

# Case Study: Setting up VOIP Network Over Wireless Mesh Network in Campus

Dr.D.Sivakumar<sup>#1</sup>, S.Srikiran Rao<sup>\*2</sup>, S.Gokula Krishnan<sup>#3</sup>, V.Guru Karthikeyan<sup>#4</sup>  
Electronic communication Engineering Department, Easwari Engineering College  
Ramapuram, Chennai-91

**Abstract** This paper deals with the communication between the various clients in the network through the VOIP (Voice over Internet Protocol) service which uses the Wireless Mesh Network. The transfer of data takes through various nodes (routers) in the network. Asterisk PBX set up will act as private branch Exchange and transfer a data between the clients in the network. BATMAN routing protocol is used transfer packets between the various nodes. Wireshark packet analyzer is used calculate the Delay, Throughput, jitter between the nodes.

## 1. INTRODUCTION

Voice over internet protocol (VOIP) SERVICE over Wireless mesh network (WMN) has been developing significantly in recent times with new features being added over it. As in conventional method, in this implementation we are going to create this network with the help of Asterisk. Here the systems with virtual PBX is connected to a wireless router with B.A.T.M.A.N routing protocol configured in it .The main reason behind is to route the calls to the alternate multiple users incase when the call routed using asterisk to the intended user is not available or ready to use, so that the intended information reaches the designated recipient irrespective of his availability over that particular system.

### A Asterisk

Asterisk is an open source software under the GPL license, it runs on the multiple operating systems on different protocols .It supports various VOIP (Voice over Internet Protocols) and it can manage digital and analog traffic on TCP/IP networks. Asterisk act as a Private Branch Exchange and incorporates as a normal telephone Exchange [1] such as call management, user Authentication, SMS messaging, voice message and callback. Linux Operating system (Debian) is chosen in this paper as the main platform for asterisk server. We used virtualbox for setting up of Linux operating

System for various operating system. After setting up the operating system also download the package for the implementation. After Compiling all the files

needed for the server to run, test has been done to make sure the server can run smoothly. Then, two clients have been chosen for the Asterisk server. For the Clients Zoiper softphone is used because it can support SIP (session Initiation protocol)[1].Asterisk is used to connect and route the calls from one user to another or trunk to the next exchange which can provide a connection to the Public telephone network.

### B. Aurdino yun

It is the microcontroller board based on the ATmega32u4 and the Atheros AR9331 which supports Linux distribution based on openwrt. Openwrt is used to implement routing protocol. It has a built-in Ethernet and Wi-Fi support , micro-SD card slot, 20 digital input/output pins , a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a 3 reset buttons.

### C. Wireless mesh network

Wireless Mesh network evolve into the next generation to provide better services. WMN has emerged recently, which is being adopted as the wireless internetworking for the near future. It has the characteristics such as rapid deployment and self-configuration. WMN do not rely on a fixed infrastructure it can be in various forms like (i) client WMN (ii) Infrastructural WMN and (iii) Hybrid WMN. It consists of mesh routers and mesh clients. Fixed or static Mesh routers forms backbone of WMN and connect with the wired networks to provide multi-hop Internet connectivity to the mesh clients they access the network through the mesh routers WMN can easily connect effectively and wirelessly the entire mesh routers. Multi-hop WMN have several benefits they reduce the number of fixed internet access point between the routers and they are providing broad band wireless Internet access in cost-efficient way and they increase the region coverage.

### D. Softphone

A softphone is a software program which allows us to make calls through the Internet using general purpose

computer rather than hardware. The softphone can be installed in various equipment such as workstation, portable computers, and tablets and even in cellphone which allows the user to make and receive calls over the internet. It appears as normal telephone with the display panel and the buttons with which the user can interact. There are various softphones such as 1. Zoiper 2. X-LITE 3. IAXComm 4. Mirial 5. QuteCom 6. DIAX 7. FLASHPHONE 8. 3CX. In our set we use ZOIPER softphone to call between the clients because it allows us to use both the a SIP and IAX trunks and more efficient than the other softphones. The extensions are created using caller ID and it will act as a phone number for the clients call is made using this number. ZOIPER softphone will act as a client and call transfer takes place through Asterisk which acts as PBX [5].

### E. Wireshark

Wireshark is an open packet analyzer which can intercept and log traffic that passes over the digital network using the computer hardware. It is an independent platform which uses the GUI to implement its graphical control elements and uses API (Application Programming Interface) to capture packets and it runs on a GNU/LINUX, OS X, BSD, SOLARIS. The packets which are received using the API are used to calculate the various QoS parameters of the WMN. These parameters will provide the knowledge of the Delay, Throughput, jitter in the various nodes so that the performance of the system can be evaluated. Wireshark allows us to calculate the traffic in the various nodes in the system.

### F. VOIP

Voice over Internet Protocol is a form of communication that allows you to make phone calls over a broadband internet connection. Basic VoIP allows us to call others who are also receiving calls over the internet and it basically call transfer over the internet. Interconnected VoIP services allows us to make and receive calls from traditional landline numbers. PBX Asterisk is set up between the two computers. They act as a client for the VOIP services in WMN network.

## II WORKING

We are going to implement a private branch exchange (PBX) in wireless mesh network (wmn) using Asterisk. After running the asterisk in virtual machine it displays an IP address of freepbx [1]. When we paste this IP address in a web browser it gives access to the freepbx account. In our setup we are going to use four wireless routers. We are going to

implement the BGP (Border Gateway Protocol) routing protocol in the router. This is done with the help of OpenWrt.

OpenWrt is an operating system based on Linux kernel which is used to route the network traffic. In the place of router we are going to use Arduino Yun board by flashing the OpenWrt with Border Gateway Protocol image file from the OpenWrt website to the Arduino board, and running the OpenWrt in one of the devices it can be implemented.

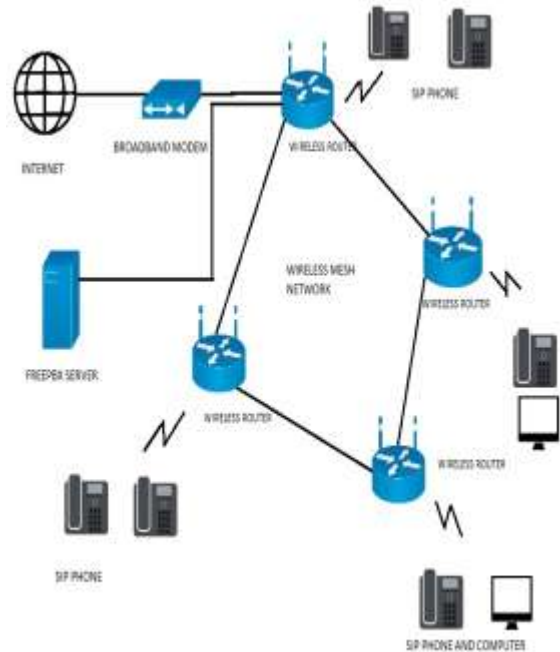


Fig.1 Topology of wireless mesh network implemented in freepbx

The internet from the broadband modem is passed through the gateway router which acts as a filter sent to the wireless mesh network setup comprising of Arduino Yun board. Each Arduino Yun board [3] is connected to a laptop which runs the program for the BGP (Border Gateway Protocol) [2]. And the Wi-Fi support of the Arduino board acts as the Wi-Fi router which helps to connect to client devices like SIP phones and computers in the network. The FreePBX

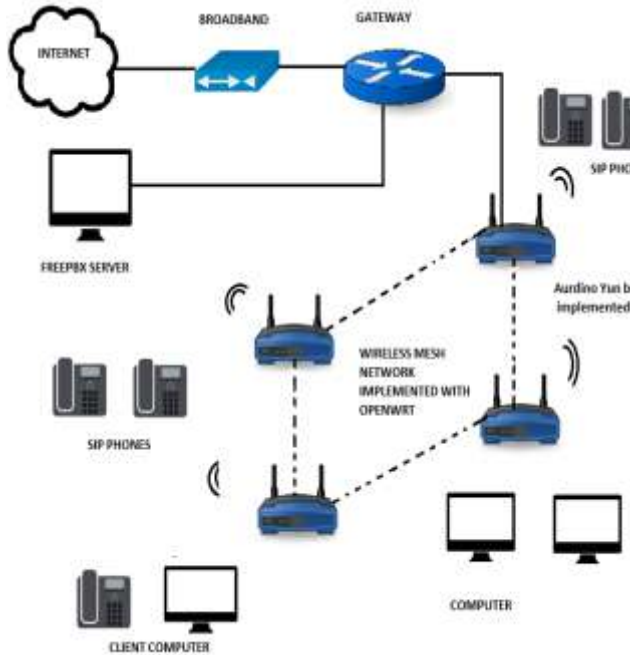


Fig.2VoIP transmission

Server which holds the record of all the trunks, extension for sip phones. It also displays the status of all the calls that get routed through the wireless mesh network.

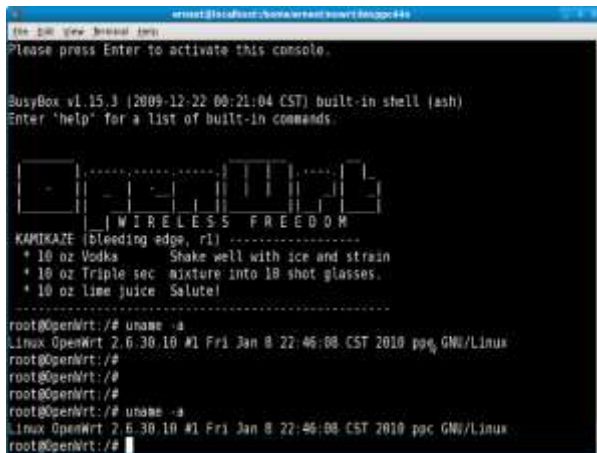


Fig. 3routing protocol implemented in Openwrt

In this paper we going to find a shortest distance between the communication of two clients in the mesh network by implementing the routing protocol[6][7] and With help of Wire shark we can able to calculate the jitter, delay losses in the transmission of packet in the mesh network and find the shortest path to reduce the loss of transmission of packets in the private mesh network.Using BGP (Border Gateway Protocol) routing protocol

[6][7]we are going to route the packets from one system to other system efficiently through the router connected to the system. Here we would be able to calculate metrics like the payload, jitter, no.of packets transmitted, losses and other metrics through the combination of software's (wire shark, open wrt).we then setup extension in PBX server in each system to communicate with each other. Both inbound and outbound route and Trunk extensions are created. Then using softphones like 3CX, X-lite [4] we make calls and route calls according to the routing protocol flashed using open WRT in the router. WIREDSHARK [6] gives all the information regarding packet losses, payload, jitteretc. when the communication between the different systems are going on.

### III RESULT

After installing Asterisk in the virtual os, we are going to connect to two freepbx accounts located in different location of mesh network by using SIP trunk option and configuring it.

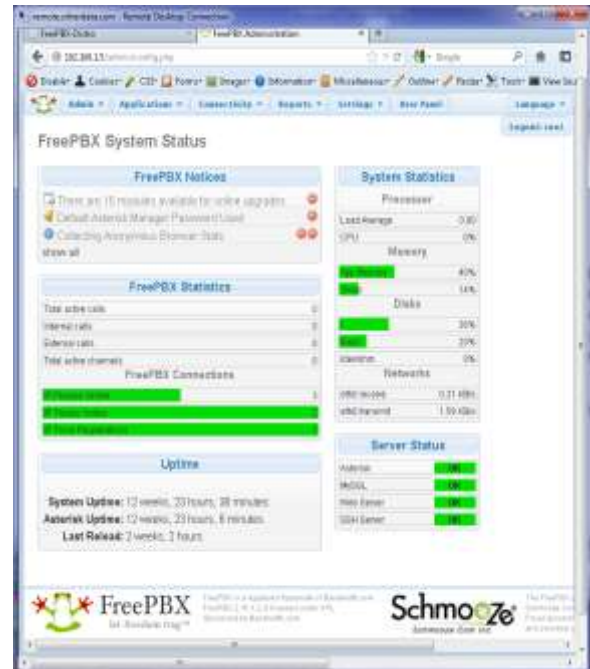


Fig. 4Freepbx ssystem status

Now we are going to initiate a call from sip phone connected to a node in a mesh network to another client in another node. While initiating the call the packets is transmitted through the network thus by calculating the shortest path by routing protocol implemented in Aurdino Yunboard [1].



Fig. 5 Incoming call to Zoiper softphone

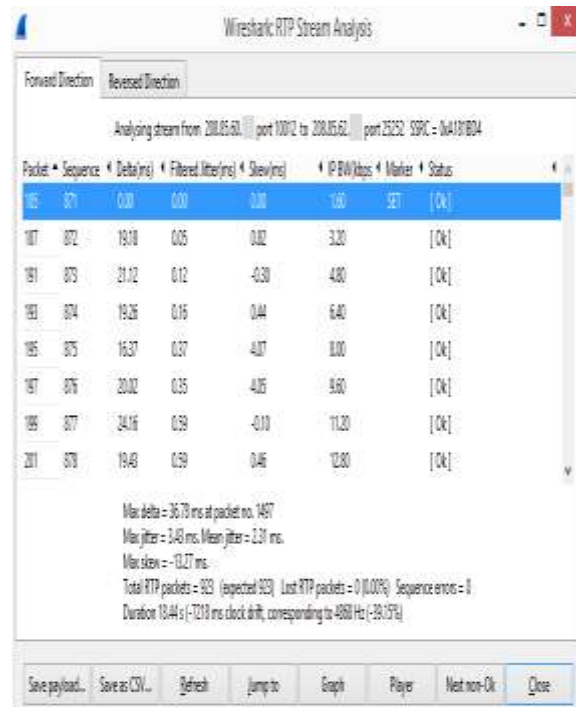


Fig. 7 delay and jitter shown in wire shark

A call between two client is initiated and the delay, jitter is calculated through wire shark [6].

#### IV REFERENCE

- [1] <http://www.asterisk.org/products/voip-gateways>
- [2] <https://downloads.openwrt.org/>
- [3] <https://wiki.openwrt.org/toh/arduino/yun>
- [4] <https://en.wikipedia.org/wiki/Softphone>
- [5] <http://www.howtogeek.com/104278/how-to-use-wireshark-to-capture-filter-and-inspect-packets/>
- [6] <http://www.ijettjournal.org/archive/239-ijett-v7p211>
- [7] <http://www.ijettjournal.org/archive/ijett-v13p231>



Fig. 6 call initiated and established in xlite softphone