Multiple Negotiations among Agents for a Distributed Meeting Scheduler

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Abstract

We present a method for multi-agent negotiation for implementing a distributed meeting scheduler. In the meeting scheduler, an agent negotiates with other agents about making an public schedule by referring user's private schedules and preferences. We propose a new persuasion method for multi-agent negotiation for reflecting private preferences. We call the method the **multiple negotiations**. *In order to reach a consensus effectively, we propose an effective preference revision mechanism based on the multi attribute utility theory. We have implemented a distributed meeting scheduler to show how effectively the multiple negotiations can be used. The result shows that the multiple negotiations are effective in supporting group decision-making for scheduling a meeting.*

1 Introduction

In social decision making, there is a problem that we need to clarify a trade-off between "reaching a consensus" and " maximizing own expected payoffs". In a negotiation method based on persuasion[1] can be widely used for facilitating a consensus among group members. By using a framework of the negotiation method, we can clarify a new multi-agent negotiation mechanism for reaching a consensus among agents effectively. A distributed scheduler for a meeting is an application of multi-agent systems. In this paper, we present a multiple negotiation method for implementing a distributed meeting scheduler. The meeting scheduler plans schedules (such as a meeting) based on a multi-agent system.

The paper consists of five sections. In Section 2, we show the architecture of our system. In Section 3, we present the multiple negotiations and a preference revision mechanism. In Section 4, we show an example and discuss the results of the multiple negotiations. Finally, in Section 5, some concluding remarks are presented.

2 The Distributed Meeting Scheduler

In the meeting scheduler, an agent is assigned to an user who plans private schedules and events in a calendar. In order to schedule a public event, a host agent negotiates with other attendee agents by using the users' private schedules and preferences. The point is that agents need to clarify a trade-off between an agreement about scheduling a public event and users' private schedules. Figure 1 shows the user interface of the distributed meeting scheduler.

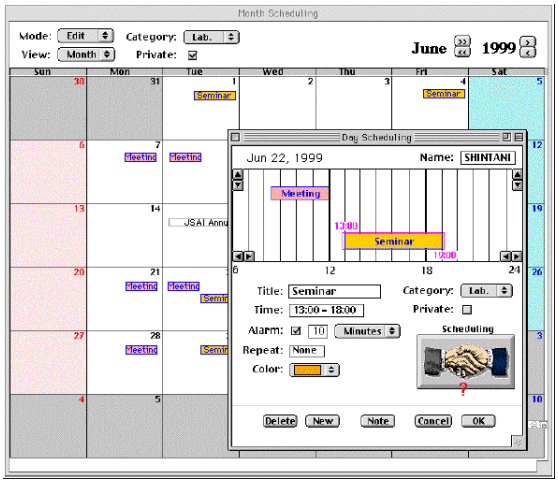

Figure 1. The Distributed Meeting Scheduler

In order to represent a subjective multiple attribute preference of an user, we employ a decision hierarchy based on MAUT[2]. Each agent keeps an user's decision hierarchy as multi-attribute preferences.

3 Multiple Negotiations among Agents

In order to get a result which can be agreeable to users, we propose multiple negotiations for multi-agent negotiation for reflecting private preferences. In the multiple negotiations, each agent has an opportunity for persuading the others by conducting all patterns of negotiation. In order to reach a consensus effectively in a pattern of negotiation, agents try to persuade the other agents. In order to facilitate the multiple negotiations, all patterns of negotiation should be conducted concurrently. The cloning technique for mobile agents enables us to realize concurrent negotiation processes for the multiple negotiation. Figure 2 shows the steps of negotiation among agents. In our system, a host user selects the best result from multiple results of the multiple negotiations.

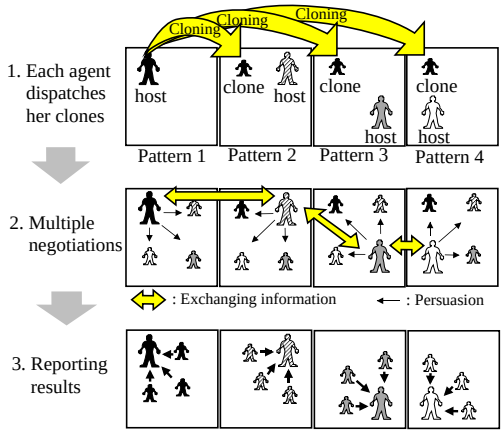

Figure 2. Negotiation among Agents

In the multiple negotiations, agents try to reach a consensus by using the persuasion mechanism. In persuasion, a compromiser tries to revise her preference so that her most preferable alternative is the same as a persuader's most preferable alternative. In order to change the order, agents try to adjust values of attributes of alternatives. In order to effectively change the preference order, we propose a preference revision strategy based on the minimal change (MC) principle and the order-based change (OC) principle. These principles can be described as follows: (**MC principle**) An agent should change an user's preference as minimal as possible. (**OC principle**) An agent should change an user's preference based on the preference order of alternatives. Based on the above two principles, a compromiser firstly tries to adjust values of attributes for a persuader's most preferable alternative. Secondly, a compromiser tries to adjust values for her own most preferable alternative.

4 An Experimental Result

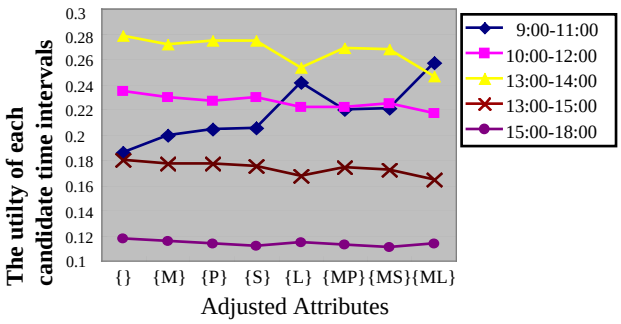

Figure 3. The experimental result

Figure 3 shows the experimental result of the process of adjusting the utility of five candidate time intervals. The vertical axis shows the utility of the alternatives. The adjusted attributes are shown in the horizontal axis. In the horizontal axis, M, P, S, and L, mean attributes Members, Place, Size, and Length, respectively. In this example, the agent's initial most preferable alternative is "13:00-14:00 ", and the agent is persuaded based on "9:00-11:00" that is the persuader's most preferable alternative. The agent tries to revise her preference. The agent, firstly, generates a power set of the attributes, and adjusts the value of the attributes in order of the size of the set. When she revised the value of attributes, M, and L, she could succeed revising her preference. Namely, this persuasion is successful.

5 Conclusions

In this paper, we proposed a new multi-agent negotiation mechanism that includes the multiple negotiations and the preference revision mechanism. We have implemented a distributed meeting scheduler to see how effectively the multi-agent negotiation can be used. The multiple negotiations we proposed here facilitates reaching an agreement among agents effectively. The result shows that the multi-agent negotiation based on the multiple negotiations is an effective method for a distributed meeting scheduler.

References

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[2] R. L. Keeney and H. Raiffa. *Decisions with Multiple Objectives : Preference and Value Tradeoffs*. Cambridge Univ. Press, 1993.