Implementation and Evaluation of Active Agent Repository for Dynamic Networking

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ABSTRACT
In this paper, we explain the implementation and evaluation of Active Agent Repository based multiagent framework to improve performance of the agent’s cooperative works by using the behavioral history of each agent. We demonstrate the experimental results to show the effectiveness of the proposal method.

Categories and Subject Descriptors
I.2.11 Distributed Artificial Intelligence

General Terms
Design, Experimentation

Keywords
AAR-based Multiagent Framework, Dynamic Networking

3. EXPERIMENTS AND EVALUATION

3.1 Experiments
As the application of the experiment, we selected the Flexible Videoconference System (FVCS) which works as some of the middleware service unit on Dynamic Networking Architecture. We performed two types of experiments using FVCS, that is experiment on processing time of organization (Exp1) and experiment on agents’ competency (Exp2) (Figure 1). In the Exp1, we examine whether the configuration time of agent organization will be abbreviated or not by using the information obtained from the history data, in the case that the service request arrives from the same user. In the Exp2, we examine whether the improvement of the service provisioning is realized by increasing the efficiency of agent’s inference cycle using the inference history of FVCS.

3.1.1 Processes of the experiment.
The experiment executed as the following processes. (1) FVCS starts between the two workplaces. Firstly, the user starts the workplace by sending the videoconference service request to the interface. The service request is sent to the repository through the network. In the repository the configuration of the organization of the FVCS is executed using the contract net protocol and the agent group is instantiated to the workplace to start providing the service.

(2) When the videoconference finished, the agents feedback automatically to the AAR from the workplace.

(3) After the feedback of agents is completed, user issues the second service request of the FVCS via the interface.

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3.2 Evaluation

3.2.1 Experiment on processing time of organization.
After feedbacking to the AAR, the new knowledge of configuration of the organization with the directed-award performative was added to the VideoConfManager. When a user issued the second service request, the message was passed to the VideoConfManager and it executed the configuration of the organization. In this phase, the result (average at the time of five times) which compared between the processing time of organization to service provisioning of FVCS at the first time (before feedback) and the processing time of organization of FVCS at the second time (after feedback) is shown in Figure 2.

<table>
<thead>
<tr>
<th></th>
<th>first time (using contract net protocol)</th>
<th>second time (utilizing the history of organization information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>machine A</td>
<td>18529 (msec)</td>
<td>14842</td>
</tr>
<tr>
<td>machine B</td>
<td>21458</td>
<td>17374</td>
</tr>
<tr>
<td>machine C</td>
<td>22867</td>
<td>17246</td>
</tr>
<tr>
<td>machine D</td>
<td>24080</td>
<td>20748</td>
</tr>
</tbody>
</table>

This figure shows that the agent organization composition time after feedback was shortened in all machines. This is because the agent group after feedback performs the organization composition operation based on the former organization composition information, and the efficiency of the organization composition operation is also increased by using the behavioral history. In the conventional framework the organization composition time cannot be changed each time by using the contract net protocol only. Hence in the AAR based multiagent framework, the efficiency of the organization composition of the agent group after feedback was increased by utilizing the behavioral history together with the contract net protocol, and it verified that the processing time of organization composition was shortened.

3.2.2 Experiment on agents' competency
Inside of the FVCS agent group which worked in the workplace, by utilizing the number of times of fired rule in the inference history of both the CPUcheck agent which supervises the use rate of CPU and the Vic agent which provides the video service, we adjust the sequence of the rule of the agent to improve the efficiency of the agent inference cycle. In the evaluation, we focus on the fps (frame per second) which expresses the smoothness of the video picture, and we measured the change of the fps value against the CPU load change in each machine.

Vic agent gains the threshold of CPU from the User agent. If the load of CPU over this threshold, Vic agent acts so as to down the load of CPU by adjusting the video parameters provided on. Starting a videoconference session of FVCS, we give the high CPU load to which exceeds the threshold for 60000msec and cancel the high CPU load after that. According to the above condition, we measured the change of the fps value. We set the same condition of first time and second time. We show the one of measure result of the machine A in Figure 3. Here the X-axis shows the lapsed time (msec) and the Y-axis shows the QoS (the value of the provided fps per the value of user’s request fps (%)).

At the point of 60000msec, we increase the CPU load, Vic agent tries to decrease the CPU load, and the value of fps was lowered gradually.

When CPU load is canceled at the time of 120000msec, Vic agent tries to increase the fps gradually toward a user's request value. It turns out that the agent group of FVCS at the second time (after feedback) controls the fps against the CPU load as compared with the FVCS at the first time (before feedback). This means that service provisioning of the agent group after feedback is developed in the respect of conformity as compared with before feedback.

From the experiment result, we confirm that it is possible to improve the quality of the service provisioning as multiagent system by changing the sequence of the fired rule of the agent after feedback. In the conventional framework, the sequence of the fired rule does not change and the processing time of service provisioning does not change. But in the AAR based multiagent framework, the efficiency of the inference cycle of the agent after feedback was increased, and it was shown that the processing efficiency as the whole multiagent system also improves.

4. CONCLUSION
In this paper, we explain the implementation and evaluation of AAR based multiagent framework. Through the evaluation experiments using FVCS on Dynamic Networking Architecture, we showed the capability of the efficient configuration of the multiagent system.

5. REFERENCES