Empirical Study on Network Security & Bandwidth Management of Aamra Networks Limited

By

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This Internship Report is presented in partial fulfillment of the requirements of the Degree of Bachelor of Science in Electronics and Telecommunication Engineering

Supervised By

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DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

JANUARY 2019

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To Whom It May Concern

This is to certify that **Tahera Mostofa**, D/O: Mr. Mostofa Patwary & Mrs. Ferdows Akter Vill: Makimabad, P.O: Hajigonj, P.S: Hajigonj Dis: Chandpur; from Daffodil International University has successfully completed 12 weeks Internship Program from 15th October 2018 to 13th January 2019.

We wish all the success in her future endeavors.

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APPROVAL

This Internship Report Titled **"Empirical Study on Network Security & Bandwidth Management of Aamra Networks Limited"** is submitted by Tahera Mostofa to the Department of Information & Communication Engineering, Daffodil International University, has been accepted as fit for the partial fulfillment of the condition for the Degree of BSc (Hon's) in Electronics & Telecommunication Engineering & approved as to its style and guts. The Presentation will be held on Jan, 2019.

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DECLARATION

I hereby declare that this Internship Report has been done by me under the supervision of **Engr. Md. Zahirul Islam**, Assistant Professor, Department of ICE, Daffodil International University & Aamra Networks Ltd. I also declare that neither this report nor any part of it has been submitted away for award of any degree or diploma.

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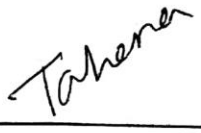

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At First, I am like to convey my gratitude to the Almighty for charitable me the right path while trying the duty.

The real sprit of achieving a goal is finished the way of quality and austere castigation. I would have never thrived in effecting my task without the teamwork, help and support provided to me by many personalities.

This internship report would not consume been possible without the provision and direction of **Engr. Md. Zahirul Islam, Assistant Professor,** Department of Information and Communication Engineering, Daffodil International University, Dhaka, under whose direction I chose this topic.

I would like to rapid my heartiest gratitude to **Md. Taslim Arefin, Associate Professor and Head,** Department of Information and Communication Engineering, for his kind help to surface our thesis and also to other faculty participants, the staffs of the ICE Department of Daffodil International University.

I must grant with due esteem the perpetual support and endurance of my family members for final this internship.

Tahera Mostofa

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Abstract

Network management is challenging. To operate, maintain, and secure a communication network, network operators must grapple with low-level vendor-specific configuration to implement complex high-level network policies. Despite many previous proposals to make networks easier to manage, many solutions to network management problems amount to stop-gap solutions because of the difficulty of changing the underlying infrastructure. The rigidity of the underlying infrastructure presents few possibilities for innovation or improvement, since network devices have generally been closed, proprietary, and vertically integrated. In this report, network security and bandwidth management of Aamra network Ltd is been described in terms of POP server monitoring, IP blacklist and firewall configuration. Moreover, some empirical picture is given and discussed which is related to network security and bandwidth management.

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Chapter1

Introduction

1.1 Introduction

In the world of computers, networking is the practice of joining two or more networking devices together for sharing data. Networks are built with a combined of computer hardware and computer software.

Modern world scenario is ever changing. Data Communication and network have changed the way of trade and other daily affair works. Now, they highly confide on computer networks and internetwork.

The computer network is a telecommunication channel using computers or devices which we can share data with one another which connected at the same network or different network. It is also called Data Network. The best example of the computer network is the Internet.

In a computer network, there are Local Area Network (LAN) and Wide Area Network (WAN).In a LAN, computers are connected together within a "local" area (for example, an office or home). In a WAN, computers are further apart and are connected via telephone/communication lines, radio waves or other means of connection.

Networks are usually classified using three properties: Topology, Protocol and Architecture. Topology specifies the geometric arrangement of the network. Common topologies are a bus, ring, and star. The protocol specifies a common set of rules and signals the computers on the network use to communicate. Most networks use Ethernet, but some networks may use IBM's Token Ring protocol. Architecture refers to one of the two major types of network architecture: Peer-to-peer or client/server. In a Peer-to-Peer networking configuration, there is no server, and computers simply connect with each other in a workgroup to share files, printers and Internet access.

In a network, there are many networking devices. Computer networking devices are known by different names such as networking devices, networking hardware, network equipment etc. However, all of the names mean the same but have got different purposes. Different networking devices have different roles to play in a computer network. These network devices also work at

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different segments of a computer network performing different works. In our new series after network topology, we talk about different networking devices like a switch, router, hub, bridge etc.

Network engineers are liable for configuring devices, optimizing, installing, maintaining and supporting computer communication networks within an organization or between organizations. Their destination is to ensure the smooth operation of communication networks in order to provide maximum performance, security of data transaction and availability for their users, such as staff, clients, customers, and suppliers.

1.2 About Aamra Networks Limited

Aamra Networks Limited (formerly Global Online Services Limited) over the last decade has consistently provided its customers with state of the art IT communication solutions. Using the state of the art backbone and infrastructure, aamra networks have ensured that clients have had minimal worry when it comes to dependability of their IT Communication. When Internet and related value added services are critical input to business, Corporate Bangladesh has but only one obvious choice aamra. Aamra networks limited (ANL) employs more than 327 employees with diverse skill sets and expertise. Through years of experience ANL is able to accurately assess constantly changing customer requirements, offering the most extensive and affordable IT services available. ANL places due importance on quickly adopting new technology by investing 30% of its budget for R&D. The company also strives to maintain international standard products and services; ANL is upholding ISO9001:2008 certification for the last 8 years.

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1.3 Company Profile

Name	**:**	Aamra Networks Limited
Address	**:**	Dhaka Office Faruque Rupayan Tower (17th Floor) 32 Kemal Ataturk Avenue, Banani Dhaka-1213, Bangladesh
Telephone	**:**	+88-02-9841100
Email	**:**	info.networks@aamra.com.bd
Website	**:**	www.aamranetworks.com

1.4 Objective of the Report

The main objectives of this report are as follows:

1. To identify the network security and its Operation.
2. To identify the network troubleshooting, router configuration, mail server and network monitoring.
3. To observe the network infrastructure of an ISP.

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1.5 Summary of the Report

The objective of this Internship is to improve an effective knowledge in network security and bandwidth management of Aamra Networks Ltd. In The First chapter, I have termed the Details & objective an overall view that I am going to the instrument during this internship work and I would describe the background of Aamra Networks Limited.

The Second Chapter, mostly describe an overview of basic networking.

The Third chapter is explaining about technical support department which includes networking security, bandwidth management, networking device configuration and many more

In Chapter Four, I talked about the infrastructure department and its operation. Finally, in Chapter Five, I discussed the conclusion and limitation of the work.

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Chapter 2

Overview of Networking

When two or more device connected physically and assign logical address between them for the purpose of transmitting data and resource sharing then it is called networking. Networking also called computer network. A computer network can be large to establish a connection between millions of devices or it can be small. Networking administration contains not just the plan, development, and utilization of a network, yet in addition the administration, support and activity of the network infrastructure, software and approaches.

2.1 Types of Computer Network

There are three major types of network design to operate the area and these are LAN, MAN, and WAN.

2.1.1 Local Area Network (LAN)

A LAN network is a network which deployed in a small area. In LAN the multiple computers are closed together like in a building or in a small office. In the LAN the computers can be connected wired or wireless. Local Area Network data transfer rate is higher than other network design.

Fig 2.1: Local Area Network

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2.1.2 Wide Area Network (WAN)

A Wide Area Network is the biggest network which can interconnect the whole world. Basically, a WAN made by two or more LAN and MAN. In WAN computers are connected through a telephone line or radio waves. The WAN also transmit high-speed data and relatively expensive than LAN and MAN.

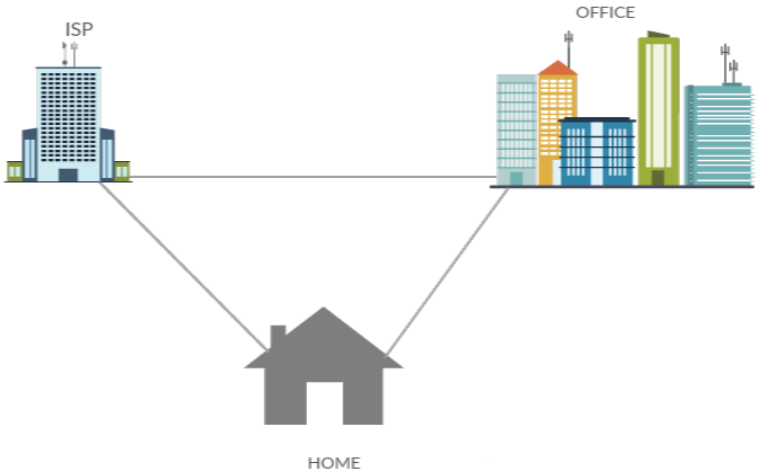

Fig 2.2: Wide Area Network

2.1.3 Metropolitan Area Network (MAN)

Metropolitan Area Network cover larger than LAN but smaller then WAN. Basically, MAN is built in a city or town for high data rate. MAN transmission rate is faster than LAN but slower than WAN.

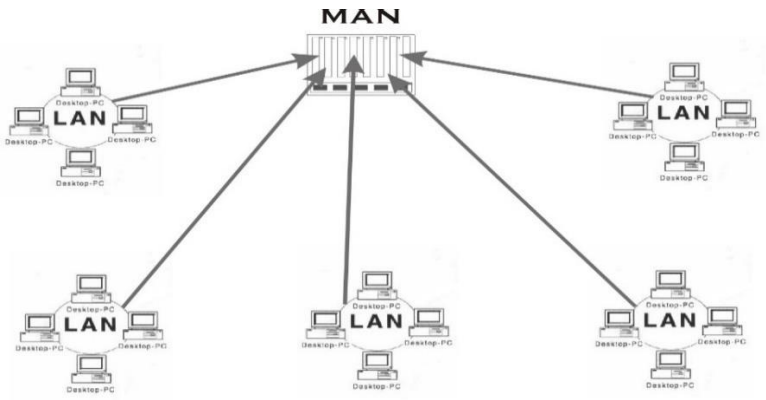

Fig: 2.3: Metropolitan Area Network [1]

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2.2 Network Topology

Network topology refers to the how different networking device connected to each other. Also, network topology is the physical and logical connection of a network. There are two types of network topology and these are physical and logical topology. Physical topology describes the physical layout of the network and logical topology describe how data transfer in the network. There is four basic Network topology. Which are Bus, Star, Mesh, Ring topology.

2.2.1 Bus Topology

In a bus topology, there is a central cable and all the computers connect through this cable. In a bus topology, there are two endpoints. This is simple and low-cost topology. Generally, an Ethernet system used a bus topology.

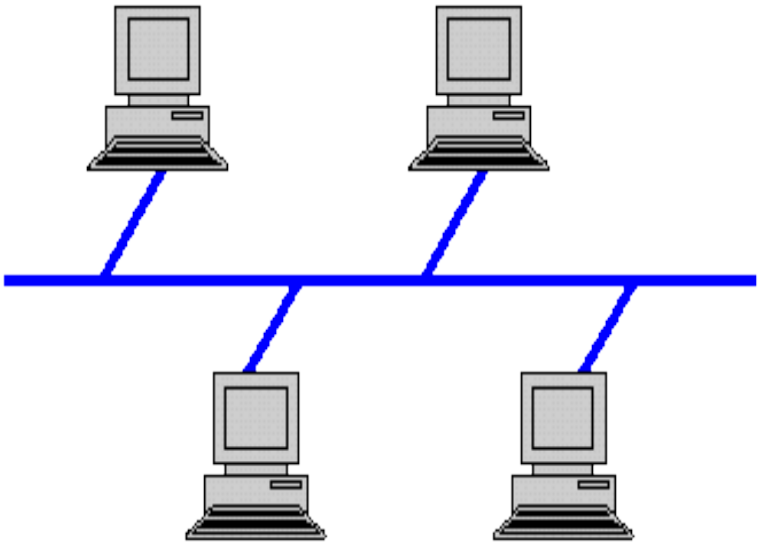

Fig 2.4: BUS Topology [2]

2.2.2 Star Topology

In bus topology all the computers connected through a single hub. Hub is the controlling point of this topology. In this topology, if one computer fails then there is no effect on the network. But if hub fails then full network down.

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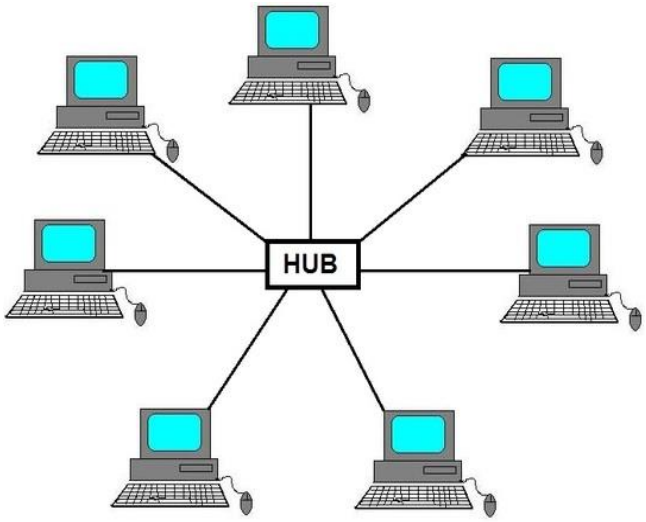

Fig 2.5: Star Topology [3]

2.2.3 Mesh Topology

In mesh topology all the nodes connected to all other nodes via cable. In mesh topology, if one PC down then the full network is down. This is most costly topology. There are two types of mesh topology and these are full mesh topology and partial mesh topology.

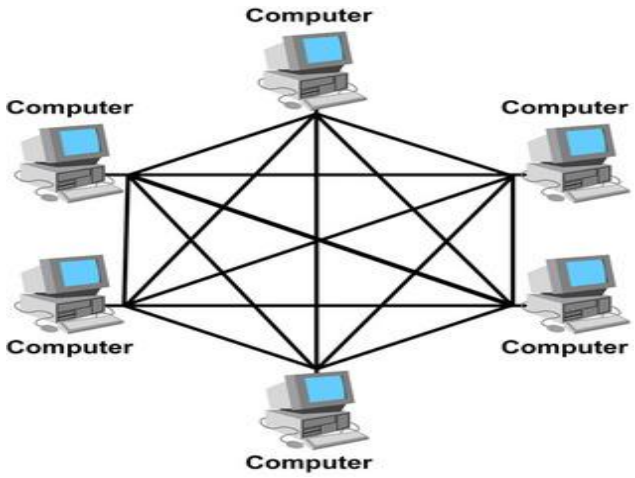

Fig 2.6: Mesh Topology [4]

2.2.4 Ring Topology

In-ring topology all the computers have two neighbor computers connected through the cable. If one PC sends data to another PC then this data travel through all the PC and receiver PC receive the data. If a computer fails then all the network become down.

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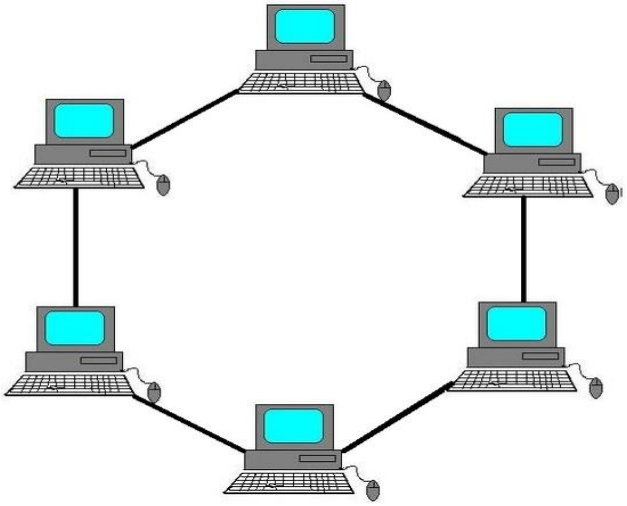

Fig 2.7: Ring Topology [5]

2.3 Networking Devices

Computer network devices have to play a different role in the networking system. It is also called network equipment. This networking device work in different topologies. These networking devices are a hub, switch, router, bridge, repeater etc.

2.3.1 Hub

Hub connects multiple hosts. In a hub, if one user sends data then this data is transferred all the user but all the host ignore data only receiver receives data. In the hub, there is a chance to data collision. Hub works in the physical layer in the OSI model. It is not an intelligence device. It is just transfer information.

Fig 2.8: Hub [6]

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2.3.2 Switch

A switch is just like a hub. But the switch is more intelligent because a switch is not just working data forwarding but also filter and forwarding in an intelligent way. In switch, there is no chance to data collision. Switch operated in full duplex mode. The switch is a data link layer device in the OSI model.

Fig 2.9: Switch [7]

2.3.3 Router

A router is a device which interconnects two different networks. The router operates in Network layer in OSI model. The router connects LAN and WAN together and dynamically update routing table.

Fig 2.10: Router

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2.3.4 Bridge

Basically, Bridge connects two different subnetworks in the same network. Bridge operates a data link layer in the OSI model. It connects two local area network. There are three types of bridges which are a transparent bridge, Source Route Bridge, translational bridge.

Fig 2.11: Bridge

2.3.5 Repeater

A repeater regenerates the signal before signal become weeks. The repeater does not amplify the signal, they regenerate the signal. Repeater operates in the physical layer. Generally, repeater is two port device. The repeater is employed in long distance communication.

Fig 2.12: Repeater

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Chapter 2

Technical Support

TSD (technical support department) main work of this department is network monitoring, mail service, support, hosting, IPLC, troubleshooting and lastly security.

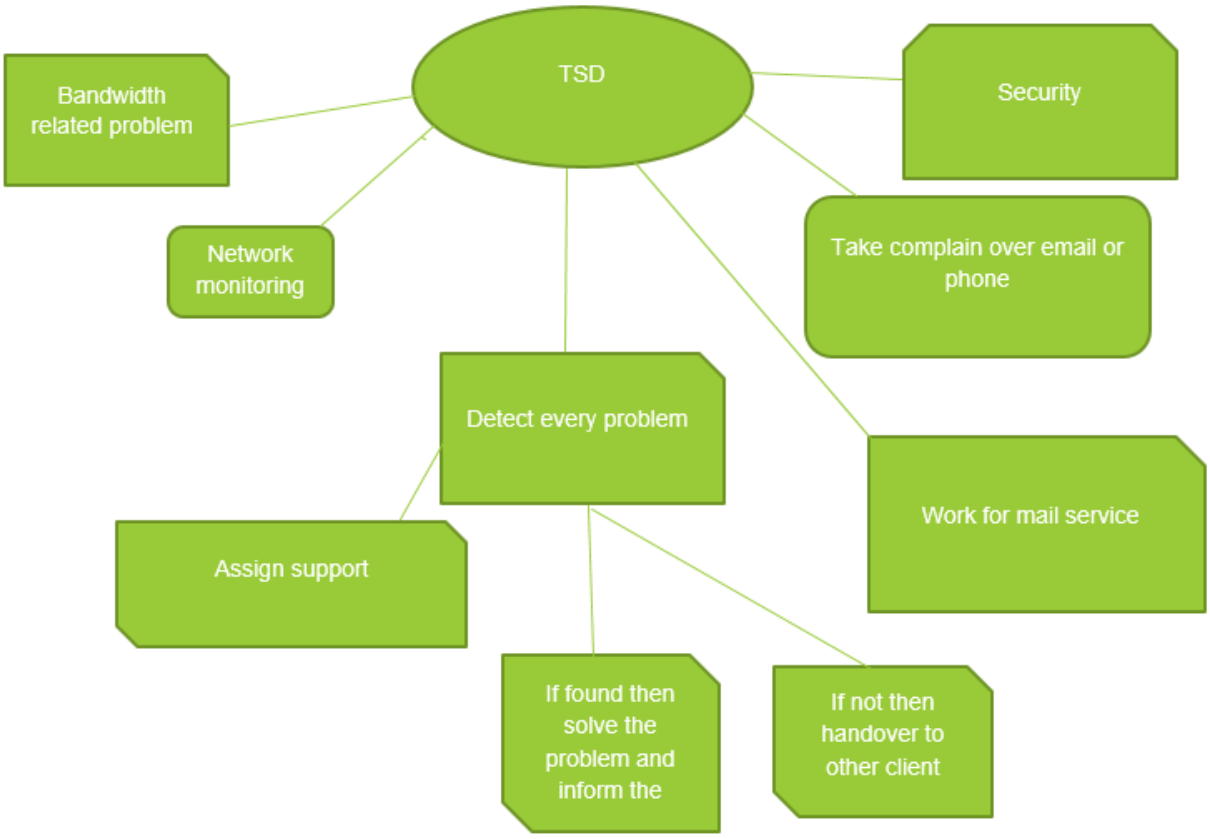

Fig 3.1: Technical Support Overview

3.1 Network Monitoring

Monitoring whole the network is main work in TSD department. They handle logical issues. To acknowledge every issue team creates a ticket against every client, that every team member can acknowledge what actually client facing, ticket assigned to a team member who can solve the issue.

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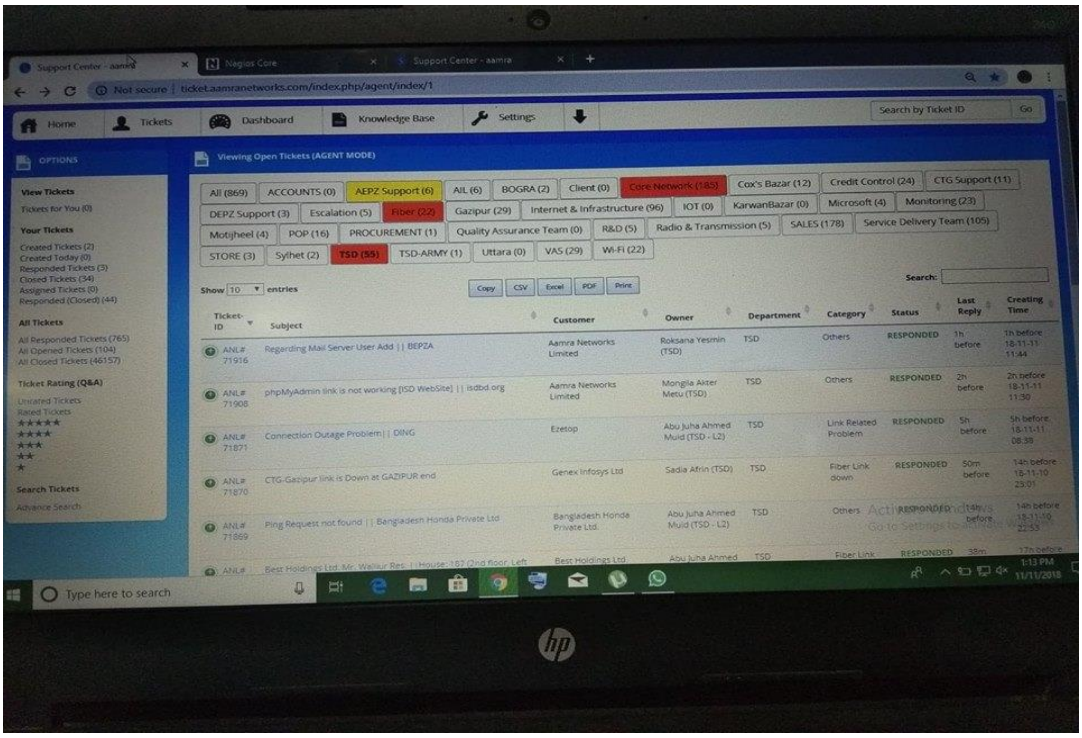

Fig3.2: Ticketing

They monitor every pop 24.7. There has 72pop whole over Bangladesh. If any client wants personally monitor his company they do also.

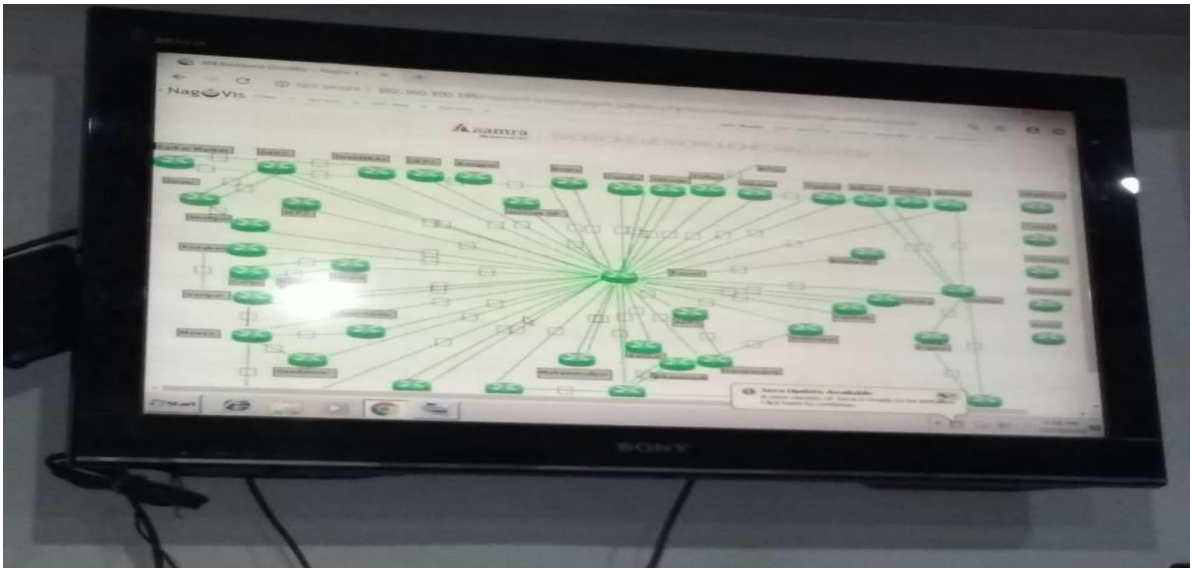

Fig 3.3: POP Monitoring

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For monitoring, they use monitoring tools like Nagios MRTG. Nagios basically used to find out client actual end, how much time the link has been down. When issue solved the link will be up.

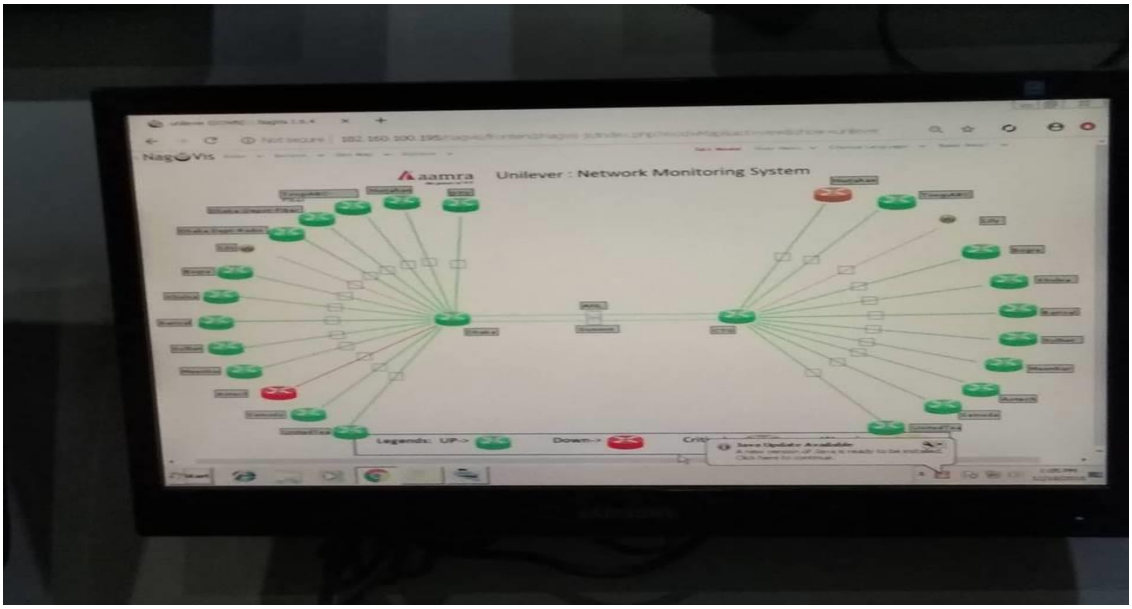

Fig 3.4: Single Client Link Monitoring

3.1.1 Nagios

Nagios basically used to find out client actual end, how much time the link has been down. When issue solved the link will be up. It's a way to find out clients which IP has been down.

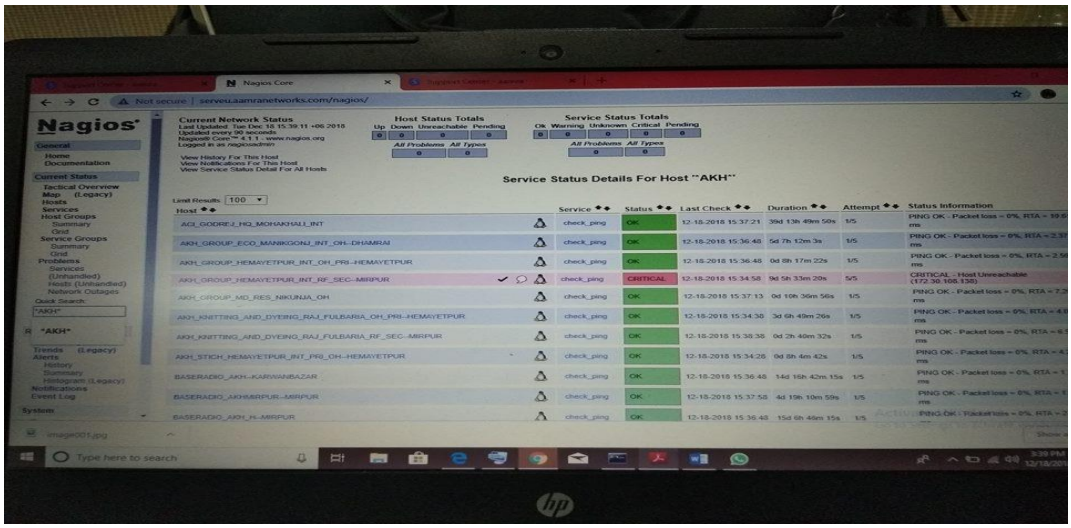

Fig 3.5: Link Up and Down

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The red color indicate that the link is down and green closure sign means this companies anther links are up, these have no issue.

3.1.2 MRTG

MRTG mainly uses for checking bandwidth result, in this graph showing a client IP bandwidth. Where the client has been given 12mbps but client getting 2Mbps.

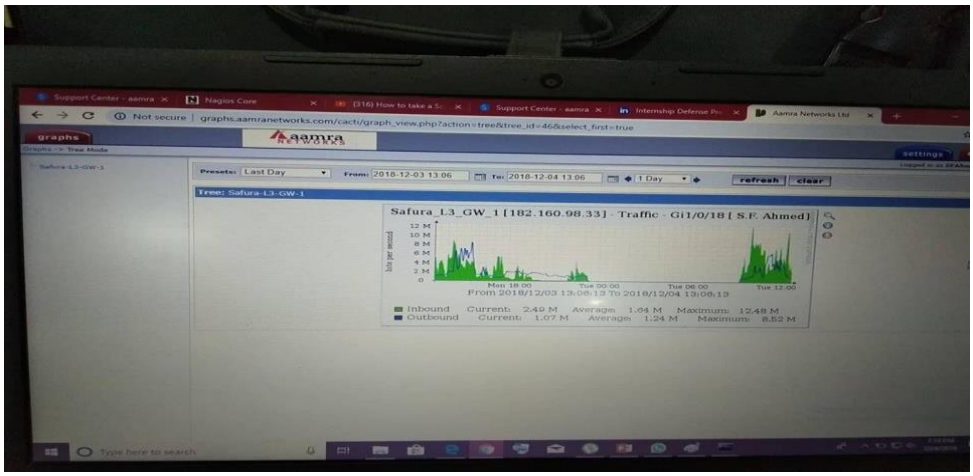

Fig 3.6: MRTG Check

3.2 Troubleshooting

Troubleshooting is kind of logical problem solving for failed processes. It's needed to identify the calamity. When client link gets down than the first check the IP and ping the IP.

Ping statistics for 202.74.245.29:

Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),

Approximate round trip times in mille-seconds:

Minimum = 725ms, Maximum = 1518ms, Average = 1022ms

C:\Users\Peyash>ping 202.74.245.29

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Pinging 202.74.245.29 with 32 bytes of data:

Reply from 202.74.245.29: bytes=32 time=1282ms TTL=60

Reply from 202.74.245.29: bytes=32 time=843ms TTL=60

Reply from 202.74.245.29: bytes=32 time=669ms TTL=60

Reply from 202.74.245.29: bytes=32 time=1277ms TTL=60

Ping statistics for 202.74.245.29:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in mile-seconds:

Minimum = 669ms, Maximum = 1282ms, Average = 1017ms

If link down then there will show a loss. And no replay will come from ping status .when latency high that ensure the link is logically down. Latency could be high for client uses .and also checking WAN and LAN connection, checking router configuration, verify TCP/IP settings.

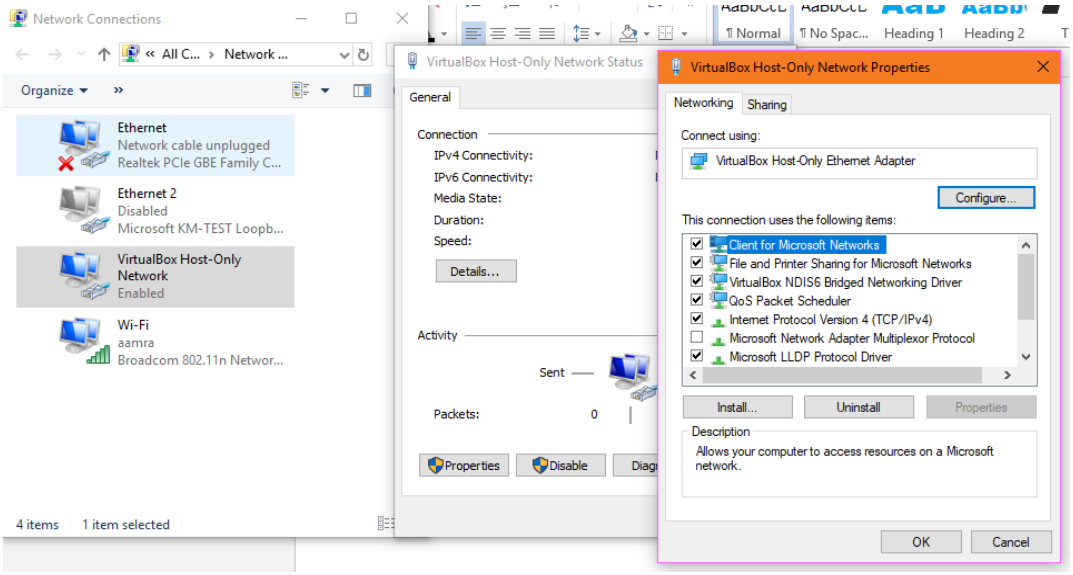

Fig 3.7: LAN Properties

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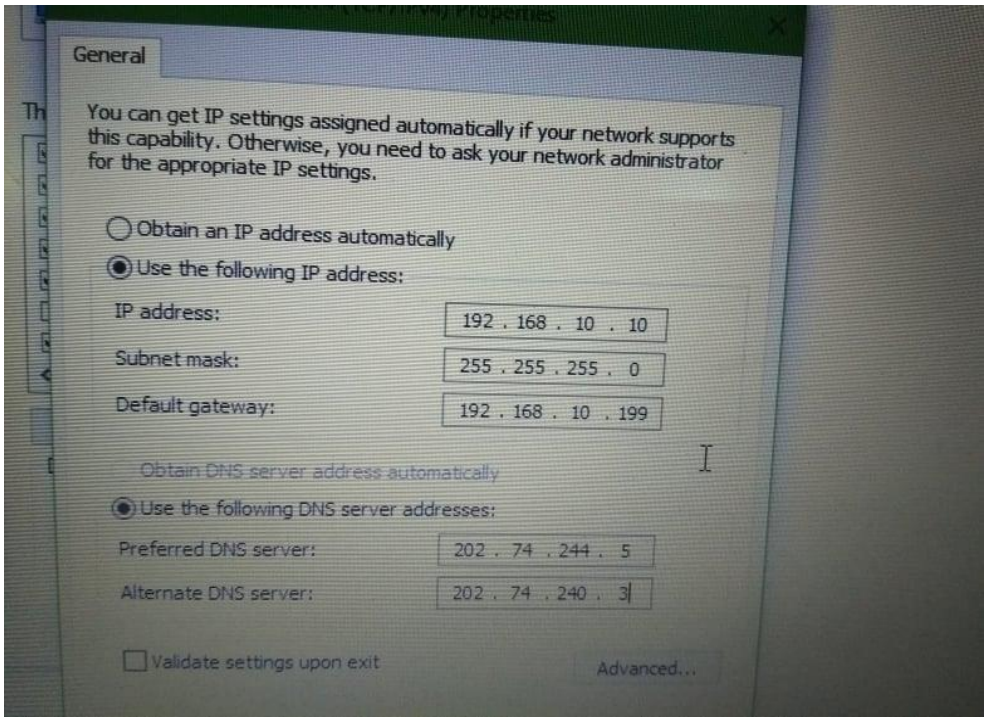

Fig 3.8: IP Addressing

3.3 MikroTik Router Configuration

MikroTik a router like TP link and cisco which is getting more famous day by day cause of its glib configuration. It's much easier than most of the router and strong by its capability. Many companies nowadays using this router so its users are increasing, here as we learned a little. There is a process of how to configure MikroTik.

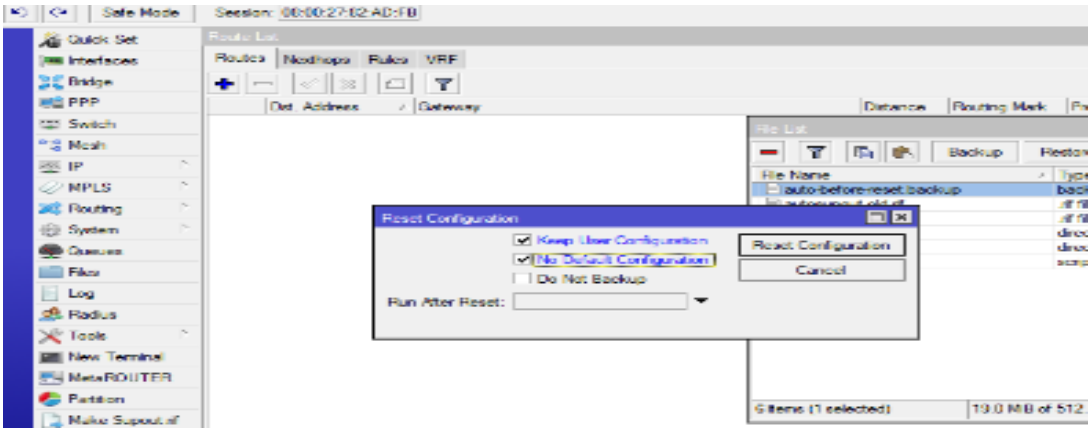

Fig 3.9: Reset MikroTik Router

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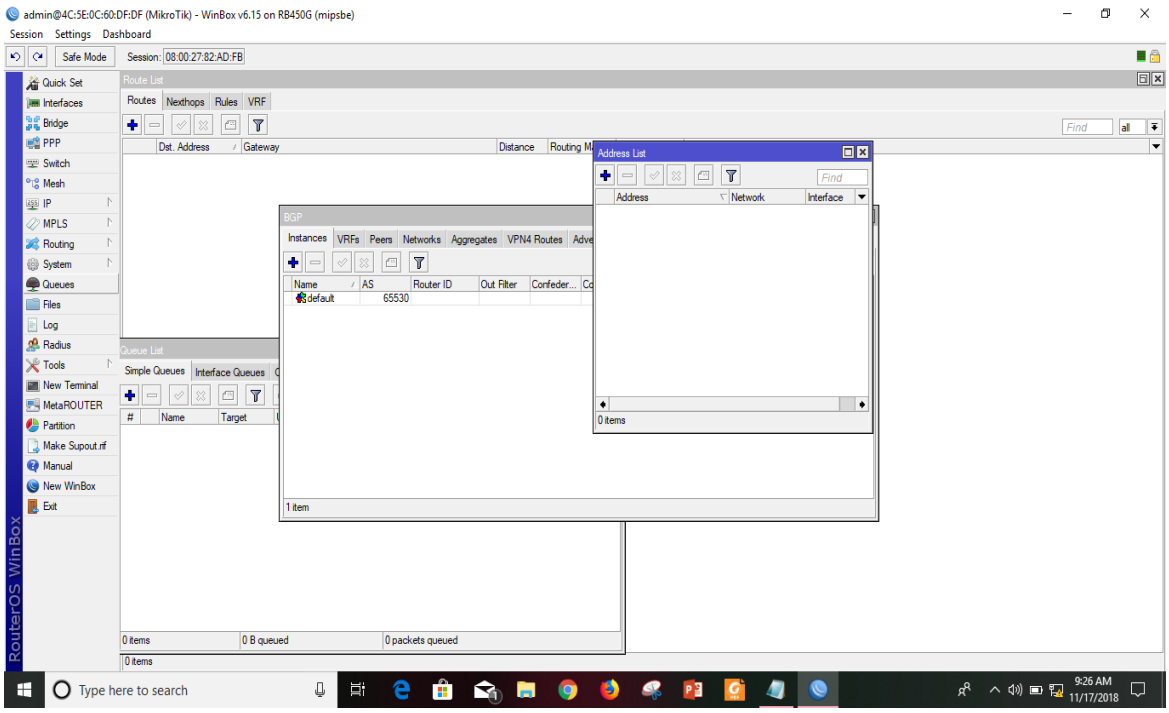

Fig 3.10: IP Addressing in Two Ports

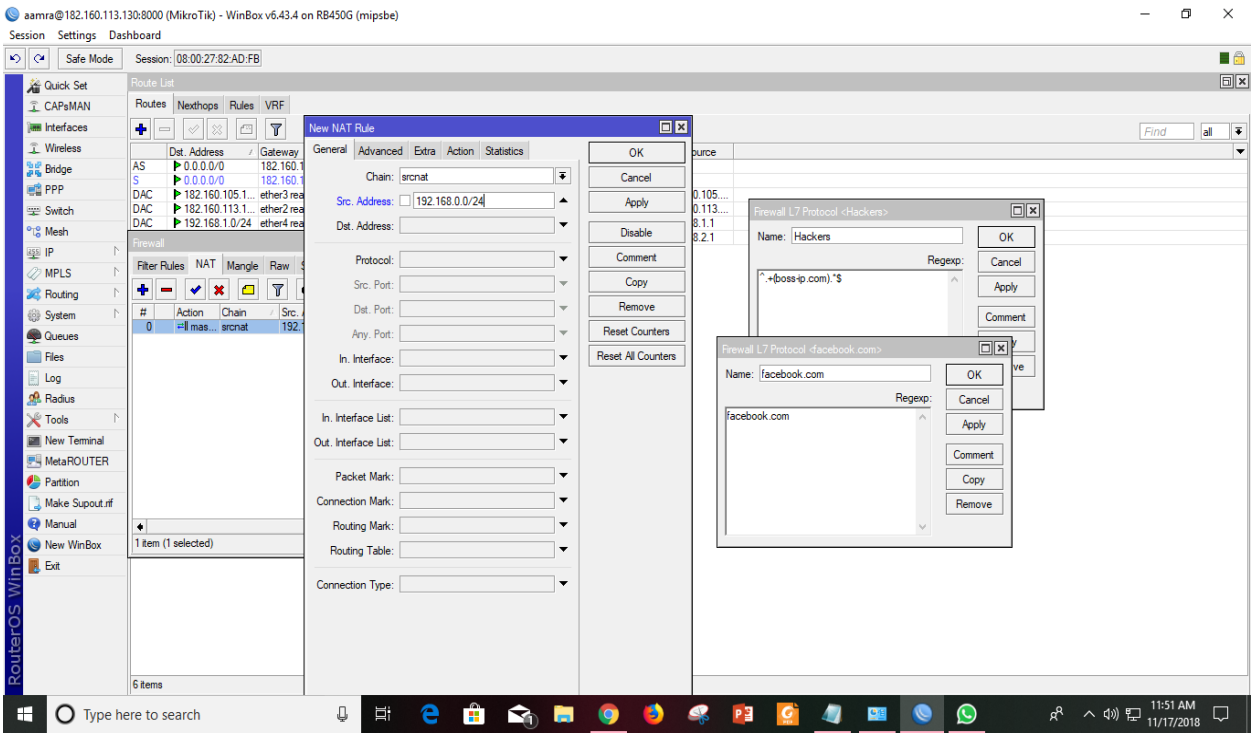

Fig 3.11: NAT Configuration

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3.4 IPLC

An IPLC (International Private Leased Circuit) is a point-to-point private line used by an organization to communicate between offices that are geographically dispersed throughout the world. An IPLC can be used for Internet access, business data exchange, video conferencing, and any other form of telecommunication.

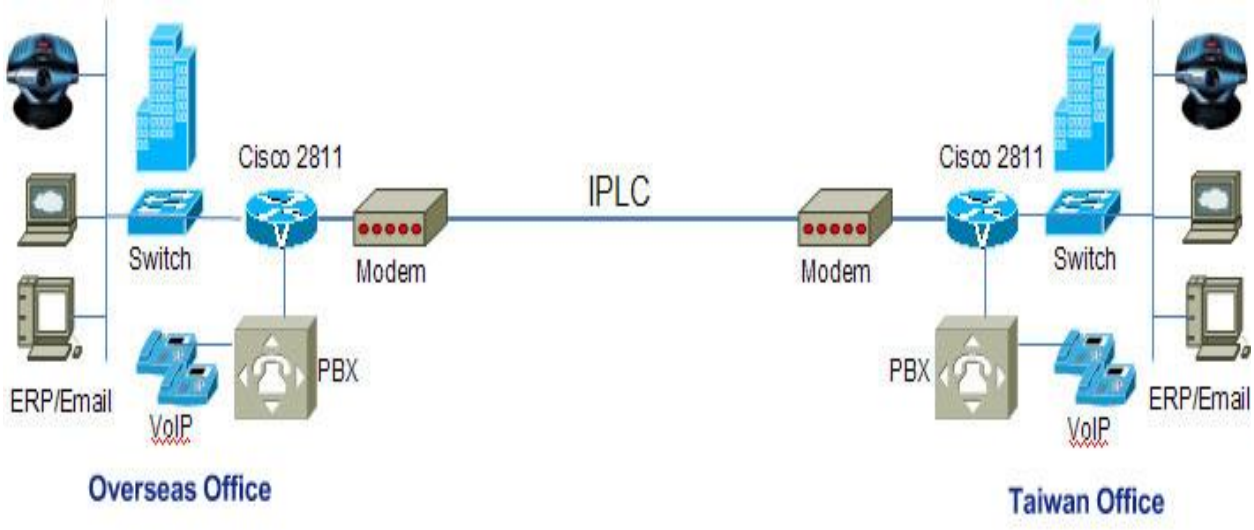

Fig 3.12: IPLC Communication

3.5 Mail server

In every company in their busy days maintain mail communication.As our simple uses of emails maybe we cannot realize how mail server could be part of the networking side.as I saw my senior one who worked for mail sever whole day for some confidential companies. I saw most of the work she did use Linux coding system.so working with my senior I learned a little about this mail server. Aamra have four server :

1.C-panel Mail Server (shared hosting)

2.zimbra Mail Server (shared hosting)

3.Local Server (dedicated server)

4.Office 365 (cloud host)

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1.C-panel Mail Server: It is based on linux web hosting where stored c-panel related data which is use for domain and mail hosting.work as two types- (1)inhouse cloud (2)global vendor.

2. zimbra Mail Server: Aamra have five zimbra server where permited upto ten domain.In every domain have upto fifty account user.And I experienced create user account and also transfer mail on new new account.

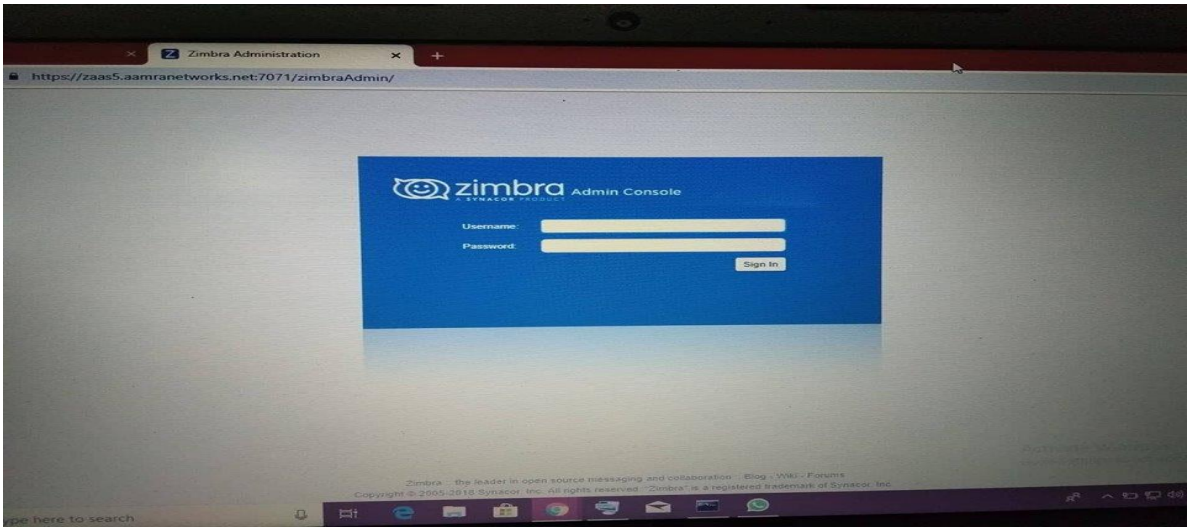

Fig 3.13: Zimbra Mail Page

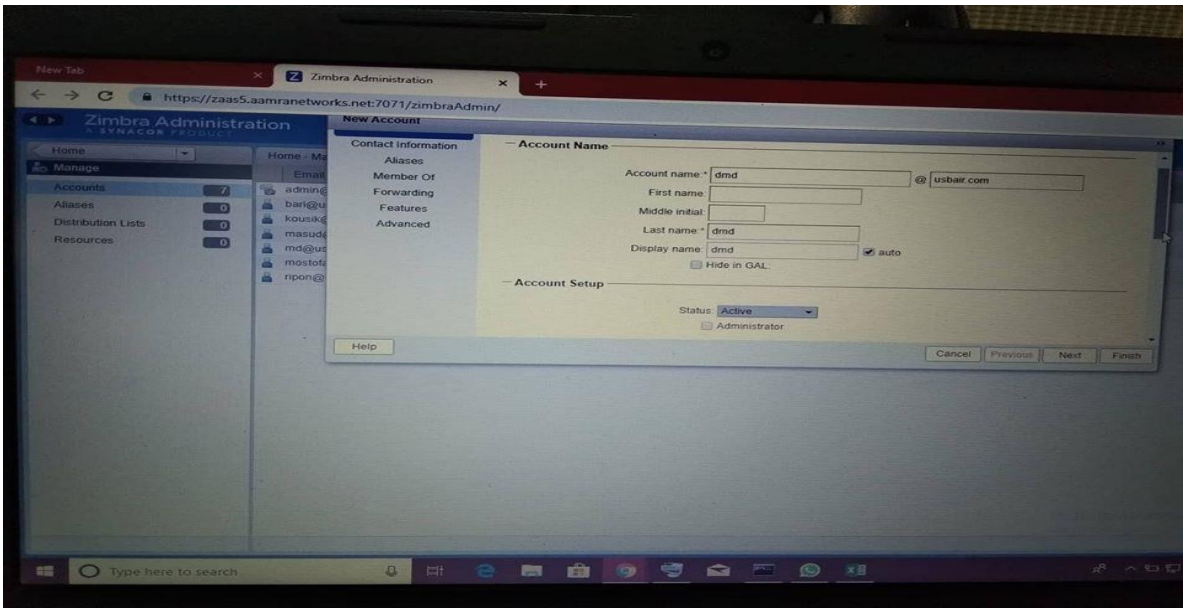

Fig 3.14: Account Create

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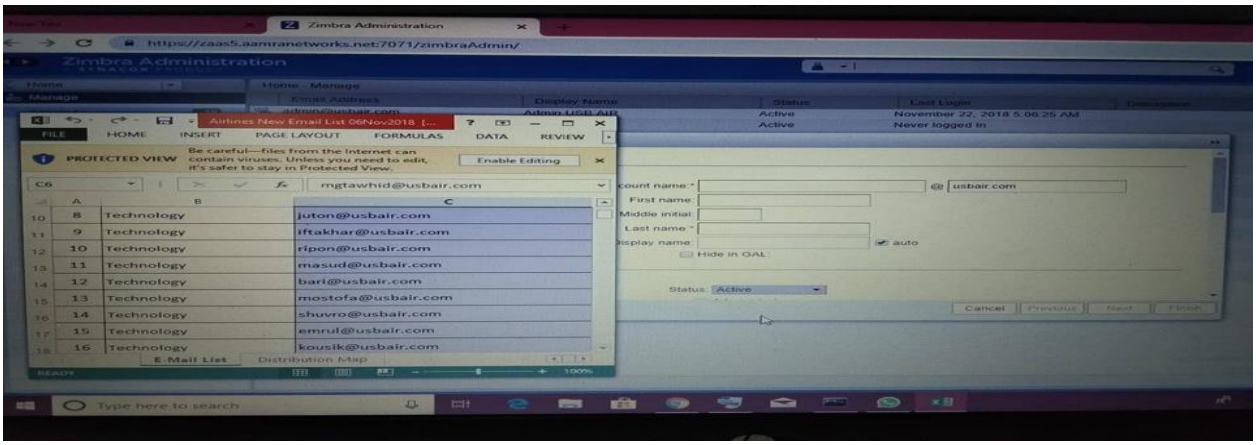

Fig 3.15: New Mail Account Create and Transfer Account

3. Local Server: It's a client premises dedicated server. It is easy to manage.

4. Office 365: It is a Microsoft cloud mail system. Aamra network buy license from Microsoft and after modify distribute to client.

Outlook: It's a common offline mail system for every sever .It is use for downloading mails automatically and client can see mail when there is no internet and also save place by downloading mails .

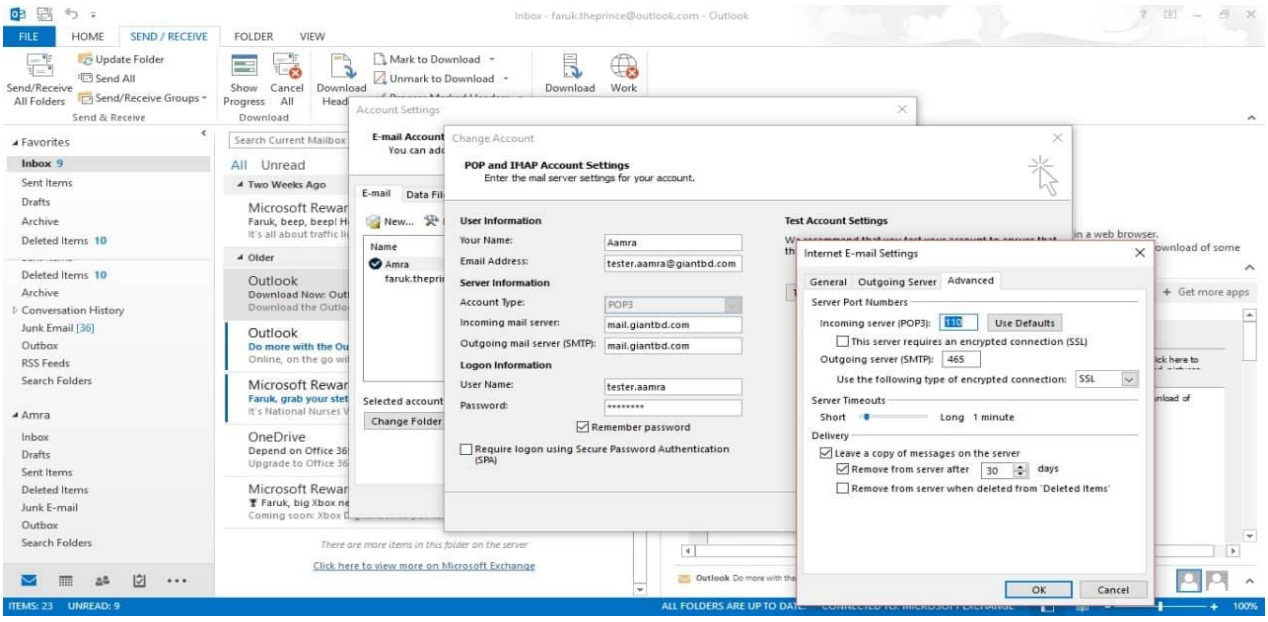

Fig 3.16: OUTLOOK Account Create

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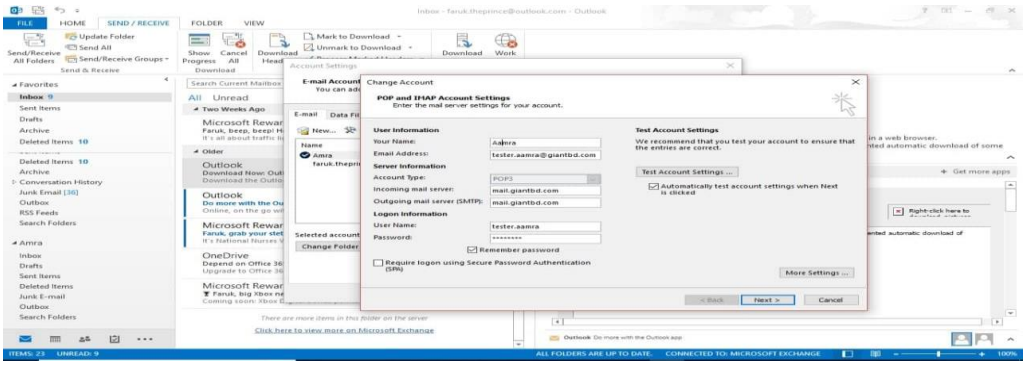

Fig 3.17: OUTLOOK Mail Server

3.6 Network security

My main topic is security as we know security is not a small issue that a company can permit you to work on it.But Aamra networks do not just believe in the power of we but also actually work as we, with their beloved attitude we learned a lot within 3months.

As a network engineer in every step of our work we have to maintain security.Aamra networks every day deal with a huge client so they have to maintain a big part the client's networks security as I have talked my previous chapter about routers and bandwidth all off the field locked securely.

3.6.1 IP Blacklist

IP is a confidential issue .you cannot use the network in any negative way, then it could be blacklisted. If your IP listed for much more time, then you may not get it back, but there is the procedure to get IP back.

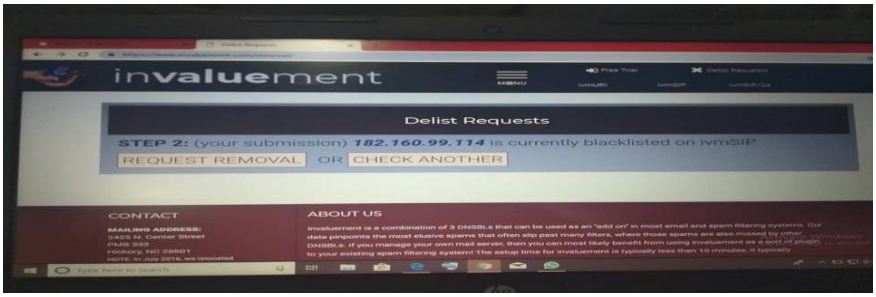

Fig 3.18: Checking IP

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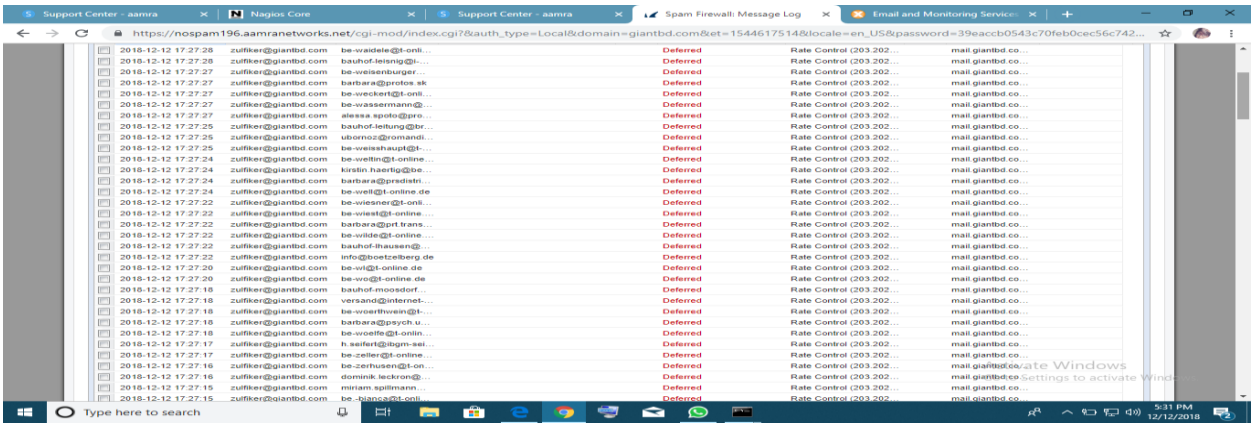

Fig 3.19: IP Blacklist

3.6.2 Firewall

In computing, a firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules. A firewall typically establishes a barrier between a trusted internal network and an untrusted external network.

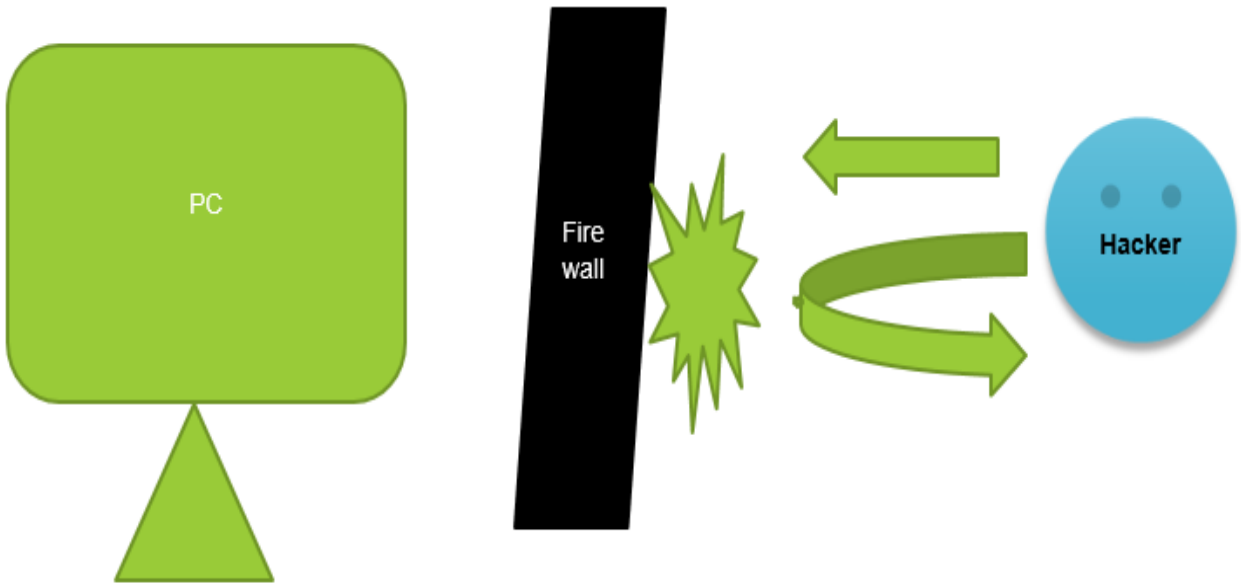

Fig 3.20: Firewall

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3.6.3 Nework Security Using MikroTik

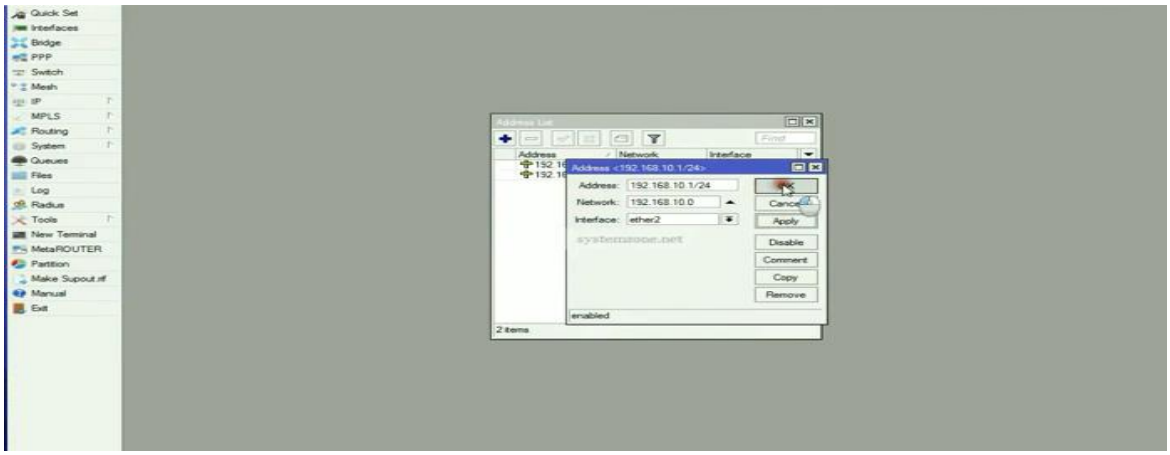

Fig 3.22: IP Addressing

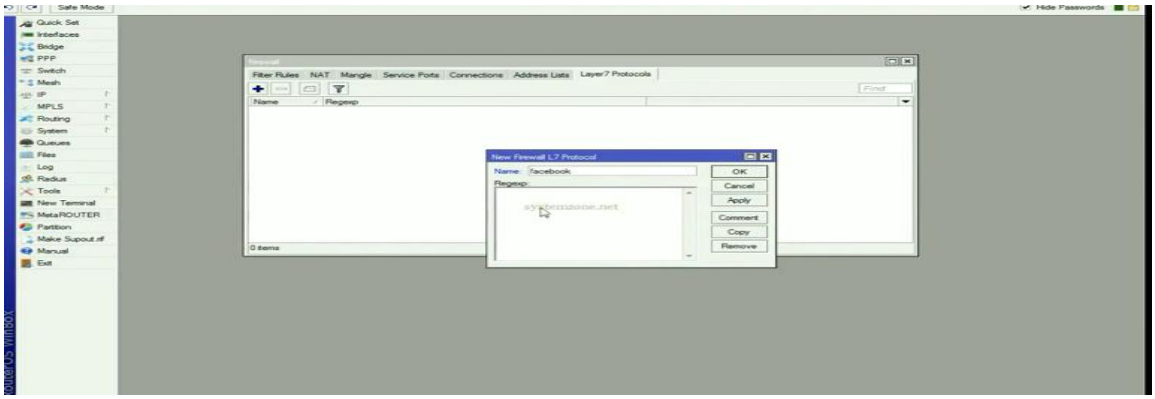

Fig 3.22: Website Addressin

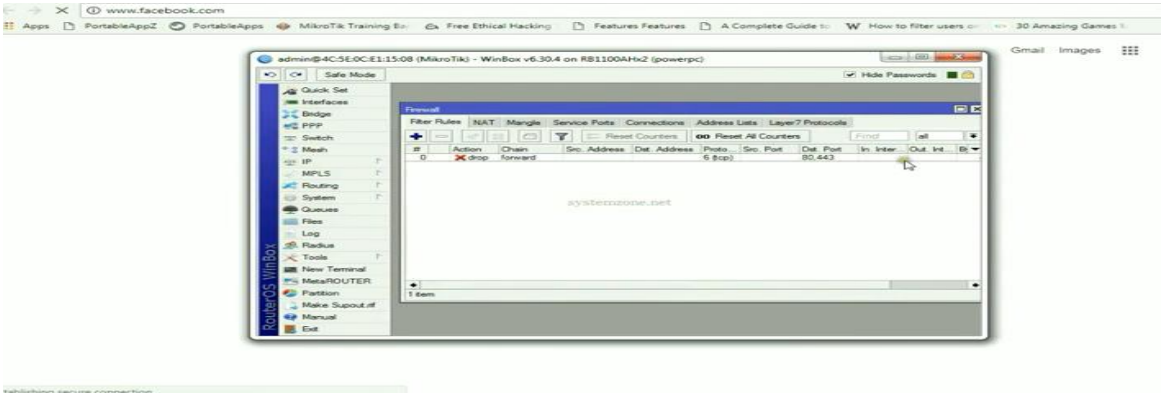

Fig 3.23: IP Disable

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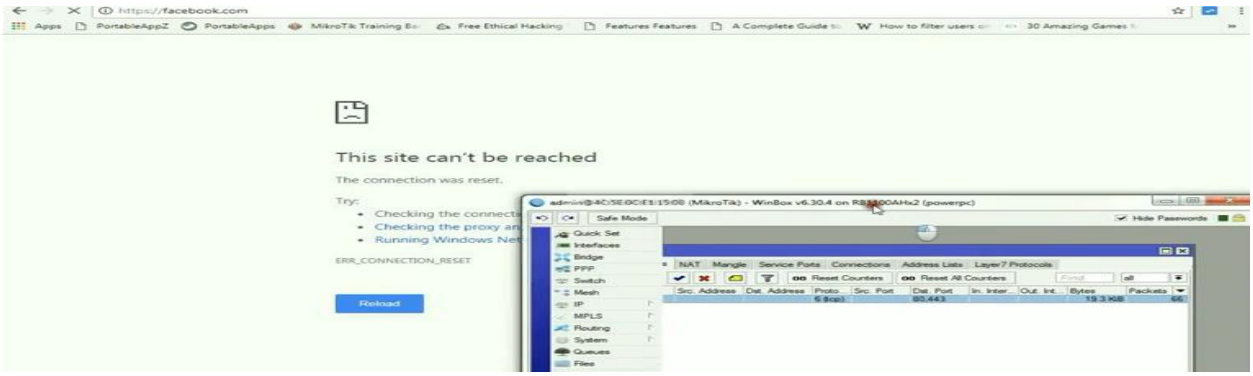

Fig 3.24: Website Disable

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Chapter 4

Infrastructure Operation

Infrastructure is the foundation or structure that supports a framework or association. In computing, Internet Service Provider infrastructure is made out of physical and virtual assets that help the stream, storage, preparing and investigation of information. Infrastructure might be incorporated inside a data center, or it might be decentralized and spread over a few data center that is either controlled by the association or by a third party.

Data center infrastructure include different types of device to support data center hardware. Data center hardware includes different types of instruments like storage, networking device, cable, radio device etc. Outside of the data center, there are many more device like fiber optic cable, antenna, repeaters, TJ box etc.

Aamra networks limited provided IT infrastructure to satisfy client information technology needs. In the Infrastructure department there are many works. And this work divided many small sections. These are the Optical Fiber section, a Radio section, Point of presence section (POP).

4.1 Optical Fiber

An optical fiber is a thin and pure glass where information can be transmitted as a light. An optical fiber has a core surrounding by a cladding layer. In optical fiber, data is transmitted at a high rate. Generally, optical fiber works as a reflection of light and it is unaffected by electromagnetic interference.

An optical fiber has three parts:

Core: The center of the fiber where light can be transmitted.

Cladding: It is the outside layer of the core and in this layer light reflects back to the core.

Buffer Coating: It is made by plastic used to protect core and cladding.

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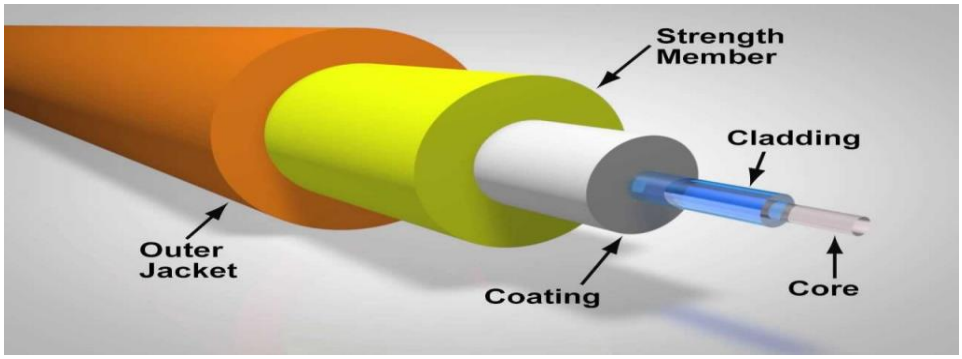

Fig 4.1: Optical Fiber

4.1.1 Types of Optical Fiber

Basically there are two types of optical fiber:

Single mode fiber Optic cable: In single mood fiber optic cable, one light signal travels in the core by using reflection. Single mood fiber optic cable has a smaller core diameter. Single mood fiber optic cable is expensive than multimode fiber optic cable.

Fig 4.2: Single Mood Fiber

Multimode fiber optic cable: In multimode fiber optic cable, several light signal travels in the core by using reflection. Multimode fiber optic cable has a larger core diameter. It is used for short distance. It is less expensive.

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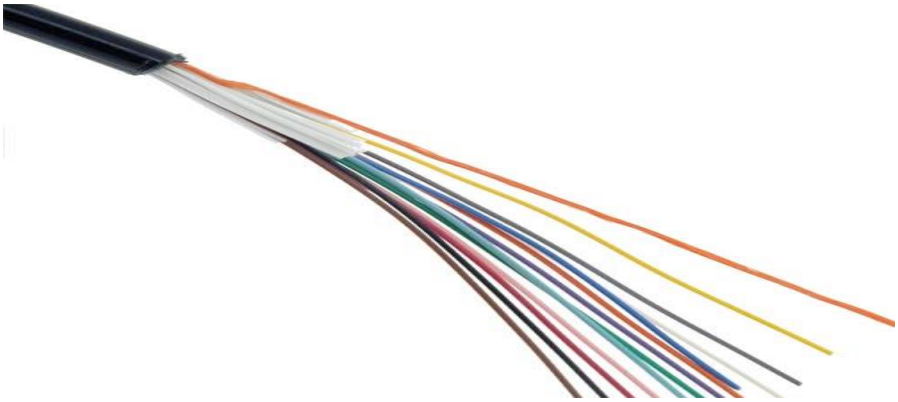

Fig 4.3: Multimode Fiber

4.1.2 Optical Fiber Instruments

There are many kinds of optical fiber device to cut, join and test optical fiber.

Fusion Splicing: Fusion splicing is the machine which is used for joining two optical fiber correctly. The goal is the two fiber fuse in the way that light is not scattered. It is used an electrode to joining the fiber.

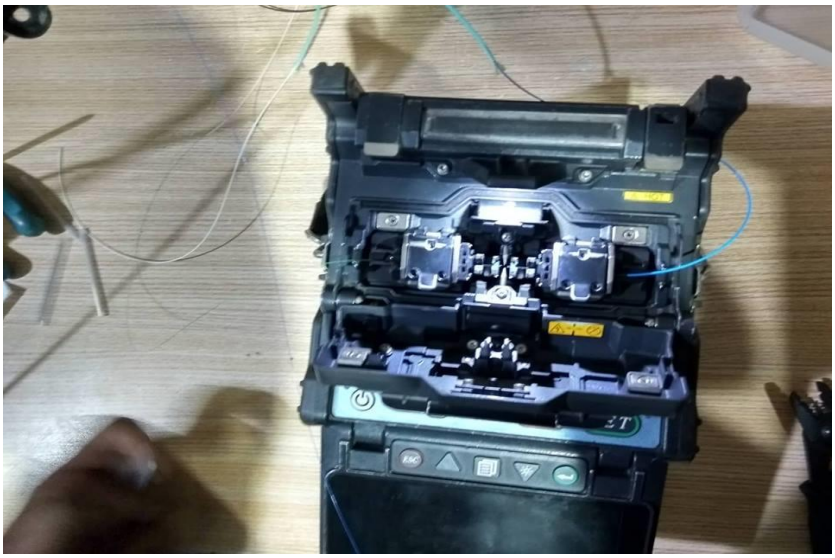

Fig 4.4: Fiber Splicing in Fusion Machine.

OTDR Machine: An Optical Time Domain Reflector uses to characterize the optical fiber. It uses pulses to measure where light is scattered or cut. It is measured by the function of the time.

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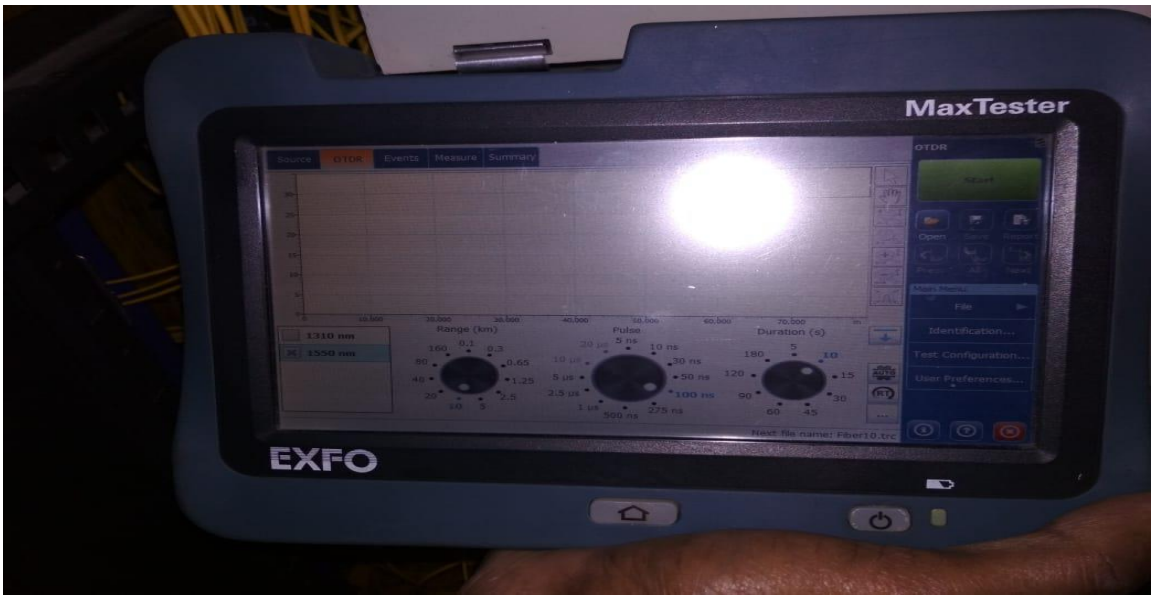

Fig 4.5: OTDR Machine

4.1.3 Fiber Optic Network

A fiber optic network depends on the customer requirement. A fiber optic network is small or big depends on client. A fiber optic network is the network on which way fiber optic device get connected through ISP to client.

There are two types of fiber optic network:

4.1.3.a Point to Point Network

In a point to point network aggregation switch at the central office connected to the media converter (MC) or Optical Network Termination (ONT) at the customer end. P2P networks provide static bandwidth. In P2P connection each aggregation switch connected different client. P2P connection is easy to connect and maintain. It is able to add individual features in the customer end. SLA and MTTR service are ensured to remain going and fixes are made inside hours to limit downtime. Capacity to use Layer 2 and MPLS networks (multi areas, L2 to offsite reinforcement, guide association with cloud suppliers, and so on.).

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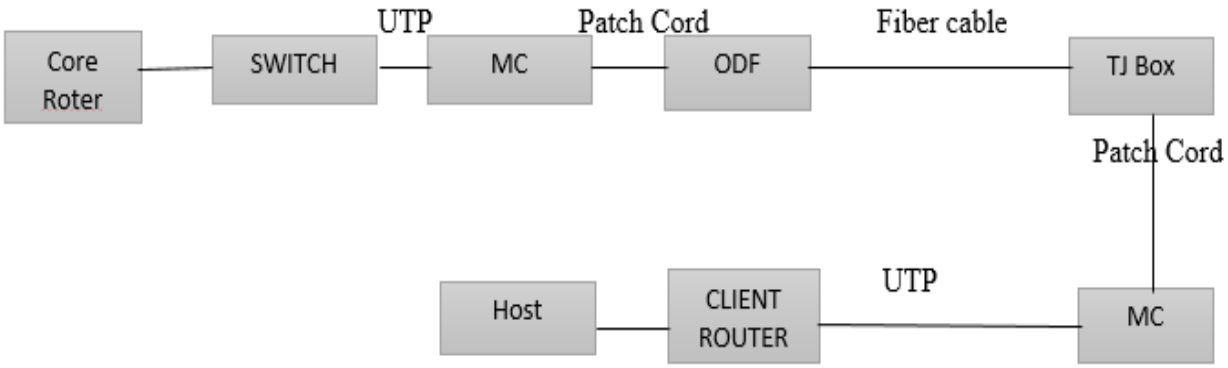

Fig 4.6: Point to Point Network

MC: Media converter is the device which is connected two dissimilar media type. In MC electric signal converts into the light signal and light signal converts into the electric signal. Media converter works parameter is wavelength. So that same wavelength media converter is not connected.

Fig 4.7: Media Converter

ODF: Optical Distribution Frame (ODF) is the frame which provides various fiber to integrate into a single unit. It is also called a protected device. It is important equipment in the fiber optic communication system. There are three types of ODF and which is wall mount ODF, floor

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mount ODF and rack mount ODF. In ODF there are many ports like 12 or 24 or 48 or 96 port ODF.

Fig 4.8: ODF

TJ Box: Transmission Joint Box used when the fiber is joining. The joining fiber is deployed into the TJ Box. Basically, TJ box connected to the client end or road end.

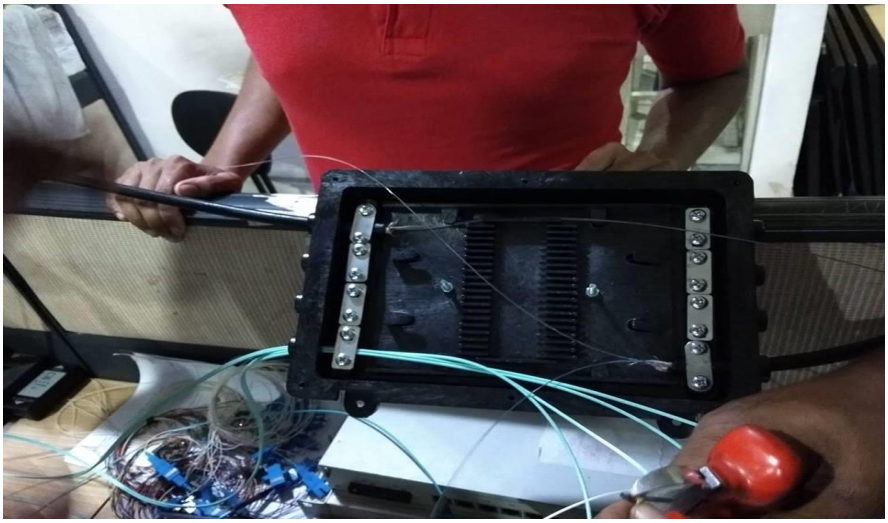

Fig 4.9: TJ Box

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4.1.3.b Point to Multipoint Network:

Point to the multipoint network also called Passive Optical Network (PON). In the case of PON Optical Line Terminal (OLT) deployed in the central office. Then a single fiber which is connected to the OLT gets connected to the splitter. In the splitter different fiber get connected to the client. It is less expensive because it uses a few cables to implement. It is more complex then P2P.

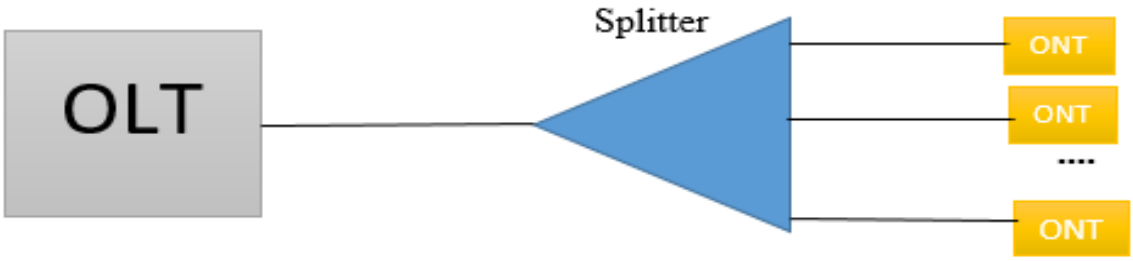

Fig 4.10: Point to Multipoint Network

OLT: An Optical Line Terminal (OLT) is the central office endpoint hardware device. An OLT has two operations. One is converting the standard signal into the frequency and framing and another is planning the multiplexing between the change devices on the optical network terminals. The OLT contains a central processing unit (CPU), passive optical network cards, a gateway router (GWR) and a voice gateway (VGW) uplink cards. SFP also connected to the OLT.

Fig 4.11: Optical Line Terminal (OLT)

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Splitter: A splitter converts a signal into two or more signal. Each signal carries a different frequency range.

ONT: Optical Network Terminal is the customer end termination point. It gets connected from the splitter to the customer router. It translates fiber optical signal into an electric signal.

Fig 4.12: ONT

4.2 Wireless

Now on this day everywhere has a wireless. Whether it is our home, car, office everywhere. Wireless technology also called radio technology. Now in network system wireless device increasing because of disadvantages of fiber optic cable. Like fiber optic cable can be cut at any time but in wireless network, there is no chance. Wireless devise also easy to deploy and configure.

4.2.1 Wireless Network

Wireless network can be broadcast or P2P network.

4.2.1.a Broadcast network

Broadcasting Wireless device used for a wide audience. Common broadcasting wireless includes cable radio, local wire television networks, satellite radio, and internet radio. In broadcasting wireless signal the signal type can be analog or digital. Broadcasting wireless has many types'

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likes commercial broadcasting, non-commercial broadcasting, public broadcasting, and non-profit broadcasting.

4.2.1.b P2P Network

A P2P network can be transmitted or receive a signal. Basically, a two-way network can be deployed in the home client or industrial client. When a client needs high speed then P2P radio network used. Now, P2P radio network increases because of high speed.

4.2.2 Wireless Devices

There are many wireless devices used in wireless communication for Internet or data connectivity. Different company produce different wireless devices. Company like Ubiquiti Networks or cambium networks produced different radio devices. This company used Ubiquiti networks radio devices.

Bullet M5: Bullet M5 is the high-performance wireless device. It reduces deployment complexity. Its data rate 100 Mbps. It receives 600 mW power. Its range 50+ Km. The bullet M5 frequency is 2.4 GHz.

Fig 4.13: Bullet M5

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Nano Station M5: The Nano Station M5 is the point to multi point wireless device. It is a high performance device. It requires no tools for assembly. It has powerful OS. The Nano Station M5 frequency is 3.65 GHz. Its data rate 150 Mbps and range 15+ km.

Fig 4.14: Nano Station M5

4.2.3 Wireless Device Configuration

For wireless device configuration there are need a radio device, an adapter, a computer and two Ethernet cable

- First one Ethernet cable connected from the adapter LAN port to the computer LAN port.
- Then other Ethernet cable connected from the Power over Ethernet (POE) to the device LAN port.
- Now open ubnt device scanning software.
- Scan IP address then search this found the IP address to the browser.
- Then enter the device configuration.
- Finally configure the network, frequency etc.

This is the process of radio device configuration.

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4.3 Point of Presence (POP)

Point of presence is an access point from one network to rest of the network. Point of Presence is implemented providing internet service to the customer. An ISP has POP more than one at a different location. The number of POP of an ISP measures the growth of an ISP. A POP includes routers, switches, servers, frame relay, ATM switches etc. POP also supports the conversion of analog to digital and vice versa.

Aamra Networks Limited has 72 POP all over Bangladesh. This all POP control by main POP, which is located at the main office.

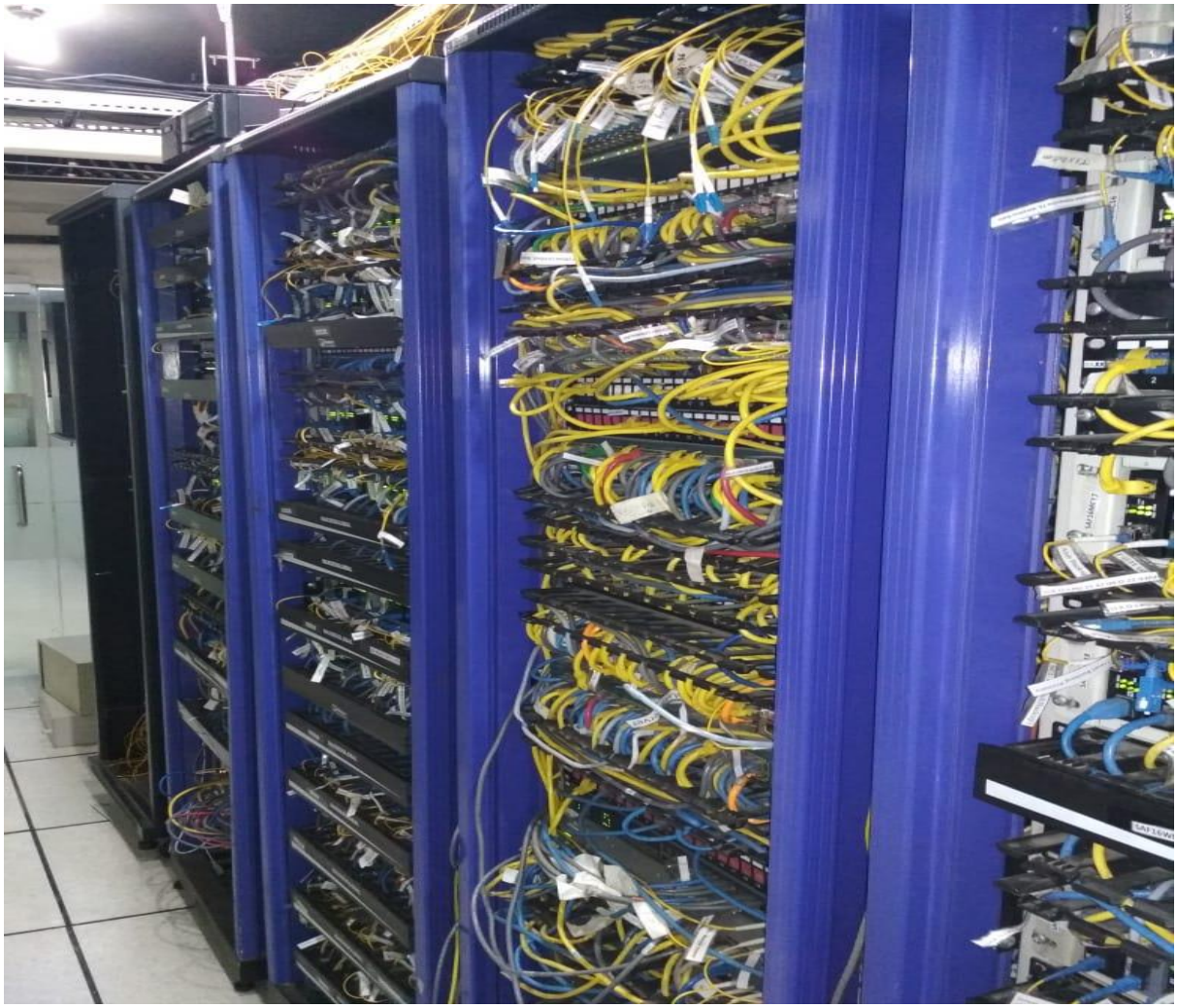

Fig 4.15: POP of Aamra Networks Ltd

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Fig 4.16: POP Routers

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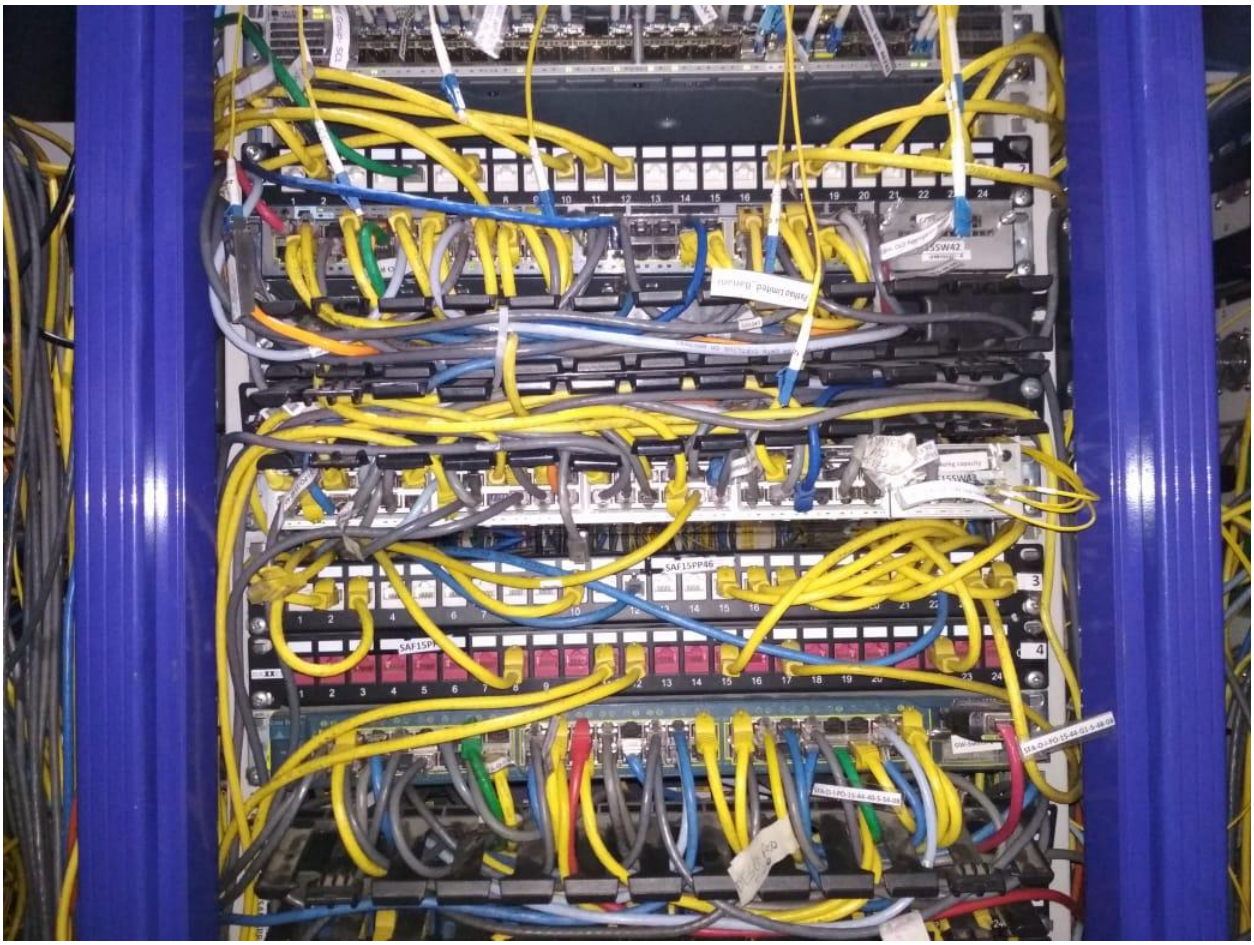

Fig 4.17: POP Switches

So, routers, switches and all equipment deployed in a POP to support customer for better service.

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Chapter 5

Conclusion

5.1 Conclusion

I got an opportunity to serve Aamra Networks Ltd. In many ways, I collected a lot of experience throughout the entire internship period. There was scope in the field of customer related problem, Bandwidth management, ensuring network security, mail server, different types of device configuration and maintenance. In this report, I have explained my experiences about technical support and infrastructure of Aamra Networks Ltd. I have learned so many significant methods from my supervisors and colleagues and directed some tasks on a regular basis throughout my entire Internship period and finally earned the confidence to deal with assignment myself. It is a great opportunity to use the knowledge and skills that I had attained. I also learned how to handle critical defect and got the new ideas. Doing this kind of work is really helpful for my career and I like to do this kind of work again.

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