



Chapter XIX

**A Mobile Agent Computation
Model for Best Buy Searching**

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The Internet changes our shopping style. With the growing popularity of Web browsers, electronic commerce (EC) has become a trend of next-generation shopping style. EC software applications are written as Web document control programs, which run on service providers. The techniques used including information retrieval, network communication, database management, communication security and others. Due to the huge volume of data transmitted on the Internet, and the number of electronic commerce shoppers, currently the Internet is overloaded on its limited communication bandwidth. Research contributions are proposed to overcome this problem. Mobile agents are computer programs that can be distributed across networks to run on a remote computer station. The technique can be used in distributed information retrieval which allows the computation load to be added to servers, but significantly reduces the traffic of network communication. Many articles indicate that this approach is a new direction to software engineering. However, it is hard to find a theoretical base of mobile agent computing and interaction over the Internet. We propose a graph-based model, with a simulation design, for the mobile agents, which evolve over the Internet. Based on the concepts of food web (or food chain), one of the natural laws that we may use besides neural networks and genetic algorithms, we define agent niche overlap graph and agent evolution states for the distributed computation of mobile agent evolution. The proposed model can be used to build an environment for many electronic commerce applications, such as advertisement agent or survey questionnaire agent.

INTRODUCTION

Communication over the Internet is growing increasingly and will have profound implications for our economy, culture and society. From mainframe-based numerical computing to decentralized downsizing, PCs and workstation computers connected by Internet have become the trend of next-generation computers. With the growing popularity of the World Wide Web, digital libraries over the Internet play an important role in the academic, business, and industrial worlds. In order to allow effective and efficient information retrieval, many search engines were developed. However, due to the limitation of now-a-day network communication bandwidth, many researchers suggest that distributed Internet search mechanisms should overcome the traditional information retrieval technologies, which perform the controls of searching and data transmission on a single machine. Mobile agents are software programs that can travel over the Internet. Mobile search agents find the information specified by its original query user on a specific station, and send back search results to the user. Only queries and results are transmitted over the Internet. Thus, unnecessary transmission is avoided. In other words, mobile agent computing distributes computation loads among networked stations and reduces network traffic.

A mobile agent, in general, can be more than just a search program. For instance, a mobile agent can serve as an emergency message broadcaster, an advertising agent, or a survey questionnaire collector. A mobile agent should have the following properties:

- It can achieve a goal automatically.
- It should be able to clone itself and propagate.
- It should be able to communicate with other agents.
- It has evolution states, including a termination state.

The environment where mobile agents live is the Internet. Agents are distributed automatically or semi-automatically via some communication paths. Therefore, agents meet each other on the Internet. Agents which have the same goal can share information and cooperate. However, if the system resource (e.g., network bandwidth or disk storage of a station) is insufficient, agents compete with each other. These phenomena are similar to those in the ecosystem of the real world. A creature is born with a goal to live and reproduce. To defend their natural enemies, creatures of the same species cooperate. However, in a perturbation in ecosystems, creatures compete with or even kill each other. The natural world has built a law of balance. Food web (or food chain) embeds the law of creature evolution. With the growing popularity of the Internet, where mobile agents live, it is our goal to learn from the natural to propose an agent evolution computing model over the Internet. The model, even applied only in the mobile agent evolution discussed in this chapter, can be generalized to solve other computer science problems, for instance, the search problems in distributed artificial intelligence, network traffic control, electronic commerce, or any computation that involves a large amount of concurrent/distributed computation.

We propose a logical network for agent connections/communications called agent communication network (or ACN). ACN is dynamic. It evolves as agent communication proceeds. It also serves as a graph theoretical model of agent evolution computing. Our research purposes include:

- Provide a model for agent evolution and define the associated rules
- Construct simulation facilities to estimate agent evolution

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