The Future of Mobile Banking

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Abstract: The mobile banking involves the use of some mobile telecommunication devices (such phones or PDAs – Personal Digital Assistants) in order to complete, in a secure manner, banking transactions (like payments, transfers, account information and so on). It does not matter where the user is physically located. Also, the hour when the services are requested is not important anymore, because, thanks to the internet banking, the offices are virtually opened 24 hours per day.

The future of mobile banking could be represented by applications that support mobile, Internet banking and EFT (Electronic Funds Transfer) transactions in a single user interface. In such a way, the mobile banking will be able to cover all the types of applications demanded at the market level.

Introduction

The most popular payment methods available for the customers from our days are described below:

a) traditional methods – like cash in advance, cash on delivery, bank transfers and payments – can be used to pay for goods purchased from classical stores or from e-commerce websites by orders placed over the Internet. In this last case, the payment and delivery are made in the conventional way, only the order is placed using the Internet;

b) electronic methods – involve e-payment, e-banking, mobile banking, electronic funds transfer, e-check, e-cash, smartcards and so on. The transactions are completed in a secure manner by using the encryption.

Basically, an electronic payment system involves the use of a digital financial instrument that allows the money exchange between the buyer and the seller. Security of banking payments methods becomes a huge potential problem.

The most important barriers in developing the electronic payment systems are the following:

- incomplete legal infrastructures regarding the card transactions and the lack of a framework involving the fraud by using stolen or lost credit cards;
- underdevelopment of the credit card industry in some countries;
- the existence of the explicit consent – a transaction cannot be considered as being valid until the owner of the credit card is physically signing on a specific receipt;
- the cash payments are preserving the anonymity, while the electronic payment systems not.

The major players of a successful e-commerce business are the following:

- seller – it should have a website with specific capabilities and an Intranet network to be used to quickly process the orders;
- customers – consumers having Internet access and owning credit cards to be used for payments. These customers should accept the idea of buying an item by seeing its pictures and reading about its features but without actually inspecting it;
- transaction partners – financial institutions that are able to process electronic funds transfers and the credit card payments;
- international express, overland transport and air freight companies – are moving physical items form the seller to the buyer;
- authentication authorities – they guarantee the security and the integrity of the transactions;
- government – it provides the legal framework for the e-commerce activities and also it protects the customers from fraud;
- Internet connection – reliable infrastructure and access packages not based on the time spent or on the traffic performed.

Internet Banking (known also as online banking) allows performing transactions and payments over the Internet through a bank's secure website. This can be very useful, especially for banking outside bank hours (which tend to be very short) and banking from anywhere where internet access is available. In most cases a web browser is used (such as *Internet Explorer*, *Mozilla Firefox*, *Opera*) and any regular internet connection is suitable. No special software or hardware is usually needed.

The *e-banking* is very similar with Internet banking but the customers are using a dial-up connection and a modem in order to setup a connection with the bank.

Grid Computing

Grid computing represents a new evolutionary level of distributed computing. It tries to create the illusion of a virtual single powerful computer instead of a large collection of individual systems connected together. These systems are sharing various resources like computing cycles, data storage capacity using unifying file systems over multiple machines, communications, software and licenses, special equipments and capacities.

The use of the grid is often born from a need for increased resources of some type. Grids can be built in all sizes, ranging from just a few machines in a department to groups of machines organized in hierarchy spanning the world. The simplest grid consists of just few machines, all of the same hardware architecture and same operating system, connected on a local network. Some people would call this a cluster implementation rather than a grid. The next step is to include heterogeneous machines but within the same organization. Such a grid is also referred to as an *intragrid*. Security becomes more

important as more organizations are involved. Sensitive data in one department may need to be protected from access by jobs running for other departments. Dedicated grid machines may be added to increase the service quality. Over time, a grid may grow to cross organization boundaries and may be used for common interest projects. This is known as an *intergrid*.

The easiest way to use a grid is to remotely run an application on a different computer than the one on it is usually executed. If the computer that usually runs the job is busy, it can execute the application on another idle machine from the grid network. The remote machine must meet hardware, software and resource requirements of the application. Desktop machines from most organizations are underutilized because they are busy less then 5% of time. Grid computing is able to increase the resource usage efficiency because it could be obtained a better balance of resource utilization. If an application is grid enabled it could be moved to an idle computer from the grid whenever the host computer is busy.

The next picture (figure 1) shows how the application parts are concurrently executed over a grid network.

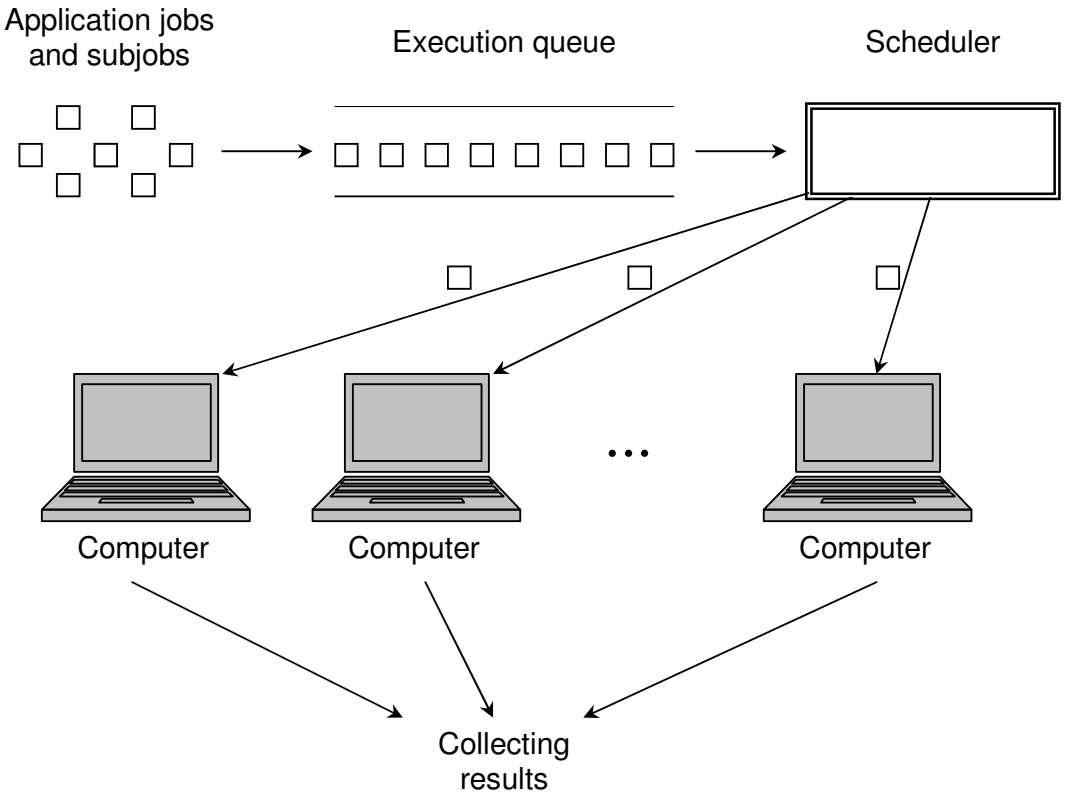

Figure 1 – Running an application in a grid network

If an application is written to use algorithms that can be divided into independent pieces, each part could be executed on a different machine in the grid. This is why the grid computing offers a high potential for massive parallel CPU capacity. This huge computing power obtained by the use of the grid is driving a new evolution in various industries like financial modeling, oil exploration, bio-medical field and so on. Scalability is the measure of how efficiently the grid processors are used. A perfect scalable application will finish *n* times faster when it uses *n* times the number of processors. It is very hard to achieve the perfect scalability. The limits of scalability are called barriers. An example of such a barrier is the situation when an application can be split only into a limited number of independent

parts. Not completely independent parts and communications between jobs are barrier examples because they limit the scalability.

Mobile Banking Fundamentals

The very quick development of the mobile devices allows the banking transactions to be performed through mobile phones and *PDAs* (*Personal Digital Assistant*). This is called *mobile banking* and implies the existence of some dedicated services. An example of a *PDA* device having an incorporated card reader is presented in the picture below (figure 2).

It does not matter where the user is physically located. Also, the hour when the services are requested is not important anymore, because, thanks to the internet banking, the offices are virtually opened 24 hours per day.

The service can be requested anytime by a user located anywhere. Customers do not need to go to the bank office and also there is no need to access a computer having an Internet connection in order to perform the banking transactions.

Figure 2 – Wireless PDA having a magnetic card reader incorporated

Other applications of mobile banking are connected with different financial services like online brokers, online banks, wealth managers, stock trading and so on.

Today, the mobile banking is based on dedicated services offered by the telecommunication operators. Some systems are using *SMS* messages exchange but others involve smartcards that store the details of the accounts that are used. The security of these transactions is one of the most complicated challenges that need to be addressed.

Of course, the mobile banking has some limitations. Customers cannot access accounts that are not assigned with their smartcards and they cannot pay at the supermarket by using the phone, for example.

The number of user accessing the mobile banking is growing faster from one year to another. The use of the *3G* mobile networks will generate the development of more sophisticated services involving multimedia.

In the last years, the banks invested o lot of money to develop Internet banking systems. Now, they need to adapt to the market and to offer to the users mobile banking solutions in the shortest possible time.

Security of banking transactions performed over the Internet becomes a huge potential problem. A very good method that can be used to protect a private network is the implementation of a firewall between Internet and Intranet. This firewall will filter the packets that transit the network according with the security policy defined at the system

level. The *SSL* protocol allows verifying the identity of a *WEB* server based on a digital certificate issued by a certification authority. Secure data transport over the Internet is done by using encryption methods.

The Future of Mobile Banking

The future of mobile banking could be represented by applications that support mobile, Internet banking and *EFT* (*Electronic Funds Transfer*) transactions in a single user interface. In such a way, the mobile banking will be able to cover all the types of applications demanded at the market level.

The *EFT* transactions are basically performed by using a dedicated device that is able to read a bank card. The user enters the *PIN* code by using a secured *PINPAD*. The *EFT* terminals are permanently connected to the bank by using dedicated wired phone lines.

By creating applications that are able to join online banking with *EFT* ones, the mobile banking will become very attractive for big retailers (like hypermarkets and supermarkets) because they will not need to invest so much money in the infrastructure (wires, cables, dedicated lines and so on). The customers will be able to pay by the credit cards using mobile devices (*PDAs*) located at the payment points and connected with a dedicated bank server by using the Internet.

All the requests by this type will be processed by specialized bank servers. If the expansion of the mobile banking will grow faster, the banks will have huge problems in processing the incoming requests generated by the mobile systems. The dedicated servers will need to complete very fast a huge number of the transactions but in a secure manner. In order to achieve very good response times, the servers could dispatch the transactions in the bank Intranet by implementing a grid network of workstations.

The use of a grid network is an economical and convenient solution because it is based on existing resources (computers located in the Intranet of the bank) that are not 100% used during the day. Their idle times could be used to process bank transactions generated by the mobile devices. Once a transaction is processed by a workstation, an answer is sent back to the server and the mobile device will receive a message containing the result of the transaction processing. Also, the parallel processing of the transactions will guarantee very quick and accurate responses even if the number of concurrent requests has a very large value. This is why grid processing can definitively contribute to the expansion of the mobile banking.

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