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MOBILE APPLICATION FOR BUSINESS CONTROL OF TELECOMMUNICATION SERVICES

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Abstract: *The expanding telecommunication networks start to support services closer to business control. Covering by default air-time account information management, they are extending to monetary operations: bank transactions, accounts' interrogations, recharge control. Thanks to smartphones proliferation the user interface is done via applications (apps) built for Android, iOS, Windows Mobile, etc. We propose Unstructured Supplementary Service Data (USSD) integration – a reliable and universally available control medium – for enhancing Business control via apps. By doing this we are implementing a Service Creation Environment (SCE) available to the operators in emerging economies and also for establishing immediate control in the new Internet of Things (IoT) environment.*

Keywords: *App, m-Business, electronic recharge, USSD, Android, Eclipse, IoT, SCE*

1. INTRODUCTION

The growth in mobile applications (*apps*) will represent a 77 billion market in 2017, each user providing customized information via 100 apps per day, according to Gardner [1].

The apps offer to the users an unrestricted access to services. This interactive model represents the new *apps paradigm*, where the capabilities are limited only by the ability to imagine and develop a service. This means expanding the apps towards *m-Business* and mobile devices and even *wearable* devices. In 2014 we are in the first stages of apps (*infotainment*) and we are expecting to continue with monetary services control (*m-Business*) and cloud integration. The apps would control a myriad of electronic devices in the new Internet of Things (IoT) environment, becoming the access & control medium towards domotics (Home IoT).

Currently there are over 100 development media for apps. A very high number are free. The financial objective is not strong; some apps are developed just for product placement or are purely infotainment-oriented. Because of this, only 0.01% are going to generate money [2] in a highly competitive market.

Our application is intended for telecom operators in order to answer specific demands related to recharge capabilities and can be extended to support interrogation and control requests for future Smart Grid and machine-to-machine (M2M) implementations. We are detailing the application development and business case for implementation in production environment and suggest new approaches related to the SCE (Service Creation Environment).

2. CONTEXT

2.1 Current usage and risks. Telecom operators are relying on USSD frames or IVR (Interactive Voice Response) to implement queries from subscribers (e.g. balance query) or to allow various operations from authorized agents (e.g. the sales network geographically distributed).

Using specialized Value Added Service (VAS) solutions the operator will increase its local presence by allowing selected individuals (commercial agents) to take the burden of distributing voucher and recharge to subscribers. This model, highly successful in emerging and developing markets (e.g. India, Pakistan, Algeria) is allowing a fast and direct interaction with the customer in the lack of banking and financial infrastructure available, very often ahead of the grid (power infrastructure is not yet available). The situation we have encountered is that physical vouchers cannot be transported on the ground (e.g. conflict zone or inaccessible due to natural disasters). For this reason, the electronic distribution of vouchers is needed, and was implemented via USSD frame or WEB interface. Considering that WEB interface is available to only a selected number of main agents (dealers) we are noticing that the bulk of operations is going to be done via USSD, by unspecialized individuals. Mitigating the access to the service is the main concern in this case.

Any USSD frame is starting with '*' and ending with '#'. The intermediary fields are also separated with '*'. The first field in the frame represents the short code (SC) allocated to this type of service and it is configured along the core network in the Public Land Mobile Network (PLMN). An USSD frame example for voucher recharge is `*123*123456789012#` where `123` represents the SC followed by a 12 digit hidden recharge number (HRN) of a voucher.

Used mainly in the developing markets, the USSD frames are especially useful in managing the *m-Business* in electronic recharge (i.e. top-up subscriber's balance). However, in some cases, like the one we have encountered, the USSD frames are becoming too cumbersome for easy and rapid utilization. One of the reasons is that alongside direct recharge, we can have other type of operations possible that can extend dramatically the number of USSD frames available to the agents in their interactions with the subscribers or with other agents. USSD frames, especially for voucher distribution, are too difficult to remember (e.g. the example for sending 500 vouchers of 100 units to agent 07712345678 is `*123*321*12345*07712345678*100*500#` with SCs and USSD password present in the string `(123,321,12345)`, alongside the voucher quantity `(500) and` face value `(100)` of the voucher).

In addition to that, account control is needed for an agent (e.g. password change, transfers to and from another agent, transaction view). This leads to a lengthy list of USSD operations available to the agents – both for initiating monetary transactions and for managing the account.

Because of these issues, there is a high risk that the agents will get discouraged from using the service.

2.2 Opportunity and our goal. USSD can also be regarded as an opportunity, since it is a reliable, tested medium for control. USSD, much like Short Message Service (SMS), is transmitted bi-directionally and alternatively between subscriber and service, along core network on the signalization channels used by Mobile Application Part (MAP) protocol. Available since 1993, it was developed in two stages [1],[2] and it was finalized in 1999, making it a tested and universally available service. Our proposition is that USSD should not be discarded from future implementations in the context of the new app paradigm as it is available *by default* in the telecom network of all operators, it is secure and light. Furthermore, the subscribers are used with this service. The USSD offers:

- stability in exploitation (standardized and in production for over 15 years);
- functional simplicity (transmitted via the signaling channel);
- ease of implementation, regardless of the service provided;
- global area of distribution, supported by all mobile terminals and all mobile operators;
- provides increased interaction compared with SMS

For this reasons we are proposing integrating the USSD functionality via mobile apps, in this case, Android OS.

2.3 Development environment. We are using for development the Android Eclipse Service Delivery Kit (SDK) [5] that includes:

- Eclipse + Android Development Tools (ADT) plugin
- Android SDK Tools
- Android Platform-tools
- The latest Android platform
- The latest Android system image for the emulator

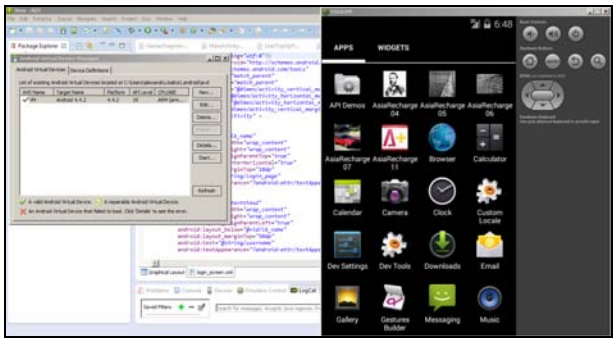

Fig. 1. Eclipse development and testing environment with the virtual machine (VM) opened

Developing in Android Eclipse is done in Java programming language and XML integration for visual app content. The available simulator (*fig. 1, right*) is helping the design and validation, before deploying on real equipment.

3. BUSINESS CASE

3.1 Advantages and previous implementations. Our goal is a mobile app that will use visual graphical interface (GUI) to store and collect data and then format it, transparently to the user, into valid USSD frames. There are several obvious advantages from this point of view: reducing transaction time, maintaining the app interface paradigm, providing a secure channel.

Formatting USSD frames via apps is available through other applications (e.g. *Easy USSD Lite*, *USSD Dialer*, *USSD Management*, *Mobile Balance Checker*, *cluBalance*, *checkBalance*, *dBalance*) [6]. However, none of them is dedicated to limited experience commercial agents and they are not capable to support all the functions needed.

Via our implementation, it is also possible to integrate special branding elements into the application, like logos or corporate on-screen messages. The application icon, menus, color scheme, can all be customized in order to be consistent with the operator's brand image.

Vendors and VAS suppliers are already seizing the opportunity, but most of the implementations are done using application programming interfaces (API) and require an Internet connection. Using USSD requests is simpler and more reliable, especially given the rough conditions available in emerging markets. This approach will allow operators to seize the app paradigm opportunity without investing in PLMN infrastructure for Internet access and it would not limit the service.

3.2 SWOT analysis. To validate our app we are listing the strengths, weaknesses, opportunities and threats (SWOT) related to it. Using the SWOT analysis we can identify the internal factors – the strengths and weaknesses internal to the organization and the external factors – the opportunities and threats presented by the environment external to the organization.

Internal

Strengths

- easy to use graphical interface
- rapid triggering of requests that, if done via USSD frame, would require separate training

- the operator has complete control over the application access medium and over the functionalities as it is built *in-house*:
  - USSD frames via the VAS provider
  - additional functionalities like lock/unlock can be supported
  - application flow and logic correspond exactly to local market demands

Weaknesses

- the current version is only available on Android OS

External

Opportunities

- channeling the new app paradigm
- no other operator, currently, provides this tool to own commercial agents
- Android based smartphones have a large market share in Middle East and developing economies.

Threats

- As the app is using USSD channel for triggering the requests, there is no additional risk. Password storage and login via the app are done via Android OS's `sharedpreferences` function.

The SWOT matrix is important to later steps in planning to achieve the objective and in this case it validates our proposal.

3.3 M2M applications. M2M applications using the apps are possible, providing there is a database with information available for query and control. One opportunity is represented by the common share of the records by the Smart Grid administrator with the Telecom operator. This is part of the vertical network integration scheme (power transmission network, metering network and transmission network). One can see simple applications being possible using already available USSD strings, even in emerging economies, where power scarcity is still a major issue (for example, balance query for power consumption, tariff plan interrogation and management).

4. APPLICATION

4.1 Solution design. The functions needed to be implemented are as follows:

- Register and login (store username and USSD password, *fig. 2*)
- Recharge subscriber
- Send voucher to subscriber
- Transfer credit to another agent
- Transfer vouchers to another agent
- Check balance for credit or vouchers
- Account settings (account update)

Other possible management operations include:

- Frequent errors (e.g. via search in Action Bar after Error ID)
- Mobile number selection from Contacts
- Guide (screens with instructions, app Help)

Implementing these operations must be done so that the user is able to select easily and fast the desired option. We are proposing drop-down menus for immediate selection and usage of large fonts and select buttons. In order to ease the access, we are implementing a *3 touch maximum* selection criterion (i.e. from any point of the application to reach another one in maximum three steps).

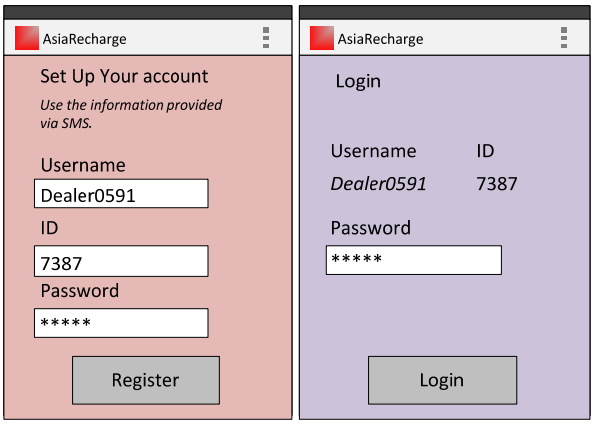

Fig. 2. Proposed schemes for registration and login screens

4.2 Implementation. From programming point of view, we are using already defined Android functions and schemes in order to implement the functionality (i.e. registering, saving the personal data, accepting selections via drop-down menus `(spinners)` and formatting the USSD string and sending them accordingly). Apart from the functional side an equally challenging task is devising an interface that can be trusted and easily used.

Since the revenue expected from the sales network is vital, the users must be able to select and work in a familiar way.

For this reason we are adopting a standardized graphical interface, the *drawer*,

that is available in Google applications like *Google Play* (*fig. 3*), *Google +* or *YouTube* and also *Facebook* and others.

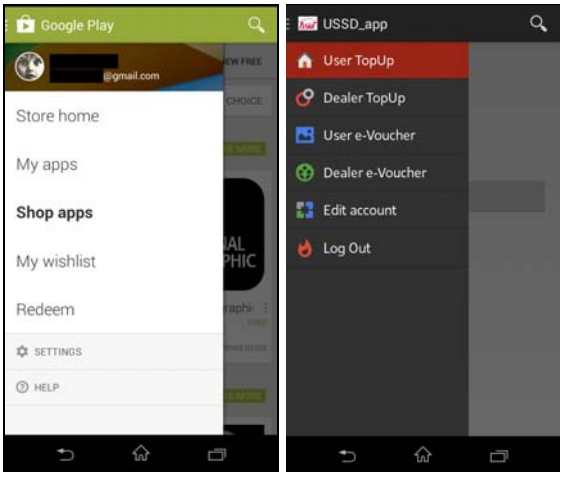

Fig. 3. Standardized, open source drawer menu design (Google Play) and the implemented one

Each screen from the drawer menu selection will contain `fragment` type screens according to our guidelines. In the recharge screen, for example (*fig. 4*), the user is presented with an `editfield` to enter the destination mobile number and a selection for the value to be recharged (via a `spinner` drop-box). The keyboard is used to input the number in the exact location.

4.3 Security. As the app will only use USSD frames to communicate with the system, there is no additional induced risk. The USSD frames are validated in advance and are part of the delivered package for electronic recharge system (license, security, acceptance). An additional security restriction can be implemented on the PLMN side: the subscribers can be barred from accessing the USSD frames based on their mobile number.

Any commercial agent will have his/her own USSD password and this can be used in parallel to trigger manually the USSD requests or can be stored in the application.

An additional functionality allows the agent to set his/her own USSD password, also. This does not introduce any additional risk other than normal operation with USSD frames.

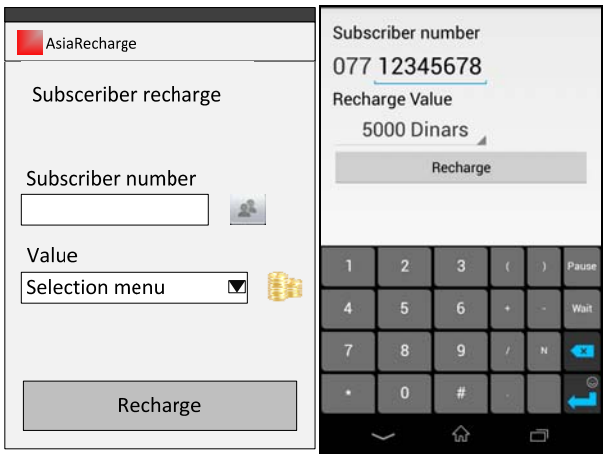

Fig. 4. Proposed scheme for direct recharge screen and implementation via Android app

5. CONCLUSIONS & FURTHER DEVELOPMENT

The advantages in developing and using apps come from reduced development costs and use of already delivered platforms for distribution (e.g. Google Play, App Store).

The apps, even after delivery and installation in the market, remain available for corrections and updates using the open development environment we presented hereby as a SCE (Service Creation Environment).

This is compliant with the perspective of IN (Intelligent Networks) where individual users (e.g. juridical persons like commercial agents) and not only network infrastructure manufacturers/ owners/ operators can develop/ deploy/ configure/ administrate the services.

These features reduce maintenance costs as well.

The app paradigm can be extended to implement also M2M queries – e.g. in Smart Grids, like monitoring electricity usage from counters (in this case the collected data can be made available, via API to the operator).

In Home IoT they can be used to stop-start the equipment or control remotely the full range of domotics. Thanks to the innate security aspects, the triggering via USSD is suitable for complex monetary scenarios – e.g. telecom operators can consider it for “mobile wallet” solutions.

As an important further development, our current proposal is under evaluation to become the access interface for the sales network of a Middle East operator.

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