



효율적인 전자시장 구축을 위한 인텔리전트 에이전트

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Agenda

- Definitions of An Intelligent Agent
- Past Intelligent Agent Development Efforts
- Past/Current Intelligent Agent Development Efforts for Electronic Markets
- Future Intelligent Agent Development Efforts for Electronic Markets





In An Electronic Information World,

- we are easily overwhelmed by the huge amount of information and the effort required to find specific information we need.
- we need to capture costly expertise and make it widely available.
- we need to minimize the time spent on routine personal tasks so that we can devote more time to other intelligent activities.

Solution: Intelligent Agent Technology



Definitions of An Agent

- A person or business authorized to another's belief.
- A person who works for or manages an agency.
- A representative of a business firm, especially a travelling salesperson.
- A substance that causes a chemical reaction.
- An organism that is a cause or vector of disease.

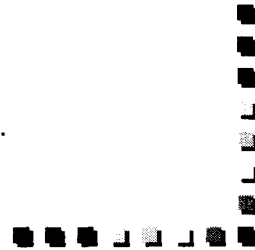
An agent plays a role as an intermediary.





Messy Terminology for Intelligent Agents

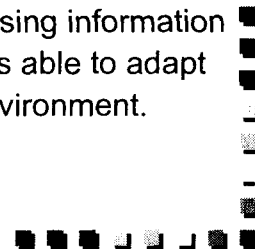
- Software Agents
- Intelligent Interfaces
- Adaptive Interface
- Knowbots
- Softbots
- Userbots
- Taskbots
- Personal Agents
- Personal Digital Agents/Assistants, etc.



Definitions of An Intelligent Agent

(1 of 2)

- IA technology is a rapidly growing area of research and application development, but it is poorly understood by most people due to its broadness and its ability to capture the imagination.
- IBM (1995): An intelligent agent is a software program that performs a given task using information integrated from its environment and is able to adapt based on changes occurring in its environment.





Definitions of An Intelligent Agent (2 of 2)

- FTP (1995): An intelligent agent is an autonomous software that is self-contained and performs tasks on behalf of a user or user-initiated process.
- Hayes-Roth (1995): An intelligent agent continuously performs three functions: perception of dynamic conditions in the environment; action to affect conditions in the environment; and reasoning to interpret perceptions, solve problems, draw inferences, and determine actions.



Properties of Intelligent Agents (IA)

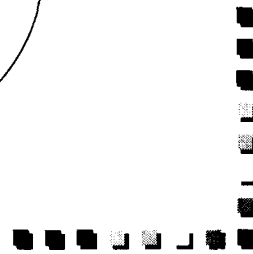
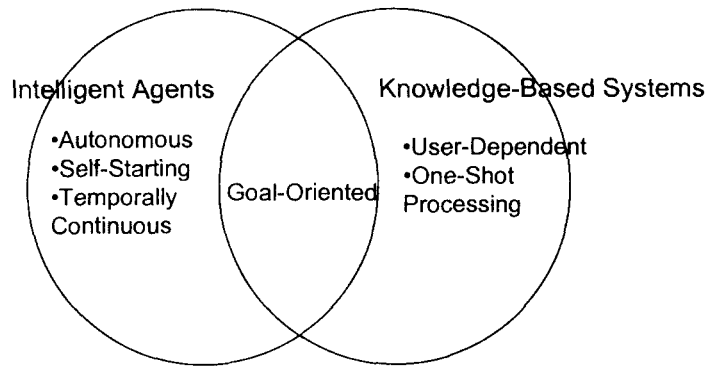
- **Reactive:** IA perceive their environment and respond in a timely fashion to changes that occur in it.
- **Autonomous:** IA operate without the direct intervention of humans.
- **Self-Starting:** Unlike standard programs that are directly invoked by the user, IA can sense changes to their environment and decide when to act.
- **Goal-Oriented:** IA accept high-level requests indicating what a human wants and are responsible for deciding how and where to satisfy the requests.
- **Learning/Adaptive:** IA learn from the user or from other IA.
- **Collaborative/Communicative:** IA collaborate with other IA.
- **Temporally Continuous:** IA are continuously running as a background; they do not perform a one-shot computation that maps a single input to a single output, then terminate.
- **Mobile:** IA can transport themselves from one machine to another and across different system architectures and platforms.

Source: Wooldridge and Jennings 1995

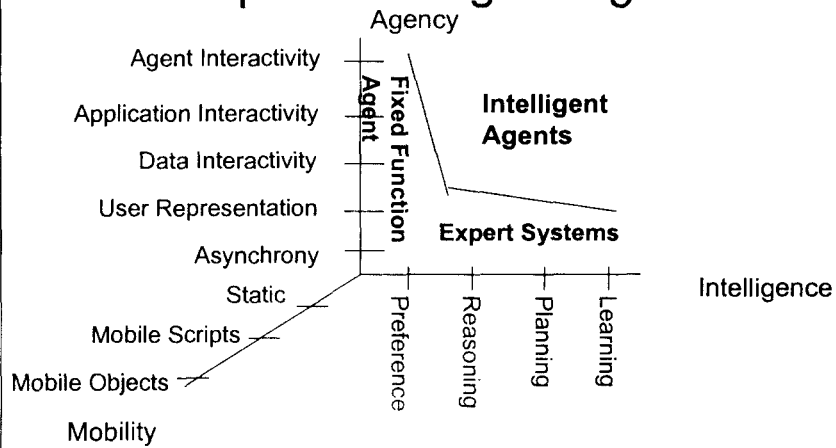




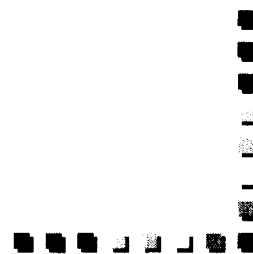
Knowledge-Based Systems vs. Intelligent Agents



Scope of Intelligent Agents



Source: IBM





The goal and challenge of intelligent agent development is to offer a computing environment that supports and helps people perform their work more effectively.

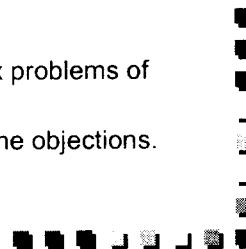


An Earlier Vision of An Intelligent Agent

- In 1988, Apple Computer published a video, “*Knowledge Navigator*”, about its vision of human-computer interaction of the year 2010.
- The Knowledge Navigator video is an interesting portrayal of the company’s vision of the future and how intelligent agents might manage our interactions with the computers.
- Criticisms:
 - It was impossible for us to solve the complex problems of speech recognition and processing.
 - The social interactions were the focus of some objections.



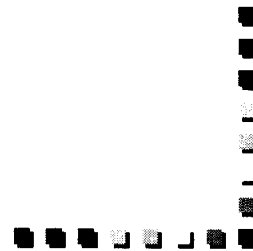
Media Clip





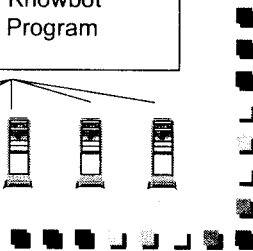
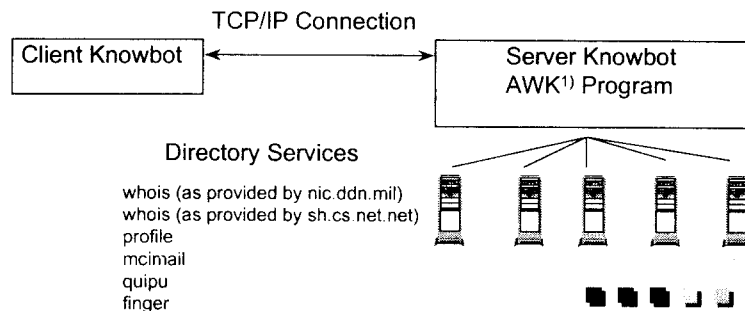
Past Intelligent Agent Development Efforts

- Information Agents: They perform the role of managing, manipulating, or collecting information from many distributed sources.
 - Knowbot Information Service
 - Information Lens System
- Interface Agents



Knowbot Information Service (KIS) (1 of 2)

- A directory or white pages service that enables us to locate a specific user on the Internet.
- A uniform user interface that integrates heterogeneous directory services into a single, uniform service.





Knowbot Information Service (KIS)

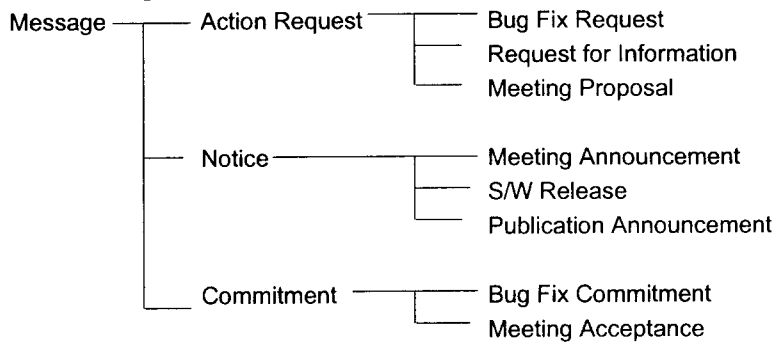
(2 of 2)

- The AWK programming language performs the format translations between the remote directory services and KIS.
- KIS uses a series of tables to specify the set of remote directory services and to describe the translations required for the queries and responses exchanged with each remote directory service.
- Show Slides



Information Lens : Intelligent Mail Sorting (1 of 2)

- Information Lens has a rich set of semi-structured message templates.



Source: CACM, May 1987, pp. 390 - 402.





Information Lens : Intelligent Mail Sorting (2 of 2)

- Information Lens allows the user to set up production rules to specify automatic processing for the messages.

Rule 1)

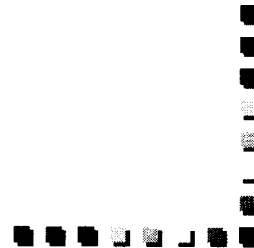
IF Message type : Action request
Action deadline : Today, Tomorrow
THEN Move to : Urgent

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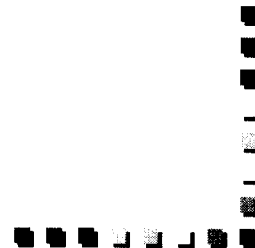
Rule N)

IF From : Baek
THEN Set Characteristic : VIP



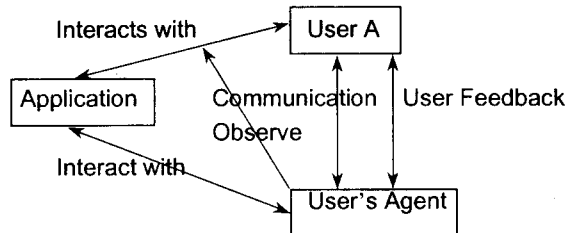
Interface Agents

- Through voice-recognition technology, they understand a set of spoken computer commands such as “print” or “save.”





Intelligent Agents for Adaptive User Interface



Source: Nwana, H.S. (1996), "Software Agents: An Overview," *The Knowledge Engineering Review*, 11(3), pp. 205-244.



Letizia

- Letizia is a user interface that assists a user browsing the WWW.
- It tracks user behavior and attempts to anticipate items of interest by doing concurrent, autonomous exploration of links from the user's current position.

QuickTime Movie

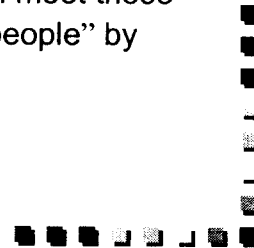
User Browsing (Depth-First Search Strategy)	Letizia Search Candidates (Breadth-First Search Strategy)
	Letizia Recommendations

Source: Lieberman, H. (1995), "Letizia: An Agent That Assists Web Browsing," *Proceedings of the International Joint Conference on AI*.

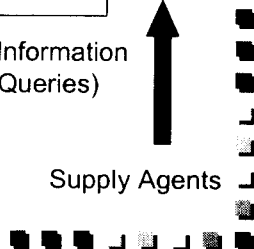
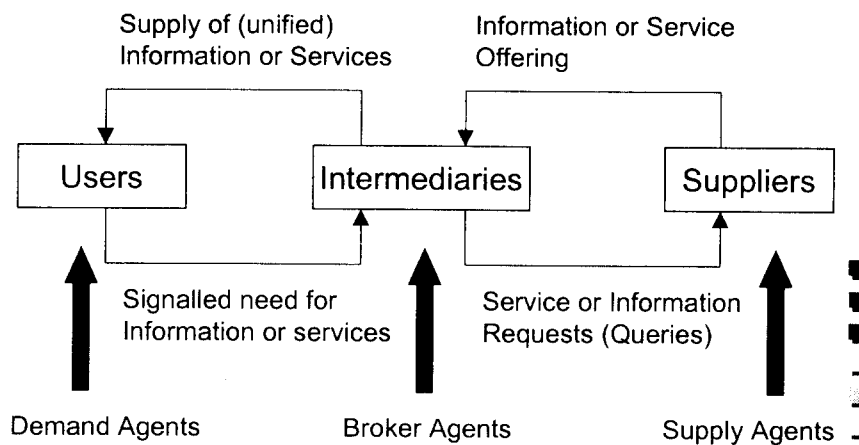


Intelligent Agents for Electronic Commerce

- The exchange of products and services on the Internet is called “**Electronic Commerce**”.
- Electronic Commerce Agents can “go shopping” for a user, taking specifications and returning with recommendations of products which meet those specifications, or can act as “salespeople” by providing product or sales advice.



The Three Layer Model





Intelligent Agents for Electronic Commerce

- Demand Agents
 - Agents' tasks are to find out exactly what users are looking for, what they want, if they have any preferences.
 - Firefly, BargainFinder, LifestyleFinder, etc.
- Supply Agents
 - Agents' tasks are to make an exact inventory of services and information that are being offered by its suppliers, to keep track of newly added information.
- Broker Agents
 - Agents mediate between agents.
 - Kasbah, Tete-a-Tete, Mobile Agents, etc.



BargainFinder

- It is the first merchant brokering shopping agent.
- It searches several online music stores for lowest prices on CDs and cassettes.
- Limitations
 - Not more than a database search engine.
 - Shopping is limited to retailers that subscribe.
 - Customers have to know and spell correctly the name of artist and album.
- New BargainFinder: Pocket BargainFinder
 - It is a small, pocket-sized device that finds the lowest price of an item in cyberspace.





Firefly (1 of 2)

- It automated the word-of-mouth process that is at the heart of most consumer purchasing.
- It implemented a technique for making personalized recommendations based on similarities between the interest profiles of the user and other users (Social Information Filtering).
- Social Information Filtering Process in Firefly
 - Step 1: Access Firefly home page, and register.
 - Step 2: Rate 20 films for how much you like.
 - Step 3: Submit your ratings.
 - Step 4: Match your ratings with other members' ratings.
 - Step 5: Find the films that you will like.
 - Step 6: Go to Step 2.



Firefly (2 of 2)

- A Social Information Filtering Algorithm

Films/User	A	B	C	D
1	1	4	2	2
2	5	2	4	4
3			3	
4	2	5		5
5	4	1		1
6	?	2	5	

- Step 1: Calculate correlation coefficient between two users.
- Step 2: Calculate a weighted average of all the ratings on Film 6.





Lifestyle Finder (1 of 3)



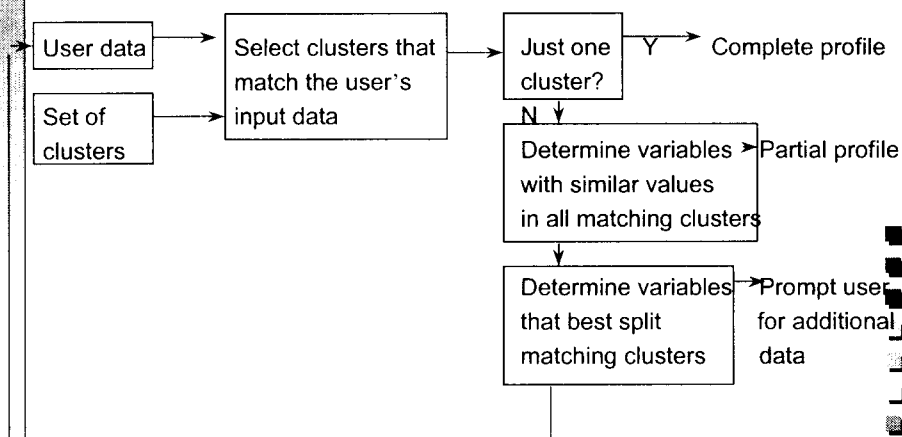
- Lifestyle finder is an intelligent agent that interacts with users on the Web and uses their profiles to recommend general areas of interests for an individual.
- Social Information Filtering: A user's profile consists of the data that the user has specified. These data are compared to those of other users to find overlaps in interests between users.
- **Demographic Generalization Method:** The method classifies users based on a commercially available database of demographic data.

Source: Krulwich, B. (1997), "Lifestyle Finder," *AI Magazine*, Summer, pp. 37-45.



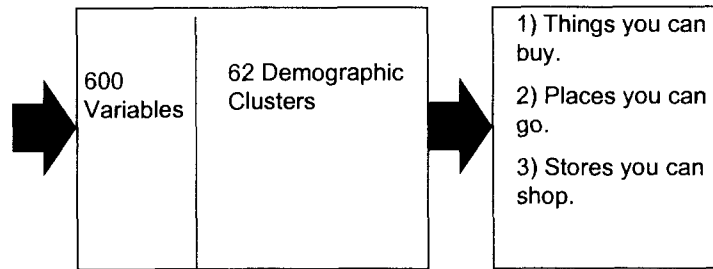
Lifestyle Finder (2 of 3)

■ Demographic Generalization Method





Lifestyle Finder (3 of 3)



Kasbah

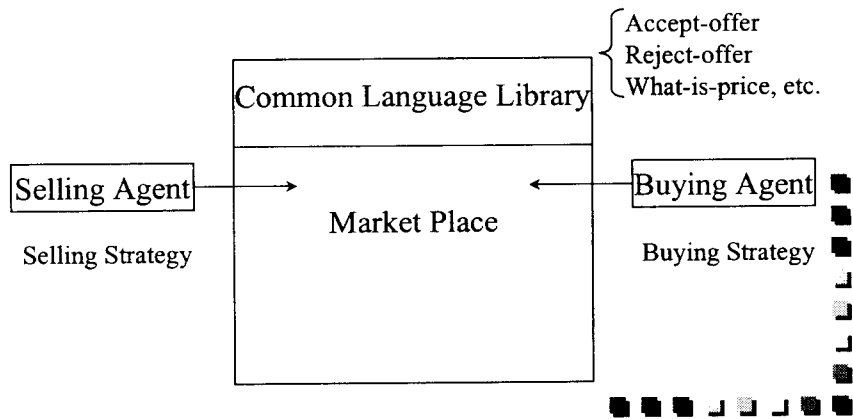
- Kasbah is a Web-based system where users create autonomous agents that buy and sell goods on their behalf.
- A user wanting to buy or sell a good create an agent, gives it some strategic direction, and sends it off into the agent marketplace.
- Kashbah agents pro-actively seek out potential buyers or sellers and negotiate with them on their creator's behalf.
- Each agent's goal is to make the "best deal" possible, subject to a set of user-specified constraints, such as a desired price, a highest (or lowest) acceptable price, and a date to complete the transaction.





Kasbah Prototype

- It is implemented in CLOS using Harlequin Lisp.

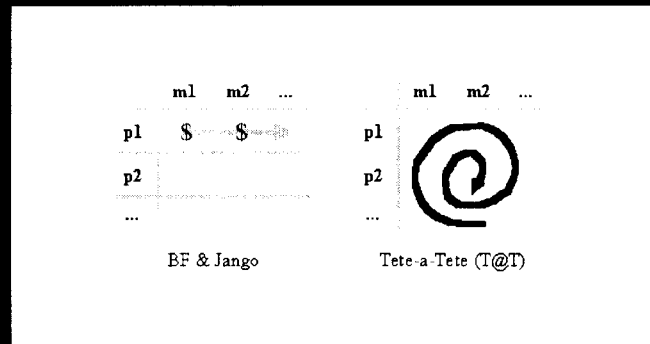


Tete-a-Tete

- T@T helps differentiate merchants' offerings by engaging consumer-owned shopping agents and merchant-owned sales agents in integrative negotiations across each product's full range of value.
 - Allow merchants to tailor their product offerings to each consumer's individual needs.
 - Allow consumers to negotiate with sales agents each owned and operated by a specific merchant.
 - During T@T negotiations, consumers actively negotiate with sales agents by refining their preferences in an effort to identify the product offering that best meets their needs.



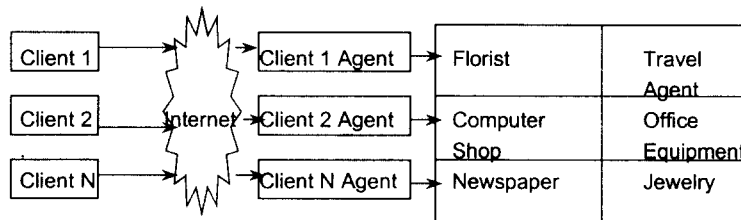
Price vs. Value



Mobile Agents

■ Telescript Shopping Agents:

To reduce the time needed for interactivity between client and server, Telescript lets users bundle messages, requests, and preferences into an intelligent program that travels to a distinct computer, retrieves answers to all the queries, and then returns with the answers.



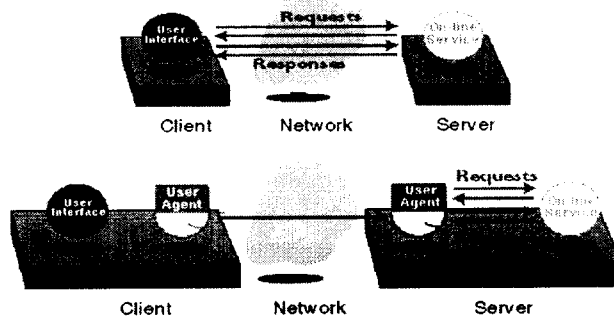
Electronic Shopping Mall





Telescript Shopping Agents (1 of 3)

Approach



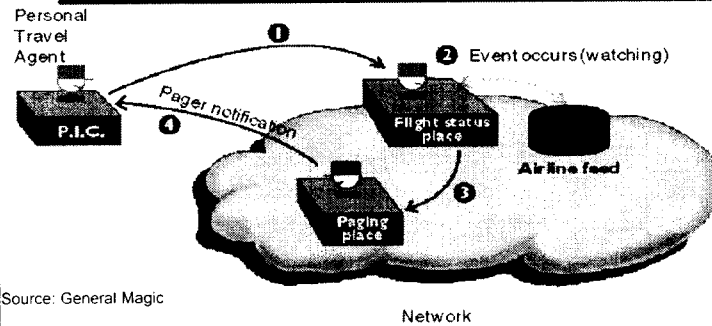
Source: General Magic

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Telescript Shopping Agents (2 of 3)

Agents Can Watch



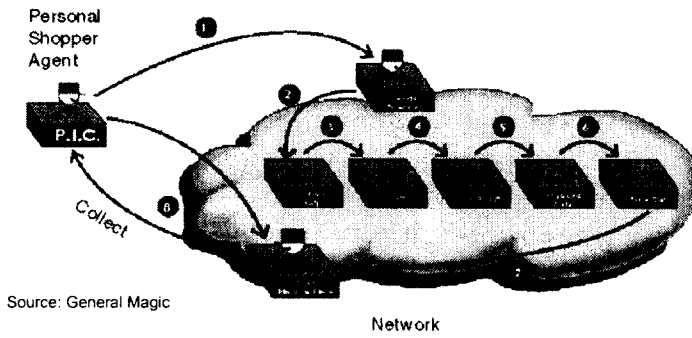
Source: General Magic

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Telescript Shopping Agents (3 of 3)

Agents Can Search



10

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Agent-Mediated Market

		Medium of Transaction			
		Manual		Agent-Mediated Market	
Nature of Product or Service	Standard	Search	High	Search	Low
	Communication	High	Communication	Low	
Evaluation	High	Evaluation	Low		
Unique	Search	High	Search	Low	
	Communication	High	Communication	Low	
	Evaluation	High	Evaluation	High	





Future Trends (1 of 2)

■ Past

- Providing directory or white page services; Providing passive information services.
- Stand-alone agent development
- Use of client-server architecture

■ Current

- Finding, retrieving, and integrating information from geographically distributed resources.
- Integrating advanced AI techniques (ex, Neural Nets, Genetic Algorithms, etc.).
- Collaborative agent development



Future Trends (2 of 2)

■ Future

- Developing standards for agent interaction (for agent negotiations)
 - The Knowledge Sharing Effort offers a promising direction for standardization, through its Knowledge Interchange Format (KIF) and Knowledge Query and Manipulation Language (KQML).
 - KIF: A set of translators between different knowledge representation languages.
 - KQML: A high-level protocol and language for agent communications (ex) evaluate, ask-one, ask-all, advertise, monitor, etc.
- Using more advanced machine learning techniques to perform pattern analysis on large amount of data (Data Mining).
- Integrating XML.

