

NISTIR 6401

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**COMPUTER-INTEGRATED  
KNOWLEDGE SYSTEM (CIKS)  
NETWORK: REPORT OF THE 2<sup>ND</sup>  
WORKSHOP**

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**NIST**

United States Department of Commerce  
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# Software Agents for Knowledge Sharing

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## 1. Background

This presentation involved a description, roles, and architectures of a software agent. In addition, an overview of agent programming languages was presented. The second part of the presentation involved agent communication and knowledge sharing technology. This technology is critical for the future of any CIKS system as it relates to the automated exchange of knowledge bases in an environment such as the Internet. Realizing the need to interface knowledge in a heterogeneous computing environment, the design of knowledge bases normally performed independently must be done with some degree of consistency or compatibility, thus producing seamless integration from a user's perspective.

## 2. Software Agents

Software agents are represented by the following entities:

- ❑ Daemons (e.g., ftp agent)
- ❑ User interface clients (e.g., email agent)
- ❑ Physical agents (e.g., robotics)
- ❑ Believable agents (e.g., virtual reality and graphics)
- ❑ Intelligent software agents

Several knowledge categories can be associated with agents. These include intelligent human-computer interface agents and adaptive user modeling agents, personal knowledge retrieval agents, mobile software technologies, and cooperative software agents (e.g., resource discovery, mediators and facilitators, and market agents). An emerging system-building paradigm has developed involving agent technology. This paradigm is characterized by distributed systems, mobile code, artificial intelligence (cognitive science), machine learning, and database and knowledge base technologies. This paradigm is important in that it addresses current knowledge issues which tend to be fully distributed and heterogeneous and the technologies are scalable. Key concepts important to the definition of a software agent are represented by goal-directed processes, their awareness and reaction to a given environment, and their interaction and cooperation with other agents (mobility).

## 2.1 Agent Architectures and Programming Technology

Several architectures are being used by agent developers. These extend beyond the client-server architecture models, are mediated architectures, represent single agents and are multi-agent systems. Agent cooperation requires a communication environment and uses an Agent Communication Language (ACL). CORBA, KQML, and KIF are representative of ACLs.

Agents can be developed using many different programming languages which have the following set of characteristics:

- ❑ Multi-threaded capabilities
- ❑ Communication and security support
- ❑ Mobility
- ❑ Graphical user interface support
- ❑ Interoperability features that support mediated features and component-based programming.

Software agents offer an opportunity to develop very large-scale distributed heterogeneous applications focusing on interactions of autonomous, cooperating processes which can adapt to humans and other agents. Intelligence is always a desirable characteristic.

The summary of Timothy Finin's presentation provides a brief overview of several important aspects of software agents. Agent technology is a complex technology and a detailed discussion extends beyond the scope of this report. However, the following references provide detailed information on agent technology and are suggested for further reading.

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