

# Phone Number Lookup based on CAP

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**Abstract**— The paper deals with the development of application enabling phone lookup function. We developed an application which customized the current Siemens CAP application to needs of corporate environment in VSB – Technical university of Ostrava. The paper describes the developed architecture and our solution which is based on CAP and involves a metadirectory. The architecture enables communication with Siemens PBX through the CSTA protocol and our application performs the lookup in the LDAP directory. The results could prove valuable to other institutions addressing a similar issue.

**Keywords**- CSTA, LDAP, CAP, phone number lookup.

## I. INTRODUCTION

The paper deals with the phone lookup function in a corporate environment. The presented solution is suitable both for IP phones and ordinary digital phones. All phone lookup functions refer to LDAP as the unique source of information for the given purpose. Almost every institution nowadays has a corporate directory. All important information regarding the staff is stored in the directory and the access to it is ensured by the LDAP protocol based on recommendation ITU-T X.500 [1].

Corporate directories contain a tree structure and involve individual records which consist of the defined attributes which are described by objects. TelephoneNumber is one of these attributes.

A significant advantage of IP telephony is the simplicity with which it can be integrated into IT applications. IP phones are equipped with a LDAP client and can acquire a contact and specific information related to the contact. The information is displayed on the IP phone and the user can easily initiate the call [2].

On the other hand we can also imagine ordinary phones in PBX's. If we consider the possibility of an analogue phone, we can discuss it being used only theoretically because no sophisticated protocols are implemented in analogue phones and nearly all supplementary services are based on DTMF control. Digital phones in PBXs are equipped with various proprietary protocols enabling interactive communication between the user and PBX using buttons. There is a possibility to call service by pressing a single button. Once a particular button is pressed, the function assigned to it is activated and we can enter letters through the telephone keypad (the principle is the same as with mobile phones). Where PBX supports the CSTA (Computer Supported Telecommunications

Applications) protocol, the third-party application can control communication in PBX, e.g. to initiate a call. The third-party application will access PBX through IP, for which the third version of CSTA III protocol (specified by ECMA) is mostly applied. Many different applications exist, most of them designed for a particular system. One of the possible solutions is to connect the individual phones and PCs through USB, Bluetooth or IP and to adopt an application based on Microsoft TAPI. Our approach is different.

## II. COMMON APPLICATION PLATFORM

First of all, we need to describe the Common Application Platform (CAP). CAP is a key component of our architecture. This application was developed by Siemens and supports not only Siemens communication systems but also the third-party PBXs of well-known vendors, such as Nortel, Alcatel, Avaya, Cisco and so on.

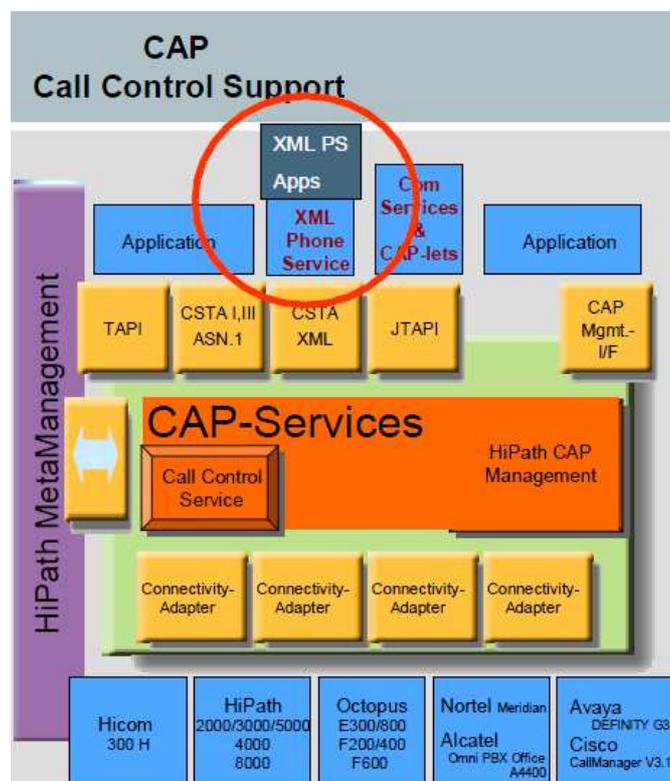


Figure 1: Common Application Platform structure

CAP serves as a powerful middleware connecting applications and is based on standard protocols. The features which are supported are grouped into five different packages and they do not make any distinction between protocols, encoding variants, or connection types. CAP is not licensed and can be installed free of charge but individual applications in CAP require licensing. We did not need licensing as we have own application for communication with LDAP and the communication with PBX is ensured by CAP.

CAP supports the following protocols: CSTA III ASN.1, CSTA XML, Microsoft TAPI, JTAPI, Microsoft WAVE API and XML Phone Service [3-5]. Figure 1 shows the structure of the Common Application Platform.

For our purpose we installed CAP and we also use the XML Protocol for Computer Supported Telecommunications Applications (CSTA) Phase III. XML tag options are specified in recommendation ECMA-323.

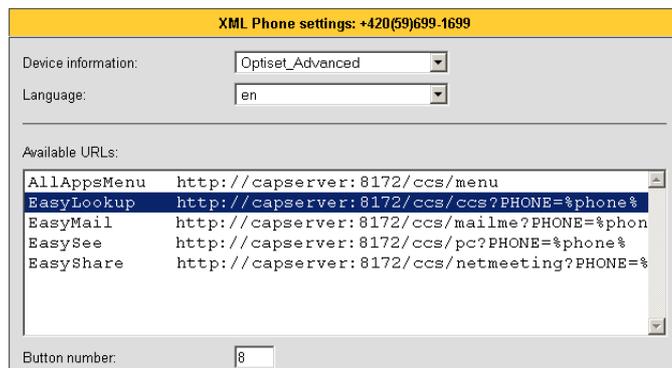


Figure 2: Menu in CAP, Button Number Assignment

Communication through IP with the CSTA III application protocol is operated between CAP and PBX. We configured it according to the instructions in the documentation. Due to CAP restriction regarding the maximum number of users (500), we decided to install more CAP applications on MS WIN7 in the VMWARE ESXI virtual platform and to operate three identical servers with separate user pools. In the end, we at VSB –Technical University of Ostrava were able to cover our 1200 users connected to PBX's with through their digital phones and achieve the maximum capacity of 1500 users.

The important step regarding user's configuration in CAP is the button assignment, which it is depicted in Figure 2. In addition to the button, we also select the language for displayed texts. The texts are configurable and we prepared two language versions, Czech and English.

When an application key is pressed at the terminal, the XML phone application starts by calling the configured URL which is associated with this button in CAP. In response, the application uses the invoke interface to send a CAPPhone object (as a HTTP response with the MIME type: XML) that should be processed for the terminal where the button was pressed. The application can show a text message on the display, generate a signal tone and set the LED status.

The XML Phone Service comes with a number of simple but useful applications called On A Button Suite [7], [8].

### III. TECHNOLOGY USED AND INTEGRATION INTO CORPORATE DIRECTORY

In order to integrate CAP into our corporate directory based on the LDAP protocol, it was necessary to develop an application operating as the metadirectory [6]. This application provides an interface between CAP and LDAP.

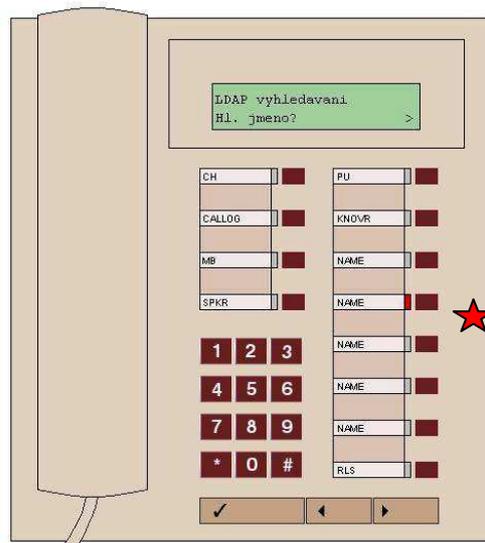


Figure 3: Menu in CAP, Button Number Assignment

We considered several solutions and finally we decided to apply a server based on openLDAP as the metadirectory and to develop an application which ensures synchronization and customization with CAP. The application was written in Ruby and this programme was named MetaLdap. Ruby is an object-oriented programming language, the syntax of which is broadly similar to well-known Python.

CAP, OpenLDAP and MetaLdap are running on the same machine, which, as we have mentioned, is virtual. CAP ensures the connection to PBX. The administrator needs to assign a button with a Lookup function to every user. Once the button is pressed on the phone, the appropriate procedure in the CAP server is launched and information is transferred in XML formats. The button assignment process is depicted in Figure 2. The situation from the user's point of view is depicted in Figure 3. MetaLdap and OpenLDAP ensure the remaining functions.

We selected cn (commonName) as the LDAP attribute for the lookup service. The database of contacts is synchronized with the original university LDAP server ldap.vsb.cz and is immediately adapted for CAP. The following items are stored in the metadirectory: surname, name, login, e-mail and phone numbers. One user can own more phone numbers and the same surnames can exist, i.e. the application should be able to offer the user more items to select from. Login is the unique identifier. Where more phone numbers are available, the first number is the main one and the other numbers are offered as alternative phone numbers. Synchronization is performed twice a day. Finally we created an important script improving the overall stability. It ensures the restart of a particular service in CAP after it had been blocked as well as a regular

restart of the Windows operation system.

The items which we can look for in ldap.vsb.cz are listed below:

- ```
auth_base: "ou=USERS,o=VSB"
search_base: "ou=USERS,o=VSB"
search_attrs:
- "telephoneNumber"
- "mail"
- "fullname"
- "sn"
- "givenName"
- "o"
- "mobile"
- "fullname"
- "cn"
```

The MetaLdap application only looks up contacts with a phone number(s). We mentioned that login is the only unique item in LDAP. This is true but on the other hand, the e-mail address is another unique item as every user has been assigned a unique e-mail address. In the first step, we select only records with phone numbers. We compare them against e-mail addresses in the metadirectory. If the contact is new, we add it into the metadirectory. If we cannot find an e-mail address which already exists in the metadirectory then the contact is deleted. Finally we compare only the 'TelephoneNumber' attribute in found contacts.

Once the data are fed into the metadirectory, the output log file sync.log is generated. This file is created for debug purposes and contains information about the executed changes, e.g. how many contacts were registered and enlisted, number of deleted and modified contacts. The file is automatically created when the MetaLdap application is launched for the first time or when the file was deleted from some reason. An example of log a created after changes had been made is shown below. We can clearly see that five modifications, four deleted records and two new created records were registered.

```
[2011-04-27] INFO -- Start: Run synchronization
[2011-04-27] INFO -- MainInfo: ADD 2 items
[2011-04-27] INFO -- MainInfo: DELETE 4 items
[2011-04-19] INFO -- Added: cn=Bohacova Jana
(boh101),cn=Users,dc=VSB,dc=cz
[2011-04-19] INFO -- Added: cn=Bujdos David
(buj020),cn=Users,dc=VSB,dc=cz
[2011-04-27] INFO -- Deleted: ["cn=Zehnalova Olga
(zeh27),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Deleted: ["cn=Kralova Petra
(kra71),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Deleted: ["cn=Kupkova Sylvie
(kup08),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Changed: ["cn=Muller Jaroslav
(mul09),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Changed: ["cn=Polinkova Katerina
(pol265),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Changed: ["cn=Fric Jindrich
```

```
(fri04),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Changed: ["cn=Kucharova Jana
(kuc11),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- Changed: ["cn=Beno Jaroslav
(ben001),cn=Users,dc=VSB,dc=cz"]
[2011-04-27] INFO -- MainInfo: CHANGED 5 items
```

#### IV. RESULTS

This paper describes the results achieved and application behaviour from the user's point of view. The LDAP search functionality is assigned to a particular button of a digital or an IP phone, i.e. any phone which is connected to PBX with CAP which is supplemented by the MetaLdap application.

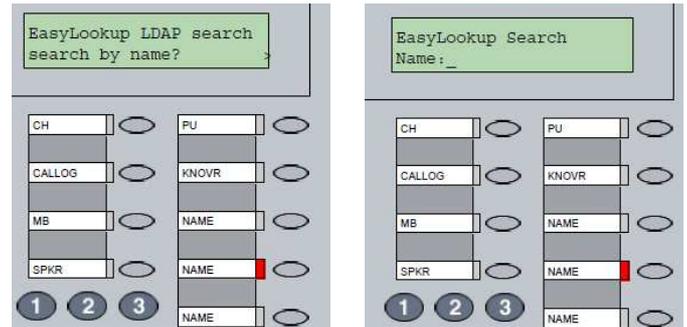


Figure 4: Call function under individual phone buttons.

Users that had been entered in CAP can call the LDAP lookup function on their phone by pressing the appropriate button. Afterwards, they can search a contact by name, see Figure 4.

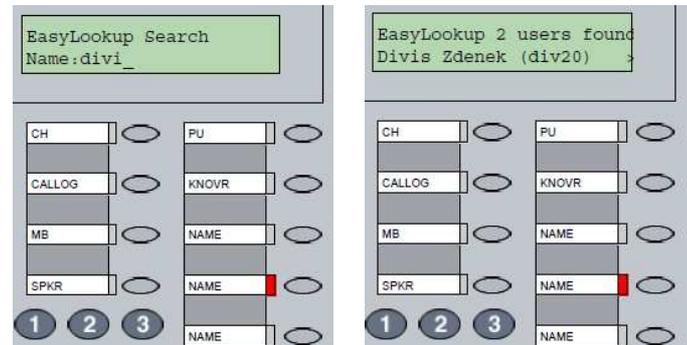


Figure 5: Entering a name on a phone.

First three letters are required at least, more specific queries are also possible. The phones communicate with PBX and PBX passes on the information to CAP which runs queries in the metadirectory. In the case displayed in Figure 5 two users matching the criteria were found.

In addition to the telephone number we can also acquire and display the e-mail address of contact in question, as shown in Figure 6.



Figure 6: Displayed e-mail address of contact in question.

## V. CONCLUSION

We developed an application which customized the current CAP solution for our needs. Thus, it enables access to the corporate directory through a LDAP protocol. We described the developed architecture and our solution which is based on CAP and involves a metadirectory. It enables communication with PBX through CSTA and our application ensures the lookup function in the corporate directory through LDAP.

The results could prove valuable to other institutions addressing a similar issue. Our solution is suitable both for IP phones and ordinary digital phones, all phone lookup functions are referring to LDAP as a unique source of information for the given purpose. This solution has been applied at VSB – Technical University in Ostrava and was designed for up to 1500 users but can easily be extended by adding more virtual machines.

## ACKNOWLEDGEMENT

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