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Approach of Intelligent Software Agents in Future Development

Jyoti tewari* *Computer science teerthankar mahaveer university India.*
swati arya *Computer science teerthankar mahaveer university India.*
prem narayan singh *Computer science teerthankar mahaveer university India.*

Abstract— Now a day's Internet is a major player in the area of communication, its security issues have become more important. Software agent technology is a rapidly developing area of research and probably the fastest growing area of information technology .New software technologies have been introduced which will make the Internet communication more secure. Software agents are one of such future technologies, which will have evolutionary effect on Internet communication and security. The agents are special software objects, which as an independent entity provide autonomous communication. They can be integrated to Internet system and used for making safe and secure communication. Intelligent Agents recurrently interact to share information and to perform tasks to achieve their goals. Without communication, different agents cannot know from each other that are doing what and how they can cooperate. Therefore communication is a must if we want to set up a useful multi-agent system using this agent's technology. This paper offers a prediction of future developments of Intelligent Software Agents.

Keywords— MAC, agents, ACL, Homogeneous Architecture, Heterogeneous Architecture

I. INTRODUCTION

The Intelligent software agents are a popular research object these days in such fields as psychology, sociology and computer science. Agents are most intensely studied in the discipline of Artificial Intelligence. Software agents have their roots in work conducted in the fields of software engineering; human interface research and Artificial Intelligence .Agents come in many different flavours. Depending on their intended use, agents are referred to by a variety of names such as assistant, transport agent, mobile agent, cyber agent, search agent, report agent, presentation agent, navigation agent, role agent, management agent, search and retrieval agent, domain-specific agent, packaging agent. The word agent is an umbrella term that covers a wide range of specific agent types. Most popular names used for different agents are highly non-descriptive. It is therefore preferable to describe and classify agents according to their exhibit specific properties.

"intelligent software agents" as basic building blocks for the development of new generation intelligent software systems triggered both theoretical and experimental computer science research aiming to develop new programming languages for agent systems.

Software agents differ from conventional software in that they are long-lived, semi autonomous, proactive, and adaptive. They define an agent as hardware or software based computer system that enjoys the properties: [2]

- **Autonomy**: agents operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state.
- **Social ability**: agents interact with other agents via some kind of agent-communication language.
- **Reactivity**: agents perceive their environment which may be the physical world, a user via a graphical user interface, a collection of other agents, the Internet, or perhaps all of these combined and respond in a timely fashion to changes that occur in it.
- **Proactiveness**: agents do not simply act in response to their environment; they are able to exhibit goal-directed behaviour by taking the initiative.

2. OTHER FEATURES OF AGENTS:

Depending on different usages of agents, they can have a lot of different features. Such features are classified as follows:

2.1. Mobility [2] – Agents can be static or mobile. Static agents are permanently located at one place, while mobile agents can change their location. When a static agent wants some action to be executed at a remote site, it will send a message to an agent at that location with the request for the action. In a similar situation, a mobile agent would transmit itself to the remote site and invoke the action execution. There are a lot of benefits from usage of mobile agents but if we wanted to get all of these benefits without a mobile agent, we would need a large amount of work and it would be practically impossible. The advocated utility of mobile agents is to support optimization of sophisticated operations that may require strong interactivity between components or special computing facilities as encountered e.g. in negotiation, network management and monitoring, and load balancing for scientific computing. Mobility of software agents is closely

related to the problem of code mobility in distributed programming with applications in operating systems and computer networks. Some problems related with mobile agents concern security and safety.

2.2. Size and Intelligence [2] –Agents can be of various sizes and can possess various amounts of intelligence. Generally, intelligence of a software agent is proportional to its size, and we can distinguish: big-sized, middle-sized and micro agents. It is difficult to make clear boundaries among these categories.

2.2.1. A big-sized agent occupies and controls one or more computers. It possesses enough competence to be useful even if it acts alone, without the other agents in MAS (multi agent system). A big-sized agent can be as big and as intelligent as an expert system with competences for expert problem solving, e.g. distributed medical care or plane ticket reservation.

2.2.2. A middle-sized agent is the one that is not useful without the other agents in MAS or without additional software. However, it is able to perform some non-trivial tasks. A user-interface agent that acts without other agents and performs some simple actions can also be classified as a Middle-sized agent. Mobile agents are usually middle-sized agents.

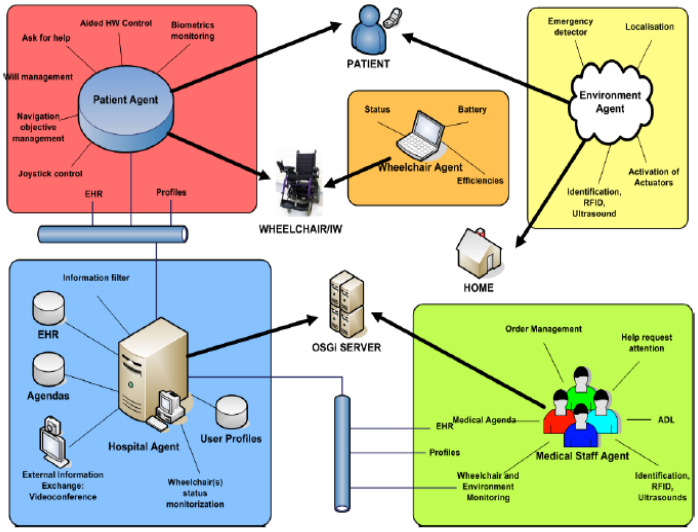

Fig.1 Agents in the distributed medical care [4]

2.2.3. Micro agents do not possess any intelligence.

2.3. Capability of Adaptation – Adaptive agents can adapt their behaviour to different Situations and changes in the environment. For example, a navigation system can adapt to changes in traffic (e.g. a traffic jam) and propose alternative routes. This makes adaptive agents more robust to non-predicted changes in a dynamic environment.

2.4. Learning ability- Agents can use learning capabilities for better performance. Learning can be done online, e.g. by data mining from data which are constantly collected through interaction with users. Offline learning refers to training processes (e.g. for pattern recognition) prior to productive agent usage.

3. Applications of Intelligent Agents:

The current applications of agents are of a rather experimental and ad hoc nature. Besides universities and research centres a considerable number of companies, are doing research in the area of agents.

Examples of this kind of agent applications are:

•Agents who partially or fully handle someone's e-mail.

•Agents who filter and/or search through (Usenet) news articles looking for information that may be interesting for a user.

•Agents that make arrangements for gatherings such as a meeting, for instance by means of lists provided by the persons attending or based on the information (appointments) in the electronic agenda of every single participant.

In application areas where now and in the future agent technology will be used. These areas are:

3.1. Systems and Network Management: In the Systems and network management is one of the earliest Application areas to be enhanced using intelligent agent technology. The movement to client/server computing has intensified the complexity of systems being managed, especially in the area of LANs, and as network centric computing becomes more prevalent, this complexity further escalates. Users in the area of primarily operators and system administrators need greatly simplified management, in the face of rising complexity. Architectures have existed in the systems and network management area for some time, but these agents are generally "fixed function" rather than intelligent agents. However, intelligent agents can be used to enhance systems management software. For example, they can help filter and take automatic actions at a higher level of abstraction, and can even be used to detect and react to patterns in system behaviour. Further, they can be used to manage large configurations dynamically.

3.2. Mobile Access and Management: As computing becomes more pervasive and network centric computing shifts the focus from the desktop to the network, users want to be more mobile. Not only do they want to access network resources from any location, they want to access those resources despite bandwidth limitations35 of mobile technology such as wireless communication, and despite network volatility. Intelligent agents, who reside in the network rather than on the users' personal computers, can address these needs by persistently carrying out user requests despite network Disturbances. In addition, agents can process data at its source and ship only compressed answers to the user, rather than overwhelming the network with large amounts of unprocessed data.

3.3. Mail and Messaging: Messaging software (such software for e-mail) has existed for some time, and is also an area where intelligent agent function is currently being used. Users today want the ability to automatically prioritize and organize their e-mail, and in the future, they would like to do even more automatically, such as addressing mail by organizational function rather than by person. Intelligent agents can facilitate all these functions by allowing mail handling rules to be specified ahead of time, and letting intelligent agents operate on behalf of the user according to those Rules. Usually it is also possible or at least it will be to have agents deduce these rules by observing a user's behaviour and trying to find patterns in it.

3.4. Information Access and Management: Information access and management is an area of great activity, given the rise in popularity of the Internet and the explosion of data available to users. Intelligent agents are helping users not only with search and filtering, but also with categorization, prioritization, selective, dissemination, annotation, and (Collaborative) sharing of information and documents.

3.5. Collaboration: Collaboration is a fast-growing area in which users work together on shared documents, using personal video-conferencing, or sharing additional resources through the network. One common backbone is shared resources; another is teamwork. Both of these are driven and supported by the move to network centric computing. Not only do users in this area need an infrastructure that will allow robust, scalable sharing of data and computing resources, they also need other functions to help them actually build and manage collaborative teams of people, and manage their work products. One of the most popular and most heard-of examples of such an application is the groupware packet called Lotus Notes.

3.6. Workflow and Administrative Management: Administrative management includes both workflow management and areas such computer/telephony integration, where processes are defined and then automated. In these areas, users need not only to make processes more efficient, but also to reduce the cost of human agents. Much as in the messaging area, intelligent agents can be used to ascertain, then automate user wishes or business processes.

3.7. Electronic Commerce: Electronic commerce is a growing area fuelled by the popularity of the Internet. Buyers need to find sellers of products and services, they need to find product information including technical specifications, viable configurations, etc. that solve their problem, and they need to obtain expert advice both prior to the purchase and for service and support afterward. Sellers need to find buyers and they need to provide expert advice about their product or service as well as customer service and support. Both buyers and sellers need to automate handling of their "electronic financial affairs". Intelligent agents can assist in electronic commerce in a number of ways. Agents can "go shopping" for a user, taking specifications and returning with recommendations of purchases which meet those specifications. They can act as "salespeople" for sellers by providing product or service sales advice, and they can help troubleshoot customer problems.

3.8. Adaptive User Interfaces: The user interface was transformed by the advent of graphical user interfaces (GUIs), for many, computers remain difficult to learn and use. As capabilities and applications of computers improve, the user interface needs to accommodate the increase in complexity. As user populations grow and diversify, computer interfaces need to learn user habits and preferences and adapt to individuals. Intelligent agents can help with both these problems. Intelligent agent technology allows systems to monitor the user's actions, develop models of user abilities, and automatically help out when problems arise. When combined with speech technology, intelligent agents enable computer interfaces to become more human or more "social" when interacting with human.

4. Future trends:

Agents will have a great impact; they will appear in everyday products as an evolutionary process. The most probable evolution will be that agents, initially, leverage simpler technologies available in most applications (word processors, spreadsheets or knowledge-based systems). After this agents will gradually evolve into more complicated applications. Developments that may be expected and technical matters that will need to be given a lot of thought are:

4.1 agent architecture / standards [1]: This is a very important issue. On a few important points are discussed are ACL (Agent Communication Language), is adopted and used by many parties as their agent communication language. ACL uses KIF (Knowledge Interchange Format) and KQML to communicate knowledge and queries to others. KIF and KQML are also used by many parties in general standards are slow to emerge, but examples such as HTML have shown that a major standard can emerge in two to three years when it is good enough and meets the needs of large numbers of

people another, related and equally important issue, is the agent architecture that will be pursued and will become the standard. There are two possible architectures that can be pursued, each of which has strong influences on required investments and agent system complexity has strong influences on required investments and agent system complexity.

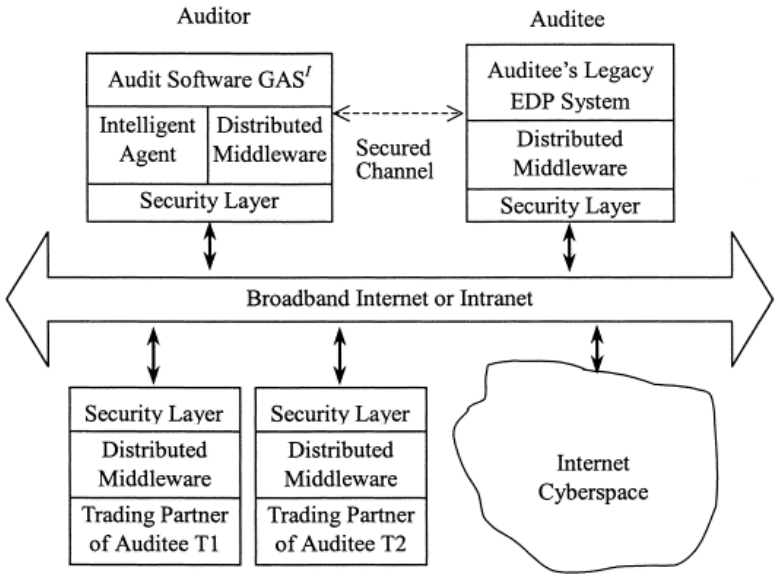

Fig.2 electronic data processing (EDP) systems on the internet in future trends. [4]

Homogeneous Architecture: there is a single, all-encompassing system which handles all transactions and functions. Most of the current agent-enabled applications use this model, because the application can itself provide the entire agent system needed to make a complete comprehensive system.

Heterogeneous Architecture: there is a community within which agents interact with other agents. This community model assumes agents can have different users, skills, and costs. There are various factors that influence which path of the developments will follow, i.e. which of these two types of architectures will become predominant.

4.1.1. The producer of the agent technique (used agent language) that has been chosen to be used in a homogeneous model: [3] this producer will have to be willing to give out its source code so others are able to write applications and use it for further. If this producer is not willing to do so, other parties will experiment with and start to develop other languages. If the producer does share the source code with others parties then these will be able to further elaborate the technique and develop applications of their own with it. In some situation, the most parties will chose to keep the source code to themselves, as they would not want to destroy this very profitable monopoly. This 'protectionism' of this producer, combined with findings of competition among parties will result in multiple alternative techniques being developed (i.e. lead to a heterogeneous architecture).

4.2.2. Interoperability requirements, the growing need to co-operate/interact with other parties in activities such as information searches. a homogeneous architecture would clearly make things much easier compared to a heterogeneous architecture as one then does not need to worry about which agent language or system others may be using. However, multi-agent systems - especially those involved in information access, selection, and processing - will depend upon access to existing facilities (called legacy systems). In the final analysis it is clear that this can only be done when using a heterogeneous agent model. Furthermore, agent systems will be developed in many places, at different times, with differing needs or constraints. It is highly unlikely that a single design will work for all.

4.2.3. the most important factor will be "user demand created by user perceived or real value". People will use applications that they like for some reasons. The architecture that is used by these applications will become the prevailing architecture, and will set the standard for future developments and applications. Although a homogeneous architecture has its advantages, it is very unlikely that all the problems that are linked to it can be solved. Although the agent architecture of the future may be expected to be a heterogeneous one.

4.2 Legal and ethical issues (related to the technical aspects of agents): [3] this relates such issues as:

4.2.1. Authentication: how can be ensured that an agent is who it says it is, and that it is representing who it claims to be representing?

4.2.2. Secrecy: how can be ensured that an agent maintain a user's privacy? How do you ensure that third parties cannot read some user's agent and execute it for their own gains?

4.2.3. Privacy: how can be ensured that agents maintain a user's much needed privacy when acting on his behalf?

4.2.4. Responsibility which goes with relinquished authority: when a user relinquishes some of his responsibility to one or more software agents (as would implicitly), he should be aware of the authority that is being transferred to it.

4.2.5. Ethical issues, such as tidiness, thrift (an agent should limit its consumption of scarce resources) and vigilance (an agent should not allow client actions with unanticipated results).

4.2.6. Enabling, facilitating and managing agent collaboration/multi-agent systems: in this work is to be done into the various aspects of collaborating agents.

4.2.7. Interoperability/communication/brokering services: How can these type services for locating engines or specific services are provided?

4.2.8. Inter-Agent co-ordination: this is a major issue in the design of these systems. Coordination is essential to enabling groups of agents to solve problems effectively. Coordination is also required due to the constraints of resource boundedness and time.

4.2.9. Stability, scalability and performance issues: these issues have yet to be acknowledged, yet alone tackled in collaborative agent systems. These issues are non-functional, they are Crucial nonetheless.

4.2.10. Evaluation of collaborative agent systems: Methods and Tests need to be developed to verify and validate the systems, so it can be ensured that they meet their functional specifications, and to check if such things as unanticipated events are handled properly.

4.3 Issues related to the User Interface [3]: Major issues are:

4.3.1. Determining which learning techniques are preferable for what domains and why.

4.3.2. Extending the range of applications of intelligent agents into other innovative areas (such as entertainment).

4.3.3. Demonstrating that the knowledge learned with interface agents can be truly used to reduce users' workload, and those users, indeed, want them;

4.3.4. Extending interface agents to be able to negotiate with other Peer agents.

4.4 Miscellaneous technical issues: There are many other technical issues which will need to be resolved, such as:

4.4.1. Legacy systems: techniques and methodologies need to be established for integrating agents and legacy systems.

4.4.2. Cash handling: how will the agent pay for services? How can a user ensure that it does not run and run up an outrageous bill on the user's behalf?

4.4.3. Improving/extending Agent intelligence: the intelligence of agents will continuously need to be improved/ extended in all sorts of ways.

4.4.4. Improving and extending agent learning techniques: can agent learning lead to instability of its system? How can be ensured that an agent does not spend too much of its time learning, instead of participating in its set-up?

4.4.5. Performance issues: what will be the effect of having hundreds, thousands or millions of agents on a network such as the Internet (or a large WAN)?

5. Conclusion

Intelligent software agents" as basic building blocks for the development of new generation intelligent software systems triggered theoretical computer science research aiming to develop aspects for the use in future technologies. It has many issues that need to overcome for the better approach of intelligent software agents in future development. So that in future trends intelligent software agents has a great impact in our communication medium.

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