Agent-Mediated E-Commerce

SENG 609.22 Agent-Based Software Engineering
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Abstract
Agent-Mediated E-Commerce (AMEC) is an important application of agent technology. Customers and vendors can use agents to buy and sell products and services on Internet markets. Agents are autonomous processes that act on behalf of their owners and work with other agents together to reach their own goals. There are lots of researches and pilot projects going on in the area. We are looking forward to an active AMEC global market filled with smarter agents in the near future.

Introduction
The combination of the Internet and software agent technologies will radically change electronic commerce. The Internet opens up electronic services to anyone with a computer and a modem, and provides effective market access for many service providers. With software agents, responsibility for purchasing or selling goods and services can be delegated to a piece of autonomous software, i.e. an agent. Travel retailing is a good example of an industry, which can be revolutionized by these technologies, and is used here to briefly show the picture. See Figure 1 as below [2].

Current Situation and Research Areas

Challenges and Potentials
The design of economic agents, mechanisms, and systems has received growing attention in the agents and multi-agent systems communities. Electronic commerce is rich with focused yet challenging problems, ripe for technical advances and practical application of agent technologies. As the domain is characterized by individual agent self-interest and private information, agent mediated trade requires principled design, often incorporating novel
combinations of theories from different disciplines. Thus, techniques from fields such as computer science, operations research, artificial intelligence and distributed systems are integrated with principles from economics and game theory. Furthermore, there are challenges to eliciting human preferences and requirements and ensuring that they are represented in automated agent behavior [1].

Besides all those general topics for all agent-based system such as system architecture, roles, communication, and standards, there are also some areas of particular interest for agent-based e-commerce systems, which include:

- mechanisms, negotiation protocols, and auctions (esp. advanced designs such as multi-attribute auctions)
- bidding and negotiation strategies
- integration of negotiation with broader decision making
- economic-based theory and design methodologies
- market-based problem solving
- trading and pricing
- eliciting human preferences and requirements and ensuring that they are represented in automated agent behavior

**Bidding Strategies in On-Line Auctions**

Electronic markets include electronic auctions and electronic marketplaces. In recent years online auctioning over the Internet is especially established as a convenient, efficient, and effective method of doing business. Research has been done to study the design and control of auctions by designing bidding strategies from a B2C point of view. The research began with a simple scenario, where users only participated at a single auction, and then extended to also consider the case of users participating simultaneously in a number of auctions, all of them not necessarily starting or ending at the same time. According to the data gathered from the study, dynamic optimization and optimal control methods and algorithms for optimal bidding from the point of view of a buyer were proposed [4].

**Price War among the Agents**

Electronic marketplaces are comparable to traditional markets in a number of ways. As in the distributed nature of a market, participants in a market are considered to be separate individuals with different strategies, needs and options.

Due to the huge number of possible agents existing in AMEC and their diversity, I don't think that it's very likely that the open web market will end up with any situation of monopoly. Instead, fierce and endless price war may be a more possible result. Although that may sound like a good news for consumers, it does not necessary mean a beneficial thing in the long run, for too lean profit makes producers and merchants suffer, which may drag the whole economy down. The point is that we don't have to worry about the antitrust law in the e-commerce, but how to avoid excess level of price war.
Some researches have already been done in the area and the results suggest that price wars occur when producers can differentiate themselves only on price. In order to prevent that from happening, producers need some other way to differentiate themselves, such as using price schedules and bundle size to differentiate from each other, targeting a niche than the population at large, presenting value-added offers instead of competing solely based on price leadership.

In fact, the above suggestions have already received strong proof from other aspects. According to a research done to survey the e-tailer prices, buying good from Internet does not necessary mean the consumer is going to get a cheaper price tag. "Our results show that there are three clusters of e-tailers that target different consumer groups and accordingly have different overall prices. We find that market characteristics and e-tailer characteristics, especially the former one, drive online price dispersion and that e-tailers charge prices in line with their characteristics" [3]. It becomes obvious that the current marketing strategy, which are still manually operated by human on the web sites, is exactly what was proposed on that of the future e-agents in the AMEC.

**Including Marketing Strategies in Agents**

In order to avoid the price war, advanced marketing strategies other than simple price changing will make agents in AMEC much more powerful in doing the business on behalf of the human. In other words, some researchers call this as moving from dynamic posted pricing through pricebots to dynamic posted offering through smarter next generation bots [7].

Based on the standard AMEC model, an improved model was proposed to facilitate the marketing strategies to segment the market, i.e. identifying different user communities in a population of users, differentiating by customizing offers to different groups of customers. The model shown in Figure 2 consists of several more new roles and service providers [7].

- Market Observer: responsible for the construction of a dynamic reliable market model
- Market Analyzer: detects opportunities and devises offers accordingly
- Offer Presenter: presents the offers following a generally agreed-upon ontology
- Offer Settler: interacts with the buyer in order to settle those issues not fixed in the posted offers
Adaptability of Agents in AMEC

Electronic markets provide structured environments for agents. An electronic market usually defines a common language and protocol, in which, e.g., negotiations or bids can be expressed and transactions arranged. Electronic markets are supported by an underlying runtime environment, by which agents can join a market, act, and leave the market with their acquired money and goods.

Just like traditional marketplaces, AMEC offers a dynamic environment to their participants in which goods, participants and policies change continually. Furthermore, agents may need to adapt to a new market and/or another agent platform. Learning techniques for multi-agent systems most probably do not provide the support needed to develop such flexible agents.

A more feasible approach is to equip agents with learning techniques geared for specific purposes, such as learning about negotiation behaviour, co-operatively building trust models, etc. Adaptation of an agent to larger changes in an agent’s environment, e.g., new ontologies, languages or protocols, availability of new strategic reasoners or volumes of experience knowledge, policy changes from single-attribute negotiation to multi-attribute negotiation, different agent platforms, etc. requires other mechanisms.

In current agent systems, mobility of agents is constrained by the environment of the agents, which are the agent platform that supports agents, and the agent’s code base (e.g., DESIRE, Java). Within the same agent platform and code base, agent migration has been shown to be possible. However, many agent platforms exist, differing substantially in the support for agents.
An approach using the Agent Factory is possible with which agents can automatically adapt to their environment, due to the generative mobility built into agents by the Agent Factory. Basically, a blueprint of an agent’s functionality is transported together with information on the agent’s state. At its destination, an agent factory regenerates the executable code of the agent on the basis of its blueprint: a new incarnation of the agent. Upon activation, the agent (possibly) restores its state and resumes execution [8].

Conclusion

There are currently only a small number of distinct examples of agent technology being applied to the electronic commerce domain, primarily price comparisons and aggressive buying agents (pricebots and shopbots). What is more common is the tedious and time-consuming process that consumers go through when shopping over the Internet. The process might start with a search for a particular product from which several links to stores are returned. The consumer typically must visit each website to check pricing and additional terms. This could involve considering alternate products from an online catalog, product availability, delivery options, return policy, or payment methods. After all relevant information is gathered the consumer then purchases the product using a credit card [9].

In the coming future, it is envisioned that software agents can be made responsible for autonomously mediating purchases for both businesses and consumers. An agent can handle all of the information gathering, decision-making, and payment processes. More importantly, “Companies will have instant access to unbounded, world-wide markets; prices and product packaging can be determined dynamically through negotiation on a per transaction basis; many short-lived, task-specific collaborations between companies will replace the more expensive, long-lasting partnerships and contracts common today” [10].

Next-generation information markets will consist of both human and computational agents. As of today the human merchants compete on prices, services and marketing strategies, the e-agents will play similar strategies and tactics on the AMEC. The best agents must be able to not only locate and price goods in an open and dynamic system, but also adapt to the environment, move freely in and out of different marketplaces, create long-term and short-term strategies, use optimized bidding and negotiating tactics, and learn from the past experiences.

The smarter an agent is, the higher chance of success and fortune it will take to its owner. That is what will happen in the upcoming huge global AMEC playground.
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