

# VOICE CALLS AND MESSAGING OVER LAN USING BLUETOOTH AND IP TELEPHONY TECHNOLOGIES

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## **Abstract –**

*Bluetooth is a low power cable replacement technology that can be used to share information including voice. Internet Protocol (IP) Telephony is a range of technologies that enables voice traffic and data traffic to over an IP network. The integration of these two technologies in order to do voice calls and instant messaging is the purpose of this paper. To build this kind of communication a Signaling protocol is required in this case we are looking at an SIP Express Router (SER) in order for us to use Session Initiation Protocol (SIP) to handle the signaling. It is true that the android protocol does have functionality that can be used to implement SIP but this is one over a network connection like Wi-Fi or a wired connection and not Bluetooth and further over a local area network how do you address mobile unit that they will addressed if needed in other words how does one identify the target of any communication.*

**Keywords-** IP Telephony, SIP, SIP Express Router, Bluetooth.

## I. INTRODUCTION

The use of Local area networks is common place in work places these days but the need for communication goes beyond data the need for instant voice communication is ever present and of course in a typical fashion is achieved by the use of the telephone by the use of the PBX. On the other had the use of smart phones is ever increasing so if the IP Telephony can accommodate voice traffic and the ever present smart phone has got Bluetooth capability why not combine the two technologies to come up with a cost-effective solution and integrate voice and data on the same network which is already present?

In other words, we intend to use what is present in the work place to come up with the solution. In this study we seek to design an architecture that will use an SER, and Desktop Computer as proxies to achieve this integration.

## II. DESIGN

We are going to use a scenario of an office with two departments Accounting and Marketing. In these we have two User agents (UA) or smartphones which will be connected to network through their Bluetooth enabled phones and the Desktop Computers which are Bluetooth enabled by a USB Bluetooth dongle. The Desktop computers are connected to the LAN through a switch which also connects the SIP Server and the Database Server as shown in the diagram below.

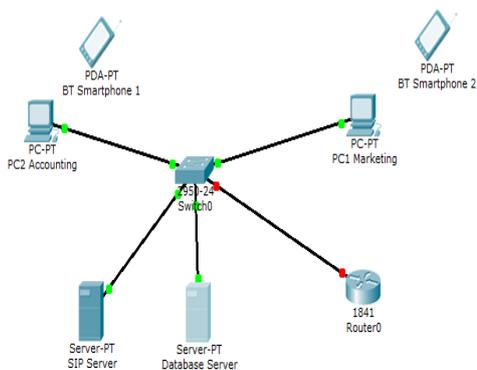


Fig.1 Architecture

Each User Agent is given a call sign or a phone number that can be used to call them over the network and they are registered in the SIP server with that number. The relation below gives you the way a user agent (Phone) is kept in the database of the SIP server. It contains all the information necessary to route a call including call Identity that is the number dialed by the calling party the IP address of the host Computer and the Bluetooth address with these details a call can be placed successfully.

Fig. 2 Subscriber Identity Relation

Call Identity	Bluetooth Address	First Name	Last Name	E-Mail Address	Friendly BT Name	IP Address
00001						

Since they are connected to a desktop computer it is the IP Address of the host computer that is to be used to locate the User Agent since in the database the location is based on the location of the desktop computer that can easily be traced to particular departments in a work place.

Below is the relation of how the desktops are entered in the database, this also serves as a location identifier since we have the IP address and the location of the desktop included.

Fig 3 Location Identity

Identity	IP Address	Computer Name	Location

In the database the numbers that are given to the smart phones are tied to their Bluetooth addresses this is important because routing a call to a particular phone will be the IP address of the host computer up to the computer which can have a number of User Agents (Phones) associated with it but it will be the Bluetooth address that will be used to direct it to a particular user.

At a particular location all the Bluetooth users form a piconet as a result we can have up to 8 user agents at a particular location.

Let's take an example of Mwita who works in accounts office who is a registered user. When she enters the accounts office her phone detects the other Bluetooth enabled device with this particular service then Bluetooth Voice Call (BTVC) application on her phone will register with the SIP server that it is connected with the Accounting Desktop and it will repeat this every 30 minutes so that the server will have up to date information this is what will be used to route a call to this particular user.

The Bluetooth Voice Call Application BTVC App (Still in development). Is going to be an application that will establish an Android SIP services over Bluetooth. This application will carry the necessary permissions to allow for Bluetooth communications to take place. We intend to use the RFCOMM for operations like Registration and call INVITE operations and the Advanced Audio Distribution Protocol (A2DP) for the actual voice session. Further it will have to create the Sip Manager which will in turn take care of the following operations Initiating SIP sessions, Initiating And receiving calls and other services necessary for our current operations. In other words it will have access and integrate the Bluetooth API and the SIP API on the Bluetooth device needless to say this application is being developed with the Android device in mind.

As can be seen from the relation IP address and computer name is the primary key for the location relation and a foreign key in the subscriber identity relation. While the Bluetooth address and the call identity is the primary key for the subscriber identity relation this means the registration at a particular location is in effect the update of the IP address in these relations.

In the development of this application we are using the java programming language for it supports both the Bluetooth API and the SIP API. It is important to note however that at this stage the focus is to develop a system to use internally so we are not looking external connections such as the making outside calls over the PSTN.

In this development we are using kamailio as an SIP server.

Also, we are not targeting working on other platforms apart from android at least for now the issue of mobility management is also not been considered at this stage.

### III. DISCUSSIONS

The study of the android platform has shown that much of the things needed to create an application to give us SIP over LAN are provided for with the use of the java programming language. Also, the Bluetooth API gives us what we need to achieve Discovery and registration of the User agent. Facilities such as the Service Discovery Protocol (SDP) allows for the service that a particular Bluetooth enabled device has and also the class of the Bluetooth device to help you determine the range of operation. In view of the foregoing it seems feasible that the SIP over Bluetooth is something that can and will be achieved.

### IV. CONCLUSION

The system we are developing is going to have to on static IP addresses this limitation comes because of two reasons. The first is we want to restrict voice to a particular virtual LAN. The second reason that the SIP server we are using restrict us to listen on an IP address hard coded in its server and port as such we cannot use Dynamic Host Configuration protocol because we desire that the IP addresses not to change dynamically. As mentioned earlier the current development is restricting this service to the Local Area Network (LAN) this means that a person from outside cannot call using this system

the same is true of the person inside he cannot use this system to call outside so further work will be needed to make this system accessible from the outside and also for the system to call the outside by making the gateway provision to the outside. The further thing we would like to achieve in the future is for a registered user who has a laptop to have access to this system from anywhere as long as there is an internet connection. We would further want to enhance the security of the system by incorporating end to end encryption. Another important feature that we want to incorporate is mobility management this is the setup where a call could be handed over from one access point to another without it being dropped. For now we have a design that is going to be fully functional by June, in which we are going to achieve a system that is going to perform the basic functions of the PBX, also it is going to give a further service of Instant messaging to the user.

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