined as $PAg = \langle G, P, R \rangle$ where G is the set of goals, P is the set of probes, R is the set of reports. Note, here we ignore the action of the agent to the environment and just focus its monitoring aspect. The definition of P is depended on the G so through analysis of G we can decide the task and the number of the probes, which can be expressed by $P = A(G)$ where A is the analysis process. In this analysis process, conflicting goals and overlapping goals will be detected and then the tasks are assigned to the probes. $D(P)$ is the set of data collected by the probes. According to the different goal, the report of the data will be different. We define $r_{g_i} = D_{g_i}(P)$ where g_i in G , r_{g_i} in R . The reporting process is automatic and $D_{g_i}(P)$ is the set of data or information that has been organized according to the goals, which means it is strategic and sensible.

For achieving a goal usually evolves multi-agents especially in a distributed environment, the probe-agent should have the ability to communicate with the other agents. Sometimes the information reported separately to the manager by the probe-agents will give little knowledge only if these reports can be analyzed synthetically.

However the probe-agents may be heterogeneous, and the goals may be divided into sub-goals or the reports may be synthesized where middle agent will be the bridge between the probe-agents and the manager. The hierarchical model could be showed in Figure 2.

3 Modeling a Probe-Agents Distributed System by Goal-Oriented Approach

In this section, we have a case of a telecommunication transmission network monitoring and management system. Telecommunication systems are large, distributed networks of interconnected components which need to be monitored and managed in real-time [3]. In this system, managers monitor and manage not only various graphically-distributed devices but also the paths and nets linked though some of these devices. Monitor and management is onerous to the managers, they need agents to help them to maintain and manage the network in order to provide the customer better, quicker or more reliable services. In this project, we use probe-agents in this system to realize the managers' goals.

The main goals of the transmission network monitoring and management system are described as following:

- Show the topology of the network in real time;
- Monitor the alarm state of the devices and paths in real time;
- Monitor the statistic data of the performance;
- Create the path schema with the reasonable usage of the resources;
- Report automatically detailed strategic information (alarm, performance state ...) that has the impact on the business;

In order to achieve those goals, we need four types of agent: alarm agent, performance agent, path agent and strategy agent. With the formulation of $PAG = \langle G, P, R \rangle$, we can take alarm probe-agent as an example to see how to analyze the goals, define the probes and the reports. From goals, there are three sub-goals in G of alarm probe-agent. $G = \{g_1, g_2, g_3\}$ where g_1 is to monitor the alarm state of the devices in each EMS (Element Management System), g_2 is to monitor the alarm state of the paths, and g_3 is to form the strategic statistic alarm data. Obviously, g_1 and g_2 are overlapped for the alarm state of the path is relative with the alarm state of the ports composing the path. Through the communication with the path agent, alarm probe-agent can get the alarm state of the path. While g_3 can be achieved within the agent with the data collected for g_1 . So the probe of this agent is to collect the alarm data of each EMS. There are three reports with respect to the goals:

$$r_{g_i} = D_{g_i}(P), \quad i = 1, 2, 3.$$

This is a distributed system and contains the legacy systems in which each EMS runs on different platform, and therefore middleware technology is used in this architecture. And we choose CORBA here as the bridge of the agent level and the EMS level. Figure 3 is the part of the architecture of the NMS system.

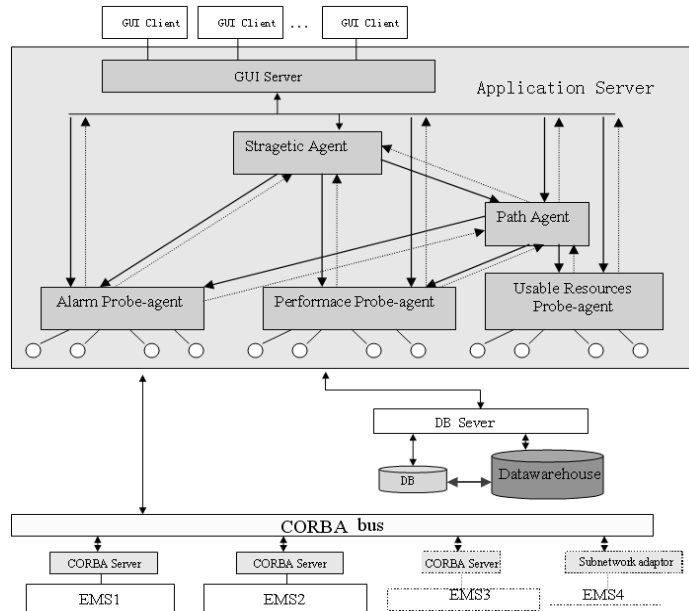


Figure 3: Architecture of NMS (part)

5 Conclusion and Future Work

This paper proposes a kind of agent called probe-agent, which is responsible to collect and monitor the data and information according to its goals. It can also organize the collected data and information into reports to inform the higher level agents or the manager automatically. Goal-oriented approach directs the modeling process of probe-agents.

There are many other research works we will do with the model, such as the conceptual transmission from the goals to the probes and reports, the communication between the probe-agents and the middle-agents.

References

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