Mobile Communications Client Server System for Stock Exchange e-Services Access

E. Pop, and M. Barbos

Abstract—Using mobile Internet access technologies and e-services, various economic agents can efficiently offer their products or services to a large number of clients. With the support of mobile communications networks, the clients can have access to e-services, anywhere and anytime. This is a base to establish a convergence of technological and financial interests of mobile operators, software developers, mobile terminals producers and e-content providers. In this paper, a client server system is presented, using 3G, EDGE, mobile terminals, for Stock Exchange e-services access.

Keywords—Mobile communications, e-services access, stock exchange.

I. INTRODUCTION

DATA transmission through mobile networks became very attractive for many economic agents, in business environment, for offering electronic services to their clients. The client server system presented in the paper offers to the mobile users 3G, EDGE, GPRS and WLAN possibilities for electronic services access, through mobile data terminals like Smartphones and PDAs. As a representative example for business environment, a stock market electronic service is installed on the server. The information was taken over from the Romanian BSE -Bucharest Stock Exchange. The client server functionality can be extended for various informational services: e-commerce, mobile-banking, location based services, e-citizen, etc, directly on site, or by URL links to other addresses.

The main components of the system are a WEB service, a server database, and mobile applications. The users can have access and consume the e-services, with the aim of mobile Internet. The 3G mobile communications networks give the users the mobility advantage and significant bandwidth. The server software can be hosted at the digital content provider locations.

Data transfer is achieved using TCP/IP protocols through 3G, EDGE, GPRS and WLAN channels. Suitable graphical user interfaces are provided to the clients.

The server site stores the electronic content of the service and uses multiple access Smartphones and PDA terminals, for data transmission.

The system architecture can be a distributed one, including various sites for different e-services. The system user is also

provided with downloadable mobile applications, ready to be installed on mobile terminals, as an executable file.

There are possibilities to integrate API resources in the system, like e-parlay type Network Resource Gateway modules.

II. SYSTEM ARCHITECTURE

A. Hardware Architecture

The client server hardware architecture is adapted for data transmissions on various mobile channels. The platform server consists of an IBM PC compatible computer, Core2Quad, 2,8 GHz, with Windows XP Professional operating system and Internet connection.

The mobile data terminals at the client side are:
-SE P990i Smartphone, with Symbian v. 9.1. operating system;
-QTEK 2020i, or HTC TyTN, Personal Digital Assistant, with Windows Mobile 2003, 2005, operating system;
-Laptop, Core2Duo 2 GHz, Ethernet interface, with Windows XP Professional or Vista OS;
-3G, EDGE, GPRS, WLAN, or CDMA data transmission modems for mobile connection of the laptop to the Internet.

B. The Server Software Structure and Functions

Several server software modules are developed, for service access using laptop, Smartphones or PDA;
-the electronic service site;
-the stock market exchange web service;
-server database for e-service information storing;
-server application, installed in the operating system;
-client applications, suitable for mobile data terminals;
-server software applications, for mobile connections requests serving, and TCP/IP data transmission.

The client software applications are available on the server, for downloading and installing in the adequate mobile terminals of the user: Smartphones and PDA.

C. The Mobile Client Software Structure and Functions

The software structure of the mobile client, for e-service access using laptop, Smarphones and PDAs consists of:
-interfaces for 3G, EDGE, GPRS, WLAN mobile networks attaching, [4];
-data transmission software modules, using TCP/IP;
-database query transmission to the server;
-the IP address of the server computer is specified in the code, or introduced in the suitable text field;
-the requested information is received from the server and

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displayed in the adequate text field;

-the GUI - Graphical User Interface of the mobile client applications give the mobile user the possibility to execute specific queries.

For e-services client access using Smartphones and PDAs, the WEB service functions are included in suitable software modules, developed for these types of terminals.

III. TECHNOLOGY DESCRIPTION

A. Server Application Development

In order to implement and publish the e-service site on Internet, the following tools are used:

-HTTP application server IIS 5.1;

-DNS installed on a server of the local network.

-Microsoft Visual Studio 2008, ASP.NET, VISUAL C#;

-.Net Framework 3.5;

- Adobe Dreamweaver CS3;

-MySQL server for storing the e-content of the service;

-PhpMyAdmin tool, for developing and administrating the database of the service;

-HTML language, using the Get, Head, Post, Push, Put functions, for data transfer;

-Php language for the project site developing.

The server database was created in the following steps:

-starting the IIS service in the PC's Windows XP OS;

-in PhpMyAdmin folder, the index.php file was opened in a web browser;

-logging as a "root" user, with suitable password, for security reasons, to access the application main interface;

-defining a new database using Create new Menu.

-embedding the scripts in Php type files and can be accessed directly on the site, as web pages.

B. The Client Software Applications Development Tools for Sony Ericsson P990i

The client server system can use various mobile telephony terminals. Adequate tools must be used to develop client applications, according to the SDK GUI platform and the mobile phone operating system [1].

In case of SE P990i Smartphone, the following tools, installed on a Windows XP OS PC are used, [2]:

-the UIQ 3.0 SDK GUI platform, for Symbian 9.1, [3];

-the CodeWarrior Professional 3.1 IDE, based on C++ language, for object oriented programming, compatible with UIQ 3.0 SDK, ;

-ActiveSync utility software, for transferring the SIS file, from PC in the Smartphone's internal or card memory, through USB cable or by Bluetooth connection.

The UIQ 3.0 SDK software design components are:

-a phone emulator, compatible with Windows OS PC;

-header files and libraries for running the application on emulator and on the real ARM processor;

-a GCC-E and WINSCW compiler and tools for UREL type build target developing and transferring the application on the phone [5].;

-specific documentation and Symbian OS libraries [6].

C. The Client Software Applications for QTEK 2020i PDA

In order to develop client applications and WEB service interfaces for QTEK 2020i, PDA, Phone Edition, running Windows for Mobile 2003, the following tools are used: .NET Compact Framework SDK libraries, MS Visual Studio 2005 IDE, installed on Windows XP Professional, Active Sync 4.0 or later, for PC connection.

IV. THE STOCK EXCHANGE E-SERVICE

A. The Client Server System's WEB Service

The WEB service is developed to offer to the clients stock exchange market information. Besides, the web service is also a public software interface, which can be accessed through the Internet, by suitable mobile client applications. The WEB service offer to the client fourteen WEB methods. which allow the mobile clients to:

-realize web transactions, following the evolution of Bucharest Stock Exchange market quoted societies;

-create, administrate of user accounts, available on the server, which permit stock-exchange market demo transactions;

-processing the orders placed by users with the maximum delay of 15 min.

A standardized description of operations and supported web service data types is published and is accessible on the main server in the form of a WDSL - Web Services Description Language - file. Through the web service the platform provides, to the client software developers, the possibility to integrate stock exchange market information in their own applications, using standard tools, instruments and protocols.

The stock market exchange data upgrade operation is done through the BSE information resources access, at the market's closing moment, when the current day transaction reports are published.

The database contains several societies, currently listed at the stock's first category. The database can be accessed in two modes: by WEB service and through PHP scripts, containing the SQL queries. The database is continuously updated, by an adequate software module. The query protocols used by the web service methods are: Soap 1.1, 1.2, Http Post, Get.

The New Account Statement method of the WEB service will be presented in the following, as an example. This method allows the client to open user accounts, in order to utilize the interactive components of the web service - fig. 1, 2, 3 and 4. An e-mail address must be also specified by the client. The New Account statment operation will be recorded, and will have effect in the local database. Automatically, an e-mail message will be transmitted to the client, comprising the account data, UserId and Password.

The method's input variables, that must be provided by the user for invoking, are the personal data: name, adress, country, town, zip code, telephone number, e-mail, etc.

The output variable is an Account class object, whose member variables comprise the user account data. In the following, the general SOAP 1.1., SOAP 1.2, HTTP GET, HTTP POST query format, for this method is presented. The

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example contains the method's query and the answer. The marked parameters must be replaced with normal values.

```
POST /webservicemobacces/service.asmx HTTP/1.1
Host: serviciimobacces.ipa.ro
Content-Type: text/xml; charset=utf-8
Content-Length: length
SOAPAction: "http://microsoft.com/webservices/ContNou"

<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Body>
   <ContNou xmlns="http://microsoft.com/webservices/">
    < StringsDefinition >string</ StringsDefinition >
   </ContNou>
  </soap:Body>
</soap:Envelope>
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Body>
   <ContNouResponse
xmlns="http://microsoft.com/webservices/">
    <ContNouResult>
     <StringsDefinition>string</StringsDefinition>
    </ContNouResult>
   </ContNouResponse>
  </soap:Body>
</soap:Envelope>
```

Fig. 1 The SOAP 1.1. general query and response format

```
POST /webservicemobacces/service.asmx HTTP/1.1
Host: serviciimobacces.ipa.ro
Content-Type: application/soap+xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<soap12:Envelope
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap12="http://www.w3.org/2003/05/soap-envelope">
  <soap12:Body>
   <ContNou xmlns="http://microsoft.com/webservices/">
< StringsDefinition >string</ StringsDefinition >
   </ContNou>
  </soap12:Body>
</soap12:Envelope>
HTTP/1.1 200 OK
Content-Type: application/soap+xml; charset=utf-8
```

```
Content-Length: length
<?xml version="1.0" encoding="utf-8"?>
<soap12:Envelope
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap12="http://www.w3.org/2003/05/soap-envelope">
  <soap12:Body>
   <ContNouResponse
xmlns="http://microsoft.com/webservices/">
    <ContNouResult>
< StringsDefinition >string</ StringsDefinition >
    </ContNouResult>
   </ContNouResponse>
  </soap12:Body>
</soap12:Envelope>
```

Fig. 2 The SOAP 1.2. general query and response format

```
GET
/webservicemobacces/service.asmx/ContNou?Nume=string&
Preume=string&Tara=string&Oras=string&Judet=string
&CodPostal=string&Adresa=string&Telefon=string&Ema
il=string HTTP/1.1
Host: serviciimobacces.ipa.ro
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<ContCreat xmlns="http://microsoft.com/webservices/">
< StringsDefinition >string</ StringsDefinition >
</ContCreat>
```

Fig. 3 The HTTP GET general query and response format

```
POST /webservicemobacces/service.asmx/ContNou HTTP/1.1
Host: serviciimobacces.ipa.ro
Content-Type: application/x-www-form-urlencoded
Content-Length: length

Nume=string&Preume=string&Tara=string&Oras=string
&Judet=string&CodPostal=string&Adresa=string&Telefo
n=string&Email=string
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<ContCreat xmlns="http://microsoft.com/webservices/">
 <UserID>int</UserID>
 <Password>string</Password>
 <DataCreare>dateTime</DataCreare>
</ContCreat>
```

Fig. 4 The HTTP POST general query and response format

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V. RESULTS

The system client software applications functionality was tested as it is presented in the following:

A. Stock Market Exchange Web Service Access Using Browser

It is useful to test the web service's functionality, before consuming it on mobile channels. This allows us to establish that the web service works properly and the extension on wireless channels is possible. The appealing and response of the WEB service, using the browser, for the New Account and Information Account method, is presented in the Figs. 5, 6, 7, 8.

B. Stock Market Exchange Web Service Access using Windows Mobile and Symbian Client Application

The specific software instalation kits for PDAs and Smartphones, developed for Windows Mobile and Symbian operating systems, are stored on the platform site, and are directly downloadable in the mobile terminals. To obtain them, the interested users can access the platform site by browsing. By registration in the database, they will receive an „User name" and a password, that will allow them to access the platform site private section, where the client application kits are stored. The mobile applications can be installed in the terminal and used to invoke the web service methods. The results of New Account method invoked from a PDA mobile terminal is presented in Fig. 9.

C. Stock Market Exchange E-Service Access using PhP Query Functions Accessed on Laptop, Smartphone or PDA

The server database can also be accessed through Php scripts, containing the SQL queries. The Php scripts are appealed directly through a Web browser, because they are hosted on the same server as the database. The call has the following general form http://localhost/query .php? parameter=value.

The company stock exchange information query is available through URL link: http://localhost/query3.php ? symbol= ATB; this stands for an Antibiotics Company.

The list of companies whose quotation variation is under/above the maxim/minim threshold "x"/"y" is obtained introducing in the browser's URL address:

-http://localhost/ query1.php?above=x or,:

-http://localhost/query2.php?sub=y; the companies are displayed in the browser.

The main client application GUI window for SE P990i mobile phone is opened by the Smartphone commands: Main Menu – Tools – Mobacces. The client will obtain stock exchange information following application GUI: Main Menu – Info Companies;

-in the Company field, the symbol of the company is introduced, then the commands Done and Go are clicked;

-in the Ready window the status of the server connection, is shown: Connecting, Connected, Data received, Successful transaction;

-requested company information is displayed, Fig. 10.

The list of companies having a quotation variation under a specified maxim threshold is obtained by the commands succession:

-in the main screen, select Menu – Maxim Threshold;

-the cursor must be placed in Threshold Maxim window, and the desired maximum value must be typed, than Done and Go buttons must be pressed;

-the companies that had a quotation variation under the introduced value are displayed.

The list of companies having a quotation variation above a specified minim threshold, can be obtained by the commands succession:

-in the main screen, select Menu – Minimum Threshold;

-the cursor must be placed in Minim Threshold window, and the maximum value must be typed, than Done and Go buttons must be pressed;

-in the information box the companies that had an index variation above the introduced value are displayed.

The same applications have been tested on a PDA terminal, QTEK 2020i see Fig. 11.

Based on these client applications, the user can efficiently decide to sell or buy shares, having the advantage of the terminal mobility. This will increase his financial benefits.

The following functions of the client server system have been implemented and tested:

-server software application for stock exchange informational service;

-client software applications for Smartphones and PDAs, suitable for electronic services access.

The client server system can be extended to provide various kinds of electronic service: e-commerce, e-banking, e-government, etc.

Fig. 5 New Account WEB service method appealed from browser

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Fig. 6 WEB service response of New Account method appealed from browser

Fig. 7 Account Information WEB service method appealed from browser

Fig. 8 WEB service response of Account Information method appealed from browser

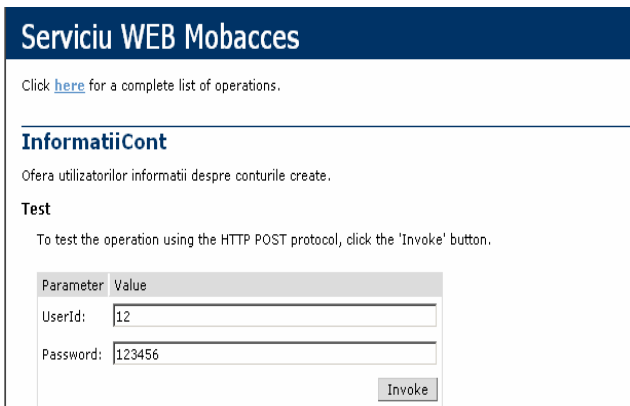Fig. 9 New Account WEB method appealed from PDA mobile terminal
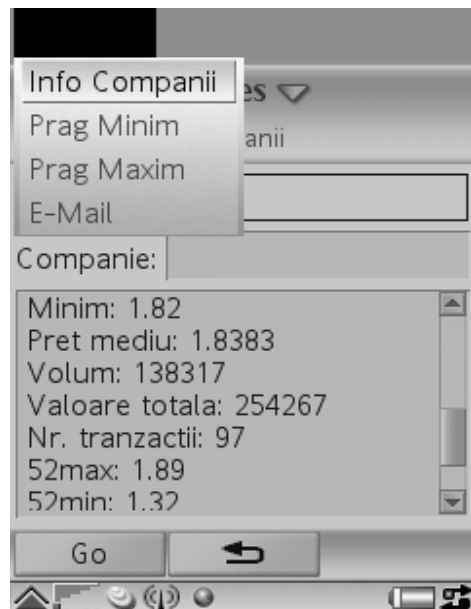
Fig. 10 Information about stock market quotation on SE P990i display

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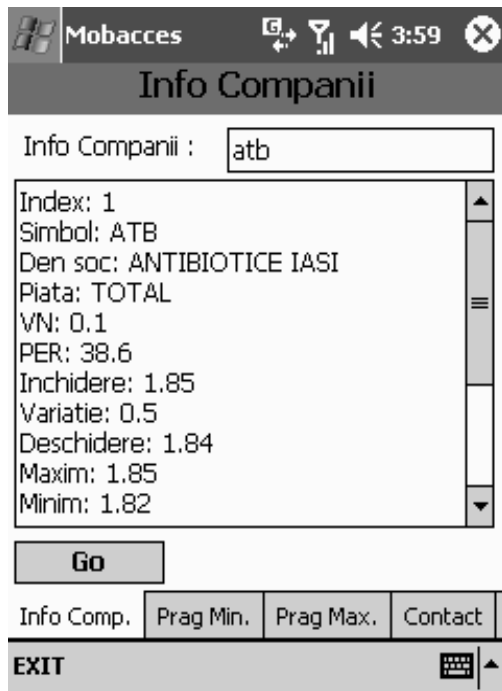Vol:3, No:4, 2009

Fig. 11 Information about stock market quotation on QTEK 2020i display

VI. CONCLUSION

A web service client server system for a stock market exchange electronic service was achieved. The mobile clients can use Smartphones, PDAs or laptops, to access and use the electronic service. 3G, GSM/GPRS or WLAN channels are used in the system, for data transmission.

The server contains the WEB service, consisting of adequate methods, that provide to the users the possibility of account statement and information regarding the quoted companies, transactions, share values, etc. The server database stores the information about companies, regarding the stock transactions indexes. Various PhP functions are implemented, to provide the answers to the client's queries:

-selected companies stock market exchange information;

-the list of companies whose quotation variation is under the maxim threshold, or above the minimum threshold, introduced by the user.

The WEB service methods can be invoked by the clients through browsers, which is a good method to establish that the web service works properly and the extension on wireless channels will have a good functionality.

The invoking and results provided by the New Account Statement method of the WEB service by browser, are presented in the paper, as an example. The client is allowed to open user accounts, in order to utilize the facilities of the service. The New Account statement operation is recorded and stored in the local database.

The stock market information is available to the client primarily by direct and dedicated applications, which significantly reduce the access time and data traffic cost.

The service's site offers to the client access applications samples for SE P990i and QTEK 2020i mobile terminals. These samples can be downloaded on a PC, and then installed on the mobile phone, using ordinary Sync type tools. The executable files can also be directly downloaded on the mobile phone, using wireless channels and a web browser.

The mobile applications of the client server system have been implemented and tested on Windows Mobile and Symbian V. 9.1. operating system terminals.

The client server system functionality can be extended and modified to develop and provide various kind of electronic services.

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