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Middle Agents

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Abstract

The computational environment has become highly distributed, diverse, dynamic, and comprising a large number of autonomous computers. These computers are called agents. In the real world there exists agents that act as middle-men to help us find services that we need, like booking an airline ticket. Similarly in the virtual world of computers, we need agents that act as facilitators to help other agents find the services they need. These agents are called *facilitators* or more appropriately *middle-agents*.

1. Introduction

One of the major problems facing multi-agent systems is finding the services and information that the agent needs and connecting to the agent that is providing this service. There are two types of information used in the agent interaction process – *preferences* and *capabilities*. To protect the privacy of each agent, preferences flow from a requester to a provider agent, and capability information flows from the provider to the requester. Agents that deal with both types of information that are neither requesters nor providers are *middle-agents*. [3]

2. Facilitator Agents

A facilitator agent is a middle agent that performs various useful communication services. Services could be maintaining a registry of service names, forwarding messages to named services, routing messages based on content, providing “matchmaking” between information providers and clients, and providing mediation and translation services. [1]

Some facilitator agents will specialize in knowing how to contact other agents (among other things) and can thus act as “agent-servers”. [1]

A main function of facilitator agents is to help other agents find appropriate clients and servers. [2] Just like objects in Object Oriented Systems, agents have some private, protected, and public information. A middle agent that can be trusted by the interacting parties is needed to facilitate the inter-agent communication.

3. Agent Types

Agents work in groups called organizations where they interact with each other. Each organization model relies on three basic roles: The requester, the middle-agent, and the provider. We will focus our attention on the middle-agents. There are many types of middle agents. In this paper only three are represented in detail, blackboard, broker and matchmaker agents.

4.1 Blackboard middle-agents

A Blackboard is a middle agent that keeps track of requests. Requesters post their problems. Providers can then query the blackboard agent for events they are capable of handling. This class includes newsgroups and bulletin boards. [3]

In figure 1 below, Agent A subscribes to Blackboard middle-agent F and displays a *want-ad* for a certain service. Agent B, advertises its capabilities with Agent F. Agent F directs agent B to agent A, which replies to it directly.

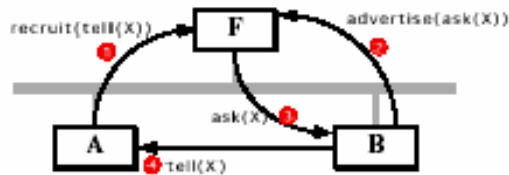


Figure 1. Blackboard Middle-agents [1]

4.2 Broker middle-agents

A broker is a middle-agent that protects the privacy of both the requester and provider. The broker understands both the preferences and capabilities, and routes both requests and replies appropriately. Neither the requester nor provider ever knows directly about the other in a transaction. [3]

The broker is known by all agents in the organization. Brokers advertise summary of capabilities built from all the providers that have advertised with them. When a request comes in, the broker matches it with a provider and sends it on; the reply is then sent back to the original requester.

In Figure 2 below, requester agent B advertises its capabilities with broker agent F. Agent A sends a request to agent F to find a service. Agent F matches agent B with this service and then asks agent B to provide it, then the reply is sent back to agent F, which forwards it to agent A.

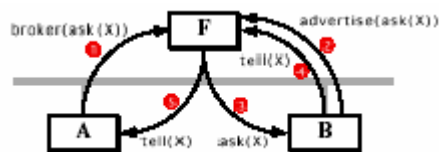


Figure 2. Broker Middle agents (F) [1]

4.3 Matchmaker middle-agents

A matchmaker is like the yellow-pages phone book. It is a middle-agent that stores capability advertisements that can then be queried by requesters. The requesters then choose and contact any provider they wish directly. [3]

Providers advertise their capabilities with a matchmaker, which stores them in a local database. A requester wishing to ask a query, first formulates a meta-query asking for advertisements from agents that could respond to the query. This meta-query is asked of a matchmaker, which responds with a set of matching advertisements. The requester can then use its full preferences to choose a provider, and make its request directly. [3]

In figure 3 below, agent B advertises its capabilities in matchmaker middle agent F. Agent A requests a service. Agent F replies with a recommended list of agents, and one of them is agent B. Agent A contacts agent B directly.

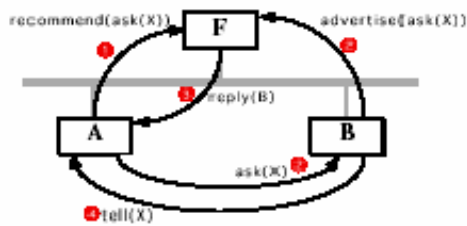


Figure 3. Matchmaker Middle-agent or Facilitator [1]

4. Conclusion

This paper has described three types of agent organizations and the roles of middle agents in them. There are many other middle-agent types that can be found and implemented.

The organized interaction between agents doesn't apply in all cases of the real world. There are cases where a hybrid approach has to be taken. The best characteristic of each organization can be combined into one organized structure.

The methods by which a middle agent assigns requests to providers and requesters can be learned from many areas of research. Middle-agents are an essential part of agent organizations. Communication costs and potential of failures are main issues. There is much to learn about middle agents and much research to be done to facilitate agent interactions.

References:

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