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Approaches to Deploying VoIP Technology Instead of PSTN Case Study: Libyan Telephone Company to Facilitate the Internal Work between the Branches

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Abstract: This paper aims to define the VOIP technology in addition to presenting a vision for the design, installation and operation of the SIP Proxy Server service in Libya Phone Company. We will also compare the connectivity methods of the Libyan telephone company using fiber optics and VPN technology in order to secure safe and reliable transmission to the data of customers who subscribe to the network service through assigned tunnels. Also with the rapid growth of the Internet and the increase of load on the network in terms of users and service providers, there are many ways to connect sites to ensure quality of service QoS and traffic security and the number of call, in this study OPNET simulator used to simulate the proposed solutions for the VOIP.

Keywords: Voice over internet protocol; OPNET; Quality of service; HLC; Virtual private network; Fiber-optic

I. INTRODUCTION

Voice over IP [1], also known as IP Telephony and VoIP, the technology began in 1995 when a small company called 'Vocal Tec' showed that the possibility of transferring phone calls Over IP packets easily be divided into two main groups: closed systems and open systems [2]. The first group includes programs such as Skype and the famous Cisco protocol (SCCP) [3]. The other group includes open standards based on SIP, H.323, LAX2 protocols. VOIP is data in Real-Time and is transferred via Internet using protocol (RTP) consists of data and the control the control part is managed by protocol (RTCP) and the packet is transferred using a set of UDP / IP / RTP protocols.
There are two types of networks:

- Voice Networks: in which the conversion of the reserved circuit and routing during communication is always in the same path [4].
- Data networks: Based on a switchbox, the information is divided into packets and each packet can be transmitted by a different path.

1.1 VOIP Rules and Standards

- Internet Engineering Task Force (IETF): The Standards Authority for Internet Protocols and Services the IETF mission [1] make the Internet better for work through high-quality production and related technical documents that affect the design, use and management of the Internet.
- International Telecommunication Union (ITU): Is an international organization within the United Nations system where the government and the private sector coordinate the global telecommunications network and services? Its main task is to include the radio spectrum segmentation and [1] connect subscribers to the public network between different countries to allow international telephone calls, considering the implementation of teleconferencing as a function similar to that of the UPU for postal services.

1.2 Protocol: H.323

Is a set of standard protocols emanating from a system developed by ITU-T to provide audio-visual communication sessions using packet-based packages? This protocol is used in most popular applications such as NetMeeting, which is part of the ITU-T H.32x series of protocols It also handles multimedia connections over ISDN, PSTN or SS7, 3G mobile networks and H.323 standard addresses controlled calls and [5-7] signals, control, multimedia transport, control and bandwidth control from point-to-point and from multi -point.

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1.3 Session Initiation Protocol (SIP)

Is an IP protocol that is used to initiate, modify and terminate VOIP phone calls? IETF has developed this protocol and has been published as an RFC 3261 protocol. Initially SIP is a protocol designed to be independent behind the Transport layer. It can also work on TCP and UDP protocols. SIP relies on the SDP protocol to perform negotiation to determine the SIP encoding. It supports session descriptions that allow participants to agree on a set of compatible media types. This protocol itself provides reliability and does not depend on TCP Reliability It also supports user movement through the establishment of agents and redirect requests for the current user includes services provided by SIP: User location; Create the connection; User Availability; User capabilities; Dealing with calls.

1.4 PSTN vs. VOIP

The importance of VOIP technology has been introduced as an alternative to the traditional public switched telephone network (PSTN). It has reduced the cost of communication, especially the international ones. It is easy to use as it uses internet methods and offers additional features and services that make it easier for the user to communicate effectively. The world does not need two networks, the Internet and the PSTN network and it want to focus on the Internet only as it is very fast provides voice and image communication and messaging.

II. VOIP SERVICE FOR LIBYA PHONE

The network is designed to link the headquarters of Libya Telecom Company in Tripoli with the company's branch in Benghazi using fibre optic and to support the VOIP communication service as a means of connecting voice conversations over the Internet [6]. To ensure the management of data traffic and the exploitation of Internet presence within the network we will use VPN which the main function is remote access. The default network is the same as the internet network, but its characteristics have been used to be confidential in the process of transferring data and maintaining the confidentiality of information and security Abbreviations and Acronyms because the data is transmitted on the Internet and is open all over the world.

2.1 Scenario 1

WAN is primarily a WLAN that connects the headquarters of a Libyan telephone company consisting of 2 routers to transform the network from WLAN to WAN using a Fiber Optics cable or optical fiber. It is used to transfer Internet service between countries and transmit data through this cable at the speed of light. This cable is used in WLAN networks only on a limited scale to use VOIP technology for wireless communication between employees and reduce the cost of local and international communications between the company's branches in terms of cost and speed of fiber optics.

2.2 Scenario 2

WAN is primarily a WLAN that connects the headquarters of a Libyan telephone company consisting of 2 routers to transform the network from WLAN to WAN using VPN technology and the VPN is the connection of two devices or two networks together via the Internet, a protocol-based technology where typically, the process of creating a private connection between two computers through an intermediate network, such as the Internet, is called the transfer of data over a security path (tunnelling) where this path is created between the two computers directly (Figure 1).

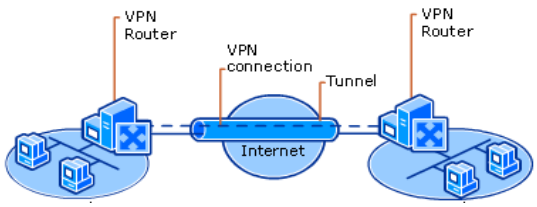

Figure 1: Tunneling path in the VPN.

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The main idea is to build a private "Tunnel" between the two devices. The VPN Tunnel is a private encrypted file that is exchanged between the two devices that decrypt when receiving information from the other side of the default tunnel after the firewall has disconnected any unauthorized connection from the system administrator or network administrator of the company or its branch.
This technology requires the device to be connected to the Real IP Address service, which is a feature obtained from the Internet service provider you enter on the Internet, which is to obtain the Public IP Address for your device remains constant in all cases, even if the connection is disconnected and reconnected And has contributed to reducing the cost of transferring information between companies and institutions between branches away from the headquarters and the user who wants access to information available in the home computer.

III. SIMULATION AND RESULTS

The result of a comparison between the global statistics the Simulation of the VOIP Scenario1 Using Fiber Optic and Scenario2 for VOIP Network Using VPN. Statistics collected and Analysis such as Jitter, End-To-End Delay (Sec), Traffic Received And Sent (Byte/Sec), Download And Upload Packet (Byte/Sec).

3.1 Global Statistics

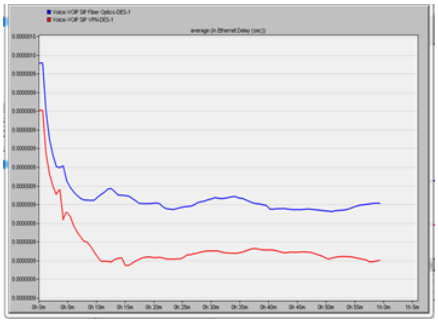

Figure 2: Ethernet delay.

Figure 2 shows the time necessary for a complete message until arrive to the target starting from the moment of transmit the first bit by the source. in scenario 1 Using the Fiber Optics the biggest delay of the traffic is 0.95×10^{-5} sec Due to Fiber Optics effect External factors. Also the data packet delay In scenario 2 using the VPN It reached to 0.94×10^{-5} sec We also note that the total delay over 50 m/s this is contrary to the recommendations of the International Federation and this happened because a the bandwidth was less in size of the data sent.

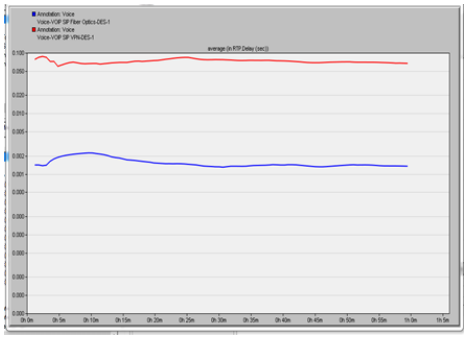

Figure 3: RTP Delay voice.

We notice in Figure 3, in order to know the real time needs to send a complete massage starting from the first moment of transmission until it reach it is distension using fiber optic the biggest delay was 0.001 sec, also in the 2nd scenario the data delay using VPN was about 0.077 sec because the bandwidth was less than data size.

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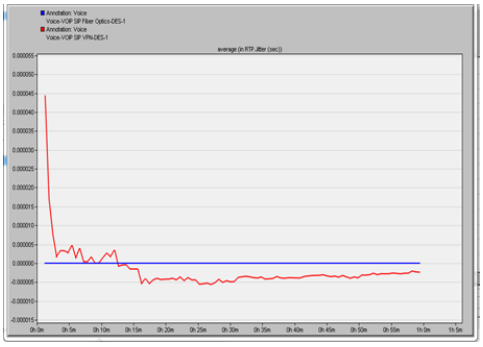

Figure 4: RTP jitter voice.

In Figure 4 there are delay in several voice sessions for RTP protocol .in the 1st scenario using fiber optic there were no variation in voice sending time delay in the other hand we notice a delay of 0.44×10^{-4} ms when using VPN and no stability in traffic because of weakness of the internet with an increase in the number of users causing transmission delay.

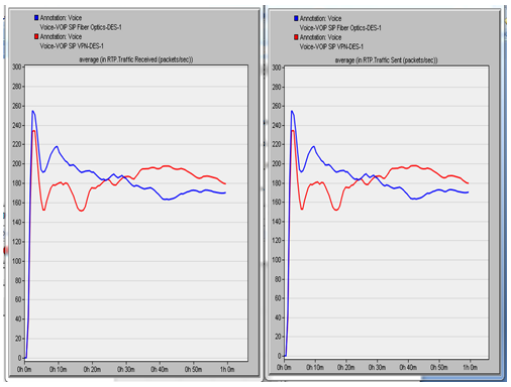

Figure 5: RTP traffic received and sent.

In Figure 5 there is a delay in the various voice packets for RTP Traffic Received and Sent. In the case of transmission and reception, which is used to verify the time of communication in sending and receiving voice data? delay of sending and receiving for the first packet in the first scenario using Fiber Optics is Sending in sec 39.75 was received at the second party in sec 39.75 There was no delay in sending and receiving data packets and audio. Also note that the difference in delay sends and receiving data in the second scenario using VPN reached 37.14 sec where it was received in sec 37.80 if there is no receipt in the same second for reasons of several weaknesses Runt with increasing number of users causing transmission instability.

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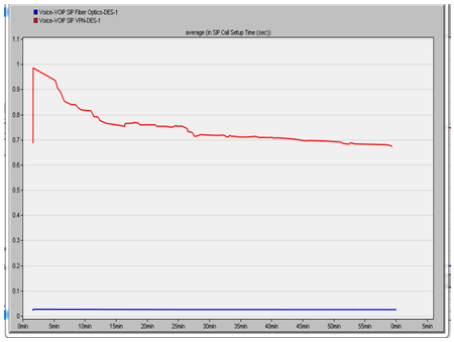

Figure 6: SIP call setup time.

In Figure 6 For SIP Call Setup Time To see which time In which time contact was made who got the call confirm the call where the scenario is 1 Using the Fiber Optics In the duration of 0.02 sec than we note Also in scenario 2 using The VPN has reached 1.05 sec which concludes that the delay using SIP. The VPN connection is higher. My Internet weakness causes or the number of connections in the network it was larger than the frequency band which caused delays in the preparation of the call.

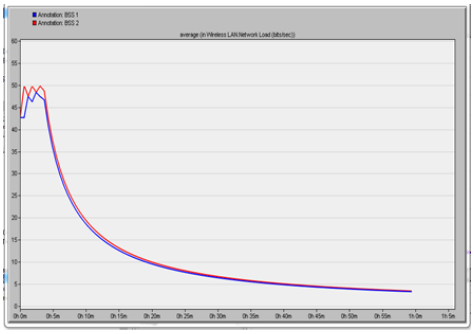

Figure 7: Wireless LAN load.

Wireless LAN load showed in Figure 7. To know the router's ability to distribution of traffic within headquarters the company is in Tripoli and Benghazi for all tracks that can access destination than we conclude the basic services are bssid1 within the company's headquarters in Tripoli reached to 42.6 sec and also note in bssid2 for the company's headquarters in Benghazi connect to 42.6 sec and the more the number of users increased the load inside the company.

3.2 Node Statistics

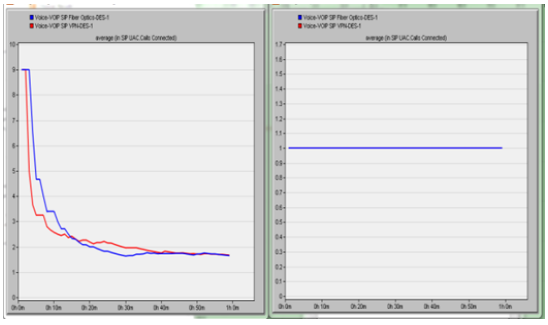

Figure 8: SIP UAC calls connected.

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In Figure 8, SIP UAC Calls Connected Number of all calls. As well as requests Incoming calls where the scenario 1 using Fiber Optics Connection event from Manager Tripoli to number 1 Of calls in the second and Manager Benghazi 9 calls in the second. We also note that the number of calls in scenario 2 using the VPN A connection occurred from Manager Tripoli There are 1 number of calls per second And Benghazi Manager 9 calls in the second which we conclude Number of calls in Contact the Tripoli Manager It was less, according to the demand of employees.

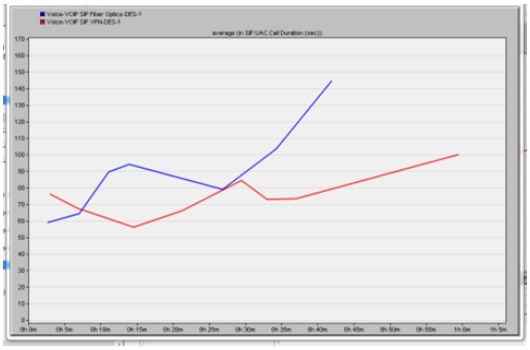

Figure 9: SIP UAC call duration.

In Figure 9 the statistics sip UAC call two sessions to know the duration of each call in time i got a confirmation call to time which got disconnected confirmation where scenario 1 is using fiber optics a connection has occurred from manager Tripoli to manager Benghazi in the period of 59.02 sec to a time termination of the connection in the period of 106.0 sec it is also noted that delay in scenario 2 using the VPN the 124.0 sec period reached an end time the connection duration is 108.1 sec which we conclude the delay using sip in the VPN connection the higher my reasons for the weakness of the internet or the number of connections in the network was larger than the frequency bandwidth causing a delay call setup.

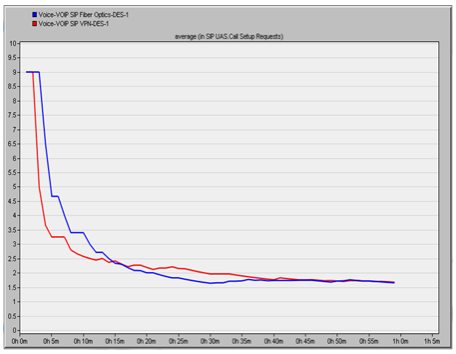

Figure 10: SIP UAS call setup requests.

In Figure 10 we note sip UAS call setup requests to find out how many requests have been received for proxy server to set up calls where scenario 1 is using fiber optics the proxy server has 9 calls we also note that the number of calls in scenario 2 using VPN proxy server has 9 calls as requested employees in the company.

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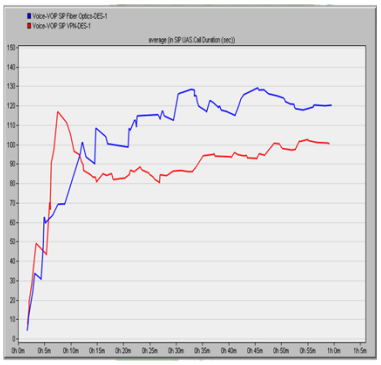

Figure 11: SIP UAS call duration.

In Figure 11 we notes in the statistics sip UAS call duration the duration of the call from the time it is connected to the time it was disconnected where scenario 1 is using fiber optics the connection occurred from in duration of 4.19 sec to time terminate the connection in the duration of 120.2 sec and note in scenario 2 using the VPN has reached 7.57 instrument time to end the connection in a period of 100.41 sec which conclude that the delay in the transmitter using the sip server using for VPN is higher and that causes me weakness internet or number of connections in the network was greater of the frequency bandwidth causing the call delay.

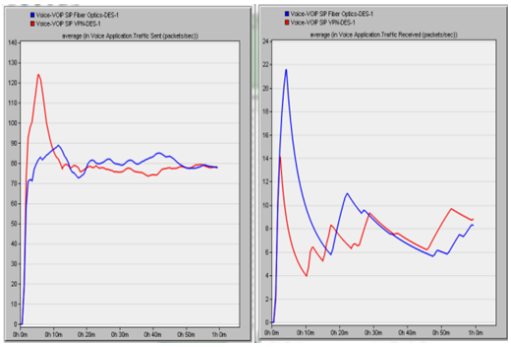

Figure 12: Voice application traffic received and sent.

In Figure 12 we note in the statistics the average number of packets which was sent and received to voice application in all of the device manager of a Hatif Libya company inside Benghazi and Tripoli where that scenario 1 using fiber optics send event from manager Benghazi in 2.425 sec to manager Tripoli in 2.425 sec and so on for the speed of fiber optics which we observe also that the transmitter in scenario 2 using the VPN event was sent by manager Benghazi in 1.99 sec to the Tripoli manager at 2.11 sec which results in delay in transmission the reception in VPN is weak online with increasing users number.

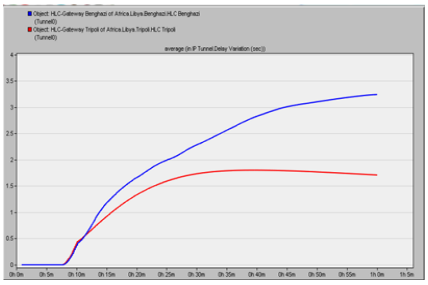

Figure 13: IP tunnel delay variation.

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In Figure 13 we note in the statistics delay in IP tunnel VPN technology for two devices routers for Hatif Libya company which we conclude delay in Benghazi router 0.0001 sec arrived for a weak reason the internet or bandwidth for the bandwidth was less than the size of the data the messenger is inside for the tunnel we also notice the delay in router Tripoli it was as low as 0.00010 sec in the delay of the package and not the arrival of her destination quickly.

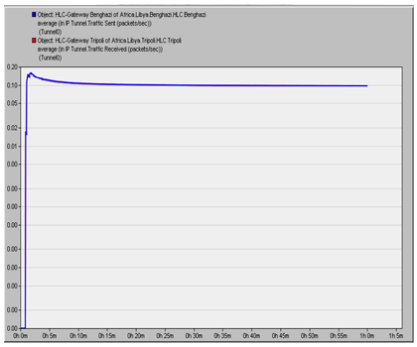

Figure 14: Traffic received and sent IP tunnel.

In Figure 14 we note time sending and receiving packets for IP tunnel if it is delay transmitter and the receipt of the other party for the first package in VPN technology for two devices routers for Hatif Libya company, which we conclude sending the router Benghazi at 0.017 sec where it was received at the other end of the Tripoli router is 0.017 sec which results in the speed and security of VPN technology in sending and receiving data.

3.3 Link Statistics

In Figure 15 we Note in the statistics The Queuing Delay measurements In the data packet and intervals Wait that challenged In the transmitter channel Measurements are taken Of the time you enter the package The queue in the transmission channel Until the last part moves Of the package where Note in Scenario 1 Using Fiber Optics Where the package entered at 0.0005 sec The other part was moved at 0.0006 sec Reverse scenario 2 using the VPN packet arrived In the waiting channel at 0.0005 sec to Move the other part of the package at 0.0005 sec Which concludes that the delay and the length of transmitter distance In the Fiber Optics connection above Bandwidth for bandwidth was Less than the size of data sent.

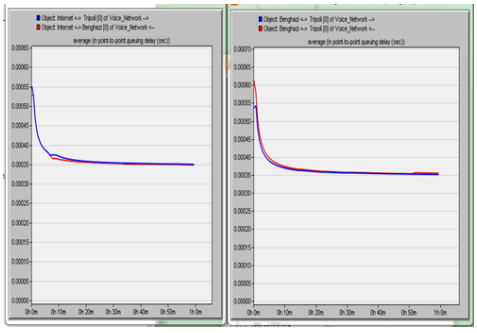

Figure 15: Point-to-point queuing delay.

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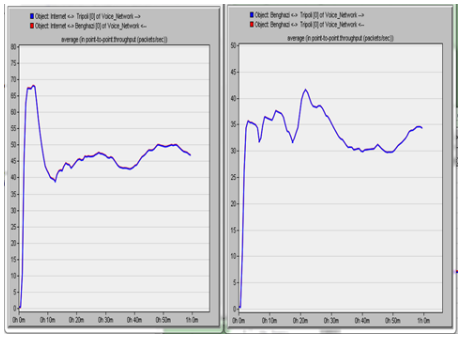

Figure 16: Point-to-point throughput.

In Figure 16 we note in the statistics the throughput is average the number of packets that are transmitted by receiving the channel or transmitter per second in scenario 1 using the fiber optics where the packets were sent at 0.38 sec and reception in 0.41 sec Ali unlike scenario 2 using the VPN where the package sent in the channel in 0.30 sec to receive the package in 0.38 sec which may conclude that the extent of reference in connect to the fiber optics ratio along the width of the package was bandwidth less than the size of data sent and its association with weak signal.

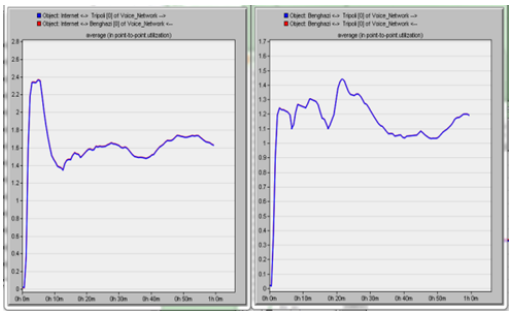

Figure 17: Point-to-point utilization.

Figure 17 show, utilization that consumption ratio so far from view channel bandwidth available in scenario 1 using the fiber optics where the ratio reached packages at 0.020 sec and reception rate at 0.022 sec to reverse the script using 2 the VPN has reached a percentage send the packet in the channel at 60.01 sec receiving the package at 0.021 sec which leads to the conclusion that fiber optics connection delays are higher so the width of bandwidth was less than size of the data sent to if the proportion of consumption reached to 100.0 sec this indicates full use of the bandwidth.

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