

Software Agent Augmented Portals

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INTRODUCTION: CHALLENGES IN THE INFORMATION ERA

The Internet was designed to connect distributed networks. It, however, provides a new way for people to interact. Connectivity becomes an important need. People feel uneasy while *not being connected*. The challenge for connecting people from different locations introduced a new concept of accessing resources and capabilities/utilities, the portal. Web portals have been successful in providing basic connectivity, for example, file archiving. On top of this, users start to expect the availability of a larger variety of services, more intelligent services, and more affordable services. New challenges emerge, however, and Web portals have limited capability to address them. It needs a significant enhancement of the mechanism of how services are provided. The software agent paradigm is a technology that is good at high level modelling and good at offering flexible and intelligent services. It has exhibited great potential to augment portals for addressing the new challenges. This article will review and discuss how agent technology can augment portals to provide desirable services.

The rest of the article is organized as follows. The next reviews the challenges of Web portals. The Software Agent, an Intelligent Buddy section gives an overview of software agent technology. The Agent Augmented Portals section presents how agent technology can augment portal services. Finally we conclude the article.

WEB PORTALS AND THE NEW CHALLENGES

A Web portal is a Web interface where users are able to access certain resources and capabilities/utilities upon successfully identifying themselves. It is a gateway or access point of a (virtual) boundary where resources and capabilities/utilities are protected from the public. Yahoo (or eBay or Google) is an example of such a portal. Many people have a Yahoo account. Regardless of where the user is, after he or she has identified himself or herself with the username and password, he or she is able to access the resources: the repository of his or her emails, account, calendar and so forth, as well as the

capabilities: composing emails, deleting emails, forwarding e-mails, making a bid, uploading images, organizing events, editing resumes, and so forth.

Conventional enterprise information systems are located in local area networks or enterprise networks/campus networks. Staff need to be physically in the office to access the resources and capabilities/utilities. Web portals create a gateway to this closed world. Through the gateway, one is able to gain access to the resources and capabilities/utilities from any location. Many organizations have created their portals. For example, Victoria University has 14 campuses in Melbourne and a number of offshore campuses in different countries. Through a portal called myVU, students at any campus, or at home, are able to access their time tables, examination results, and lecture notes.

Although Web portal technology has achieved a great success for providing fundamental connectivity, it has limited capability to address many new challenges that have emerged. The following part of the section analyzes new challenges and difficulties that Web portals have to address.

1. **A Web Portal Only Provides Support to a Limited Range of Services:** Although the Web portal acts as a door open to the vast Internet, it relies on standard thin clients¹, for example Web browsers. The evolution of Web browsers is restricted by the slow progress in releasing of new standards compared to the evolution of the Internet. This mismatch implies that in the near future, support to browser-based applications will remain much weaker than that to desktop applications.
2. **The Interaction Model of a Web Portal is of Low Efficiency:** The Web portal however was originally designed for access, not for interaction. Inefficient interactions could cause a big loss to service providers, especially e-commerce providers. Auto response (interaction with a piece of program) is a widely adopted practice, because telephone-based customer service is expensive. Usually, a significant proportion of customers need to make a query, either because the standard searching function could not help, or they do not know how to make a customized search. Form-based interaction is a standard interaction model Web portals

provide. The Web portal processes the form submitted, directs the query to a customer service staff, who then provide the response to the e-mail address filled in the form. If the response does not answer the query well, another form is required to be filled!¹ When customers are surfing the Web, few would even fill the first query form and wait, for an uncertain period of time, for the response. Many e-commerce sites have experienced a loss of sales because customers could not have a fast enough response (Goldsborough, 2005).

3. **There is a High Cost to Provide a Service through Web Portals:** The Web portal, as the access point to Intranet services, has to be based on the integration (or at least a certain degree of integration) of existing services. The integration is at system level, which is expensive and time consuming. It also faces management barriers. The management overhead is especially significant for integrating medical information systems. Although patients' expectations are that the information services of different clinics and hospitals are integrated, their management is very cautious in integrating with others. Medical information systems are often close to each other (Kim et al., 2002).
4. **Web Portals Fail to Provide Services at a High Level:** Portals address the fundamental accessibility of resource and capability, which is normally at the system level. Or in other words, portals are data and function-oriented. While human users are goal-oriented. We need services at a conceptual or higher level, not at the system level.
5. **Portals are Connection-Oriented, not Task-Oriented:** Portals are introduced when the wired networks are the main connection media. In recent years, mobile devices become a main service platform. It requires that the access to portals is better service-oriented or task-oriented. For example, a tourist would like to have the information about good sightseeing around. The ideal way is to disconnect him or her first upon receiving the request and push the result back to his or her handheld device after the result is ready.
6. **Portal Service Faces the Information Overwhelming Problem as Well:** When portal services increase exponentially, locating the right service will be as difficult as what we have experienced in searching for information online. How can human beings obtain relevant information more efficiently? Human beings interact within communities. Besides browsing catalogues, people often ask colleagues or friends. If portal services could incorporate this mechanism, the quality of service can well be improved.
7. **A Portal is Good at Providing Fundamental Services, However, It has Limited Capability to Support Complex Services** (Kiessling, Fischer & Doring, 2004): B2B e-commerce is an area often involves

complex processes. Take the searching function of an e-procurement portal as an example, the product searching process is tedious and involves a lot of manual work. Due to the complexity and variety of the catalogue structure of products, the widely-used keywords searching is not suitable. It requires the user/customer to know exactly what he or she wants to buy. A higher level, more intelligent support is expected for providing complex services.

These challenges of Web portals show that it needs to be significantly enhanced. It should support intelligent, task/goal oriented services, with a brand new model of interaction. Software agent technology, as a new paradigm of software engineering and intelligence carrier, has shown a great potential to augment portals.

SOFTWARE AGENT, AN INTELLIGENT BUDDY

A software agent is regarded as a new paradigm for developing software systems (Nwana & Ndumu, 1999). It has been applied successfully in many areas including information collection/filtering, personal assistance, network management, electronic commerce, intelligent manufacturing, education, health care, and entertainment (Miao et al., 1999). It is also hailed as the new revolution and most promising technology to be used in the new millennium (Kendall et al., 1998). Many popular software systems now contain software agents. To name a few, Microsoft Office, Google Desktop, and most of the antivirus software.

An essential difference between a software agent and a conventional object is that objects are passive while agents are active, or proactive. Namely, we are able to operate an object for a purpose and the object has to behave accordingly. On the other hand, we are not able to operate an agent. An agent has its own thread of control. It is alive (the thread exists in the process until the agent terminates, as compared to object method, such a thread does not normally exist) and has its own *thought* (each thread executes its code independently, normally with a certain form of logic as its knowledge and the corresponding reasoning algorithm.) Other parties (users through interface or other agents in the system) have to *ask* an agent to work for a task. The agent will decide whether or not it will follow, and how it would achieve the goal.

More technically, the method of any object is free to be invoked by any other object in the system that has the access. That is to say, the behavior of the object is controlled by the calling object. For example, a *public method* of an object can be invoked by any other objects in the system. This mechanism works well for simple imperative systems, but not for complex intelligent systems. An agent however, has its own thread of control. The only approach available

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