Abstract

Internet-based software is rapidly increasing. Not only PCs, but also mobile phones, PDAs, and even VCRs are connected to the Internet. More and more software will be developed and deployed in the Internet.

Currently, most of such software is built on top of object-oriented technology. Specifically, Java programming language, invented by Sun Microsystems, is the de facto standard for the development of software for the Internet. Object-oriented technology was actively investigated in 1980s and commercial systems followed in 1990s.

Advanced utilization of intelligent multimedia is essential for information technology in the 21st century. New paradigm for the development of computer systems is required for that. One of such paradigms is the agent technology that is beyond current object-oriented methodology.

Agent-oriented technology is regarded as a next-generation of object-orientation. Universities and research organizations have been working on agents aggressively. However, most of these works are academic researches and few effort has been made for promoting the technology to the industry and international standardization based on the systems development.

There are three main international standardization bodies that deals with the agent technology: FIPA (Foundation for Intelligent Physical Agents), JAS (Java Agent Services) and Agentcities. FIPA specifies logical and external behavior of agents and multi-agent systems. JAS standardizes interfaces in Java programming language that are used to implement a FIPA agent platform. Agentcities interconnects FIPA-compliant agent platforms using the Internet to conduct interoperability trials and develop applications on the infrastructure.

The author of this paper is a key personnel in Japan for these international activities. In FIPA, he held such important positions in the organization as a Board member, chair of the Architecture Board, chair of the Interoperability Technical Committee, and Auditor. He is an expert member of JAS and made a great contribution to both specification and reference implementation. He is the only member from Japan who joined Agentcities, RTD, an EU IST 5th Programme project. In Japan, he is the president of Intelligent Agent Society, a technical committee member of Japanese Standards Association Information Technology Research and Standardization Center, and a technical committee member of Japan Information Processing Development Corporation. Through the national activities, he contributed
reports and translated FIPA specifications, which were finally published as Japan Industry Standards Technical Reports (JIS-TR).

Under above circumstances, this paper has described interoperability of heterogeneous multi-agent systems based on the author's experience of research and development of agent technology. The interoperation of heterogeneous agents is indispensable for the commercial utilization of the agent technology in the Internet era. The contents of the paper (see the abstract by the author), activities in national and international standardization bodies, and external presentations all make up critical contribution to establishing the future agent technology. Moreover, his research has made it possible for Japan to take an international initiative in the area of next-generation software and communications technology.

By these reasons, it has been concluded that this paper is qualified for a doctoral dissertation. Also, the author has been interviewed by an oral examination to check his knowledge in computer science in terms of the contents of the paper especially distributed processing and programming language. He has successfully passed the examination by showing that he has enough knowledge as a doctor in computer science. Therefore, it has been judged to confer a doctorate to him.