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How Regular Business Has Becomes Mobile Business. A Mobile Agent Approach

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Abstract

The age of static business and slow information flow, when most decision was based on day-or week-old data, has come to an end. Now new technology helps organizations provide a more agile, flexible approach to business that was not technologically available five years ago. As a result, organizations are paying more attentions to supporting business process with the ability to adapt to the dynamic environment. This paper describes how the action of mobile agent enabled decision support in conjunction with the organizational trends, enables new practice in the field of e-Business. This is done to understand the magnitude of the e-business context problem and to suggest possible ways around the problem when building mobile agents. Therefore, a mobile agent approach is proposed in this paper to offer solution for mobile business and to manage complex business activities.

Key words: mobile agent, mobile technologies, mobility, business
JEL Classificiation: **M21**

1. INTRODUCTION

With the availability of improved wireless devices, better software, and broadening global-wireless infrastructure, companies world-wide are urgently pursuing mobile capabilities. Real-time adaptive processes are becoming the norm, and deploying mobile-business infrastructure is now essential for cost cutting and increasing employee productivity.

In short, the business world has become mobile. Mobile agents are currently a hot topic in the domain of e-business. Mobile agent technology can help to design innovative solutions in this domain by complementing other approaches, and improved network and data-management possibilities. In this paper we describe briefly a system that uses mobile agents to support mobile business for mobile computers.

An agent is a program that is autonomous enough to act independently even when the user or application that launched it is not available to provide guidance and handle errors. According to the specialists' opinion, the intelligent agents represent a new type of logicians, specialized. Taking into consideration their multiple abilities in progress, we

can assert that the intelligent agents will constitute one of the most attractive business opportunities (Wang, 2004:11).

A mobile agent is an intelligent agent that can move through a heterogeneous network under its own control, migrating from host to host and interacting with other agents and resources on each, typically returning to its home site when its task is done (Steffen, 2002:10). From a conceptual standpoint such mobile agents can also be regarded as itinerant, dynamic, wandering, roaming, or migrant. The rationale for mobility is the improved performance that can sometimes be achieved by moving the agent closer to the service available on the new host. From example, if an agent wants to obtain information from several sources on different platforms, it could send information requests to each of the platforms using the equivalent of a remote procedure call. However, if the volume of information exchanged with the remote site is large, issues of traffic and bandwidth must be considered. Also, the agent might be able to process the remote data more effectively than those services offered at the remote site. In either or both of these cases, relocating the agent to each of the various platforms could be a more efficient way of processing.

We argue those mobile agents are a good paradigm for the context of mobile business and an excellent paradigm when mobile computers are involved.

2. HOW REGULAR BUSINESS HAS BECOMES MOBILE BUSINESS

In the business world, the e-business notion together with the notion of business intelligence and mobile business, are familiar terms, and already known by everybody. All these new technologies represent a new way to manage through electronic interconnection in an efficient and innovative way. Two key technologies, the Internet/Web and mobile communications, are transforming the way we contact business. Over the past few years, there is a tremendous effort in developing appropriate business models and technologies that will utilize these new technologies for business. Most of the current approaches work well with only one of the two.

The ability to manage employee time and expense data quickly in this fast-paced age of increasing mobility is critical. In this context, mobile workers are constantly on the move-and moving faster than ever-to provide more services, make more contacts, and generate more revenue. To do any less would give the competition an unfair advantage. A natural result of this increased mobility is a greater difficulty to keep track of employee working times and expenses. This is particularly the case at the companies with limited infrastructure in place to record information from the field, integrate it with main IT systems and send data back to mobile workers. Too often, excess time is spent on administrate tasks, the quality of data is poor, and customer service suffers.

Healthy business depends on the regular receipt of critical data from the field and its input into back-end financial and human resources systems. It is vital that these processes run smoothly and efficiently, all the time.

The Mobile technologies offer opportunities and benefits to business through some devices (cell phones, PDA-personal digital assistant, pocket PC, laptops, digital projectors, IRV/voice portals, smart phones) which support a variety of interfaces and specific accessories. The increased use of the mobile technology led to the growth of mobile solutions demand and to their integration into the business processes. In this way, we can show a series of elements which competed into the transformation of the usual business into a mobile one:

- synchronized access, in real time to data, rates and information in the company;
- an efficient management of meetings, calendar, business contracts, folders;
- the reduction of the operational costs;
- selling efficiency due to mobile access at any time and place;
- applications can be easily and rapidly accessed no matter the space or time using a corresponding mobile device;
- the mobile applications offer the possibility to accomplish offline transactions and to synchronize them later.

Businesses must accelerate the flow of information, analysis and decision making in order to be more responsive to fast-moving events. This business requirement will drive the augmentation of schedule-based technologies with event-based technologies - i.e., event-based business intelligence (Lawton, 2006:5). Business intelligence solutions typically offer the ability to analyze quantitative data and produce information that monitors business performance. The analyses may be summaries or drill downs that present details on subsets of data.

More broadly, business intelligence can include any information, such as articles and reports, which offers insights into an industry or company. Usually, quantitative data and text information are considered separately, but now quantitative analysis is being paired with information in text form to achieve a deeper understanding than either can provide alone.

3. RELATED RESEARCH

Research within agent-technologies usually explore different lab related studies regarding how to cope with the vast information overflow, using mobile agents mainly based on different rules-based mechanism.

Mobile agents are an effective choice for many applications, for several reasons, Lange and Oshima, including improvements in latency and bandwidth of client-server applications and reducing vulnerability to network disconnection. Although not all applications will need mobile agents, many other applications will find mobile agents the most effective implementation technique for all part of their tasks. (Lange, 1999:4)

Kotz D. and Gray R. note that “we believe that current trends in Internet technology and usage lead to the use of mobile agents, several technical and non-technical hurdles must be addressed along the way. These hurdles represent significant but not insurmountable challenges ….. (Kotz, 1999:3)

Many researchers extend the mobile-code concept to the mobile objects, in which an object (code and data) are moved from one host to another. The mobile-agent abstraction extends this notion further, by moving code, data, and a thread from one host to another. (Alagar, 2004:1) (Odell, 2005:8)

Others have specifically suggested using mobile agents in mobile-computing environments. Samaras, Evripidou and Pitoura propose a framework for agents to interact with heterogeneous mobile database, but they focus on database consistency issues more than communication and transport issues. Mobile agents provide an efficient platform for distributed dynamic processing which works equally well with both the fixed and wireless networks (Samaras, 2000:9).

Recently there are many mobile agent systems based on several slightly different semantics for mobility, security and communication. Researchers now need to begin to distil the best of these ideas from all of the proposed approaches and identify the situations where those approaches best apply.

4. MOBILE AGENT ACTION. CASE STUDY

Along the years many toolkits with mobile agent have been developed, even if this thing was implied a great research volume done by the software developers due to an increased lack of co-ordination among similar projects. The same area specialty literature faces different interpretations of the basic concept for the mobile agents. For instance:

- What a mobile agent should do from the program developer’s point of view: to implement a certain type object which should define several basic functions for the mobile agents such as: the communication and the migration, or to use any series-type object?
- What level of communication is necessary: a simple one among the agents that belong to the same agency or a complex one that allows long distance communication?
- What security level is necessary: one which protects the hosts against some malicious agents, or one which should protect the agents also against the malicious agencies?
- What kind of mobility is necessary?

Sometimes even the most general research idea cannot be applied for another toolkit by the mobile agents because of the differences between the basics concepts. Another obstacle is the number of different protocols of migration which exist nowadays. With the

exception of two toolkits (Aglets and Grasshopper) that support the emigration protocol MASIF suggested as standard, it is practically impossible to make two toolkits inter-operational.

4.1. Background

In operation with the implementing of the great number of prototypes, few of these have been developed as mobile toolkits which could be used as applications on an industrial level. There are developed as monolithically systems, with a great number of functions and they are difficult to make configuration and usage. It is almost impossible to modify and extend such systems to use them successfully in any type of scenario of software application.

To solve this situation, one of the most important challenges was that through Tracy project to develop a new model of architecture as basic for other mobile toolkits. In the same way Tracy can be adapted for domains of diverse applications. One can make Tracy configuration on software specifications and hardware also. If a certain plug-in is not necessary, one can skip this. In this way the quantity of necessary resources to rule an agency is diminished. The Tracy architecture offers support to place a mobile agent on other devices, because the services that are not necessary can be taken out while working. The code reusing is also supported. Tracy offers the following plug-ins in the basic configuration:

- Agency Shell – to communicate towards an agency through a textual interface;
- Agent Launcher - to start the agents automatically during the Tracy working process;
- Domain Manager - to create a logical network of agencies, in which the agents can communicate with the similar agencies;
- Message - for inter-agencies communication;
- Migration / for the agents mobility, using the Kalong component;
- Place – for the agents to know their working environment;
- Survival – to start the agents at a certain time span.

4.2. Case description

In this section we shell present examples of Tracy agents to show which interface should be implemented and which methods should an agent provide in order to be executed as a Tracy agency. Our study case consider an independent traveling salesperson carries a laptop when visiting customers and uses software that helps to select vendors and products and to place orders. Agents represent orders and travel to the corporation's computers where they interact with billing, inventory, and shipping agents to arrange for

the purchase. Agents are also used to explore vendor catalogues and search for products that meet the customer's needs.

Using mobile agent application, mobile employees can enter data about work performed, business trips, and related expenses into a laptop and upload it later to main system. This mobile solution provides efficiency and data accuracy and it accelerates complex processes in areas such billing and financial accounting.

For the proposed study case the followings two plug-ins are used: Survival – used by an agent to program its execution and Agency Shell – used by an agent to send messages to the user it upholds.

Next we consider that both plug-ins have been correctly installed (their JAR folders are stocked in the plug-ins directory and the Agency Shell plug in has been configured upon the previous instructions.

The Tracy agents need to implement the java.lang.Runnable interface which is basic interface for JDK and which defines only a run method, without parameters and returned value. This is the only interface that any stationary agent soft can implement. In Tracy we cannot distinguish differences among types or classes of agents as in other toolkits by the mobile agents. Tracy does not define commune classes for the software agents which provide access methods to services. If we want to programmer mobile agents, the Agent class should implement the interface java.io.Serializable which ensures that the agent object can be transferred in a stream.

Now let's enter into further details to start an agent. After the agent's class has been initiated, the agent's execution will be done through the run method. As the software agents are active and work autonomously, each agent is attributed a control thread from the thread group. An agent is not at the same level with the thread, does not passes the same thread for its life duration, but it is executed as thread as long as it is active. After the run method has been finished, the agent could close or pass in the waiting condition.

The two conditions, running and waiting, but also the ways in which they change are important things to be known about the agent's life cycle. After the run method of the agent which finished the execution, the agency should determine if the agent is set in waiting condition or not, after that it can be deleted from the agency. The rule is very simple: if the agent is registered by a service, then the agent is set in the waiting condition, otherwise it is deleted immediately. When the agent is in the waiting condition it is just a passive object which waits to be active again. Because it does not need an active tread of control in this condition, the thread is given back to the thread group and can be reused to execute other agents.

The run method is the only obligatory method which the agents' class needs to implement. It defines the agent's behavior; this means the complex control of the flux inside the agent's thread. So this method is the only starting point for the agent. In Tracy the agents are usually started several times along their existence. This thing makes it

special from other toolkits of mobile agents where the main method of the agent is called just once. In Tracy an agent exchanges frequently the running and waiting conditions.

5. CONCLUDING REMARKS

The success or the failure of an organization depends on its ability to incorporate the new concepts, to assimilate the advanced technologies from e-business, business intelligence, mobile business, and to obtain advantages from the evolution of the whole: processes- the information technology.

There is a stronger case for the use of the mobile agents in many mobile business applications. Moreover, there is a clear evolutionary path that will take us from current technology to widespread use of mobile code and agents within the next years. Once several technical challenges have been met, and more and more sites install mobile agent technology, use of mobile agents in a business context will expand rapidly.

Mobile agents offer solutions to help companies for extend their existing applications beyond traditional way to make business, so they can reach any user, anytime, anywhere. Applications of mobile agent can provide the answer for companies that use mobile technologies and seek to support mobile business.

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