#### EMPIRICAL STUDY ON NETWORK CONFIGURATION AND MONITORING USING MIKROTIK ROUTER AT DAFFODIL ONLINE LTD. (DOL).

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Electronics and Telecommunication Engineering

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#### APPROVAL

This Project titled **"Empirical Study on Network Configuration and Monitoring Using MikroTik Router at Daffodil Online Ltd. (DOL).**", submitted by **Rezwan Maruf Sajal**, ID: **142-19-1552** to the Department of Electronics and Telecommunication Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Electronics and Telecommunication Engineering and approved as to its style and contents. The presentation was held on **October, 2022**.

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#### DECLARATION

I hereby declare that, this report has been done under the guidance and supervision of **Ms. Tasnuva Ali, Assistant Professor, Department of ETE, Daffodil International University**. I further certify that this internship file and any related materials have not been submitted elsewhere for award of any diploma or degree. I further declare that I obtained information from my internship in the host company **Daffodil Online Limited (DOL)**, books, online websites and my acquaintances.

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#### ABSTRACT

"Empirical Study on Network Configuration and Monitoring Using MikroTik Router at Daffodil Online Ltd. (DOL)" is the topic of this study. This type of wireless network allows a network administrator to gain control over the entire network by utilizing a security key.

One of the most widely used switches for every ISP network as well as any business company is the MikroTik Router. The main objectives of this internship are to better my understanding of network management and MikroTik router setup as well as to broaden my expertise in these areas. I took advantage of the chance to complete an internship at Daffodil Online Ltd. to act properly for the benefit of my future career. These features include DNS server, DHCP server, Hotspot, IP Addressing, Firewall & Nat, Routing, Bandwidth Limiter, P2P Tunneling Protocol, ARP and many others. Each of them has a distinct function, and without them, a framework would be difficult to maintain. When we need to anchor our information and the framework is connected to the Internet, we employ MikroTik. WinBox Software allows for the completion of all of this configuration. This will undoubtedly help me land a job at an ISP firm. Following the completion of all assistance, this framework is tested at several points and serves as a useful model. In the future, I must enhance the focus setup structure to enhance client execution.

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# **CHAPTER 01: INTRODUCTION**

#### **1.1 Introduction**

For students who are seeking to make the transition from university to the working world, the internship program has grown in importance very much. Fortunately I became accustomed to a certified workplace at Daffodil Online Limited. I had the chance to work in this area during my internship and consider how an IT organization creates things like applications that are used by other firms. My previous experiences helped me identify attachment components including social affair work, the workplace, peer support, and completion. As a result, the brief employment phase gave me the chance to learn more, identify my skills and shortcomings, and create plans for improving my self-care for my future job.

#### **1.2 Motivation**

I am in my final semester of a four-year bachelor's degree program in Electronics and Telecommunication Engineering at Daffodil International University, and I recognize the value of gathering empirical data to support classroom learning and provides the students a broader viewpoint.

People in Bangladesh are mostly interested in MikroTik systems since they offer a faster and more efficient networking source. I was inspired by the significance of gathering data that will enable a hold to continue learning from the course books while gaining a frequently broad perspective on the practical topics.

I settled on Daffodil Online Limited (DOL) for my internship since I knew that due to their stellar reputation, Daffodil Online Limited has gained their consumer satisfaction and outperformed all other service providers. I have to admit that I was well taught in the basic parts of MikroTik throughout the brief activity at the host company. I've been speaking with people, responding to their requirements, and giving them better communication during my training.

#### 1.3 Objectives of My Internship

The major goal of my internship training is to learn networking with MikroTik in order to position myself as a capable person in the competitive job market. This opportunity is being offered by Daffodil Online Limited. There I learnt how to manage a MikroTik network as an ISP and received a lot of real world experience. Here are some of my objectives:

a. To efficiently control bandwidth to enhance consumer success. The MikroTik operating system is designed to be used as a router smoothly. The software and operating system on a computer is what really enables it to serve as a network router. Numerous IP and wireless network functionalities are built into the PC.

b. To run the Linux-based Router OS system designed for use with routers equipped with MikroTik Router Boards. It can be set up on a computer and used as an access point, firewall, VPN server and router. The system can be utilized as a captive gateway because it is based on a wireless access system.

c. To cooperate with others, develop relationship and managerial skills, and understand professional morals, characteristics, and principles. These are essential skills to thrive in corporate life.

#### **1.4 Report Layout**

**CHAPTER 01:** In this chapter, I have presented the introduction, motivation and objective of my internship.

**CHAPTER 02:** In this chapter, I have provided information on the company, its target group, products and market situation and organizational structure of the company.

**CHAPTER 03:** In this chapter, I have provided information on task and activities, events, IP addressing, networking, types of networking etc.

**CHAPTER 04:** In this chapter, I have provided information on Introduction of MikroTik and MikroTik RouterOS, basic MikroTik configuration of my internship.

**CHAPTER 05:** In this chapter, I have provided information on all about competencies and my reflections on this internship.

**CHAPTER 06:** In this chapter, I have delivered my conclusion and future scope of my internship.

#### **CHAPTER 02: ORGANIGATION**

#### **2.1 Introduction of the Company**

Daffodil Online Ltd. is one of Bangladesh's prominent Internet Service Providers (ISPs). It began offering their services in 2002. They are the most seasoned and earliest ICT Corporation, with basic business values centered on long-term client connections. Based on client preferences and time restrictions, they have increased their operating and service portfolio in recent years. They established a name for themselves by participating on a range of domestic and international initiatives. They use cutting-edge technology and regularly enhance their services. Their Corporate Network Solution division, which has a highly efficient technical expertise group, is able to provide adequate cutting-edge networking and telecommunication solutions.

#### 2.2 Target Group

Daffodil Online Ltd. believes in providing complete satisfaction to customers in terms of ISP solutions in order to establish long-term relationships with them and to adapt to emerging technologies in order to get a sustainable share in the market. Clients and small-to-medium-sized enterprises are counted as new companies in the organization's customer stand. The corporate approach is to think about clients, because these are the principles that focus on our new quick contributions and holding the company's maximum potential growth. According to Web Solutions, these commercial center sections have unique estimation and administration requirements, as well as more loyal and dependable clients.

Learners with prior IT experience are also encouraged to apply because this organization may be able to assist them in expanding their IT skills.

#### 2.3 Product and Market Situation

Daffodil Online Ltd. began operations in 2002. They have expanded their operating and service offering in recent years based on consumer recommendations and considering demands of 21th century. Daffodil Online Ltd. provides a variety of IT services, including professional services. These are listed below:

- a) ISP support.
- b) Corporate level Internet Solution.
- c) Pearson Vue Testing Center.
- d) CCNA.
- e) MikroTik Routing and Security.
- f) Linux System and Administration
- g) Cambium Network.

#### 2.4 Organogram of Daffodil online Limited

Organizational Structure of Daffodil online Limited is given below:





Figure 01: Organogram of Daffodil online Limited.

# CHAPTER 03: INTERNSHIP TASKS, PROJECTS AND ACTIVITTIES.

#### 3.1 Daily Tasks and Activities

I was familiar with numerous important concepts, such as TCP/IP, a networking protocol that allows two computers to communicate. But I was given many fundamental lessons before I started my internship. I've learned about IP configuration. I discovered several key topics of interest in IP sub-netting. We also recorded a wide range of facts and data. I had no idea about MikroTik switch configuration until I learned a lot about DHCP design, PPPoE setup, data transmission on board, and how to share or choose transfer speed.

**1st Month:** In the first month of my internship, I gained knowledge and fulfilled several obligations. They are:

- a) Recognizing the basics of networking
- b) Learning the various IP addressing classes and ranges.
- c) MikroTik Overview & First Time Startup.
- d) Practical understanding of MikroTik Basic Configuration.
- e) Static Routing

- f) Dynamic Routing
- g) Evidence-based understanding of Network Address Translation (NAT).
- h) Basic section of the router.
- i) Understanding how to reset a MikroTik router

**2nd Month:** In the second month of my internship, I gained knowledge and fulfilled several obligations. They are:

- a) Studying DHCP management.
- b) Experience with routing configuration.
- c) Hotspot Fixture.
- d) Bandwidth control.
- e) Scheduling and scripting.
- f) Port forwarding
- g) Bridge and STP (Spanning Tree Protocol)
- h) Management of VLANs.
- i) Firewall and ACL
- j) MikroTik Failover
- k) How to unblock and block a website.

**3rd Month:** In the third month of my internship, I gained knowledge and fulfilled several obligations. They are:

- a) Wireless management
- b) ARP Setup
- c) Networking & routing protocol
- d) Administration of users.
- e) Backup and Recovery
- f) Setup for queue and DHCP.
- g) Setting up PPPoE
- h) MikroTik load balancing.

#### **3.2 Events and Activities**

Through this internship training, a variety of perspectives can be changed. I'm gaining experience in a novel way due to my internship. Below is a list of a few:

- a) Regarding IP addresses for all IP classes with Subnet
- b) Being familiar with networking resources.
- c) Monitoring and protecting networks.
- d) Generating the client's secret key and client account.
- e) LAN, switch, router, and server setups.
- f) Identifying and avert network errors.
- g) Using WinBox's charts and connections to monitor web speed.
- h) Learning and configuring the following: WEB server, DNS server, MAIL server, and Proxy server.
- i) Evaluating MikroTik devices, their prices and their power.

#### 3.3 IP Addressing

#### 3.3.1 Introduction to IP Addressing

A device on the internet or a local network can be identified by its IP address, which is a special address. The rules defining the format of data delivered over the internet or a local network are known as "Internet Protocol" or IP. IP addresses, which carry location information and make devices reachable for communication, are essentially the identifier that permits information to be exchanged between devices on a network. There must be a means for computers, routers, and webpages to be distinguished on the internet. A method for achieving this is provided by IP addresses, which are crucial to the operation of the internet. The Internet Assigned Numbers Authority (IANA), a part of the Internet Corporation for Assigned Names and Numbers (ICANN), produces and distributes them mathematically. In order to assist maintain the security of the internet and make it accessible to everyone, ICANN was founded in the United States in 1998. [1]

The internet seeks a method of differentiating among various computers, routers, and webpages. It does this via IP addresses. A series of integers separated by periods makes up

an IP address. Four sets of numbers are used to represent IP addresses; for instance, 192.158.1.38 might be one such address. The range of each number in the set is 0 to 255. Therefore, the complete IP addressing range is 0.0.0.0 to 255.255.255.255.

#### 3.3.2 IPv4: Address Classes and Range

Class A, Class B, Class C, Class D, and Class E are the 05 classes of IPv4 addresses. Here is a summarized table of Addresses, Classes and Ranges: [2]

CLASS	ADDRESS RANGE	NETWORK	HOST	USED FOR
		BITS	BITS	
Class A	0.0.0.0-127.255.255.255	8	24	Gigantic
				network
Class B	128.0.0.0-191.255.255.255	16	16	Medium large
				network
Class C	192.0.0.0-223.255.255.255	24	8	Small network
Class D	224.0.0.0-239.255.255.255	N/A	N/A	Multicasting
Class E	240.0.0.255.255.255.255	N/A	N/A	Experimental

A hypothetical calculation is made to calculate the IP address ranges for a different class in the table. There are certain unusual IP addresses that are kept for a particular purpose.

#### **3.3.3 Private and Public IP Range**

#### **IPv4-Private IP Range:**

CLASS	CLASS RANGE	ADDRESS RANGE (private)
Class A	0.0.0-127.255.255.255	10.0.0.10.255.255.255
Class B	128.0.0.0-191.255.255.255	172.16.0.0-172.31.255.255
Class C	192.0.0.0-223.255.255.255	192.168.0.0-192.168.255.255

IPv4–Public IP Range: Except these Private IPs, rest of the IPs are known as Public IP.

#### 3.4 Networking (LAN, MAN, WAN, PAN)

The process of connecting at least two computing devices for information sharing is known as computer networking. PC networks are managed using a combination of tools and software. Computer networking can also be defined as the activity of transmitting and exchanging data amongst nodes through a common medium in a data structure.

Computer networks can be classified in a variety of ways, including LAN, MAN, WAN, and PAN.

#### 3.4.1 Local Area Network (LAN)

Local Area Network is the phrase used to describe a computer network that is spread throughout a building and run by a single administrative system. LAN typically encompasses a company's offices, classrooms, and campuses. Personal computers and workstations can share information, resources, and software thanks to the local area network, or LAN, which links network devices. The TCP/IP protocol uses a private addressing method to connect the collection of devices and computers using a switch or stack of switches. [3] [4]



Figure 02: Local Area Network (LAN)

# Figure 2 depicts a small office with a printer and four PCs connected via a local area network.

#### 3.4.2 Metropolitan Area Network (MAN)

A metropolitan area network (MAN) is a type of computer network that links computers in an area with many buildings, such as a single large metropolis, several smaller cities, or any other sizeable area. The size of a MAN is more than that of a LAN but less than that of a Wide area network (WAN). The name "metropolitan" emphasizes the scale of the network, not the demographics of the area it covers, hence MANs are not need to be in urban areas. [5]



Figure 03: Metropolitan Area Network (MAN)

With Metropolitan Area Network, we can link the client to all of the PC resources in a certain area or location. Figure 3 shows a single MAN connected to four LANs. It can cover an entire city or region.

#### 3.4.3 Wide Area Network (WAN)

A collection of LANs or other networks that connect with one another makes up a widearea network (WAN). The Internet is the biggest WAN in the world, and a WAN is essentially a network of networks. It is a vast computer network connects collections of computers over considerable distances. Leased lines, VPNs or IP tunnels and other methods are used to establish these long connections. [6]



Figure 04: Wide Area Network (WAN) illustrated in comparison with Metropolitan Area Network (MAN)

#### 3.4.4 Personal Area Network (PAN)

A personal area network (PAN) is a type of computer network used to link electronic gadgets in a person's workspace. With the help of a PAN, data may be transmitted between gadgets including PCs, cellphones, tablets, and PDAs. PANs can link to higher level networks including the Internet, with one master device acting as the gateway, or they can be used for communication amongst the individual personal devices themselves. [7]



Figure 05: Personal Area Network (PAN)

#### **CHAPTER 04: BASIC CONFIGURATION OF MIKROTIK**

#### 4.1 Introduction of MikroTik

A Latvian firm named MikroTik was established in 1996 with the goal of creating routers and wireless ISP systems. Across most nations throughout the world, MikroTik currently offers hardware and software for Internet access. Since 1997, they have been able to develop the RouterOS software system, which offers substantial stability, controls and flexibility for all types of data interfaces and routing. They have many expertise with complete routing systems and industry standard PC hardware. Their decision to manufacture hardware in 2002 gave rise to the "RouterBOARD" brand. SIA Mikrotīkls has more than 280 workers and is based in Riga, the Latvian capital. [8]

#### 4.2 MikroTik RouterBOARD and RouterOS

#### 4.2.1 RouterOS

The Router Board's operating system is called MikroTik RouterOS that is based on Linux. It is a well-known network device that **SIA Mikrotīkls** provides. It may also be installed on a computer, turning it into a router with all the necessary functionality. It may function as a hotspot, router, firewall, gateway, wireless access point, VPN box, and dedicated traffic shaper.

#### 4.2.2 RouterBOARD

On the other hand Router Board is a full-featured hardware operating platform for Router OS. Routing, Firewall, Bandwidth Management, Wireless Access Point, Backhaul Link, Hotspot, VPN Server, and other key ISP capabilities are all included as they come as a packaged product. The company brands them as RouterOS and RouterBOARD.

#### 4.2.3 Advantages of MikroTik RouterBOARD and RouterOS:

- a) Simple and Quick Installation.
- b) WinBox GUI through MAC and IP.
- c) CLI with Serial Console, Local Console, Telnet, and SSH.

- d) API for creating custom devices.
- e) Web-based interface
- f) Simple to Use & Maintain.

#### 4.2.4 Popular MikroTik Ethernet and Wireless Routers

MikroTik Ethernet routers are reliable, low cost and simple to use. They are perfect for managing companies varies from small to very large. Some of the popular MikroTik routers are: hAP mini, hAp lite, mAP lite, RB951Ui-2HnD, hEX lite, hEX PoE, RB2011UiAS-IN, RB5009UG+S+IN, CCR1036-8G-2S+ etc. [9]



Figure 06: hAP mini



Figure 07: hAp lite



Figure 08: hEX lite



Figure 09: hEX PoE



Figure 10: RB2011UiAS-IN

#### 4.3 First Time Configuration and WinBox Installation

#### 4.3.1 Initial Steps to Configure MikroTik RouterBOARD

There are several methods to connect to the router after you have installed the RouterOS software or switched it on for the first time:

- a) Using a keyboard and display if your router has a VGA card, Telnet, SSH, serial cable, or any other method to access the Command Line Interface (CLI).
- b) Utilizing a web-based GUI (WebFig)
- c) Making use of the **WinBox** setup tool (Windows app, compatible with Wine)

The IP address **192.168.88.1/24** is pre-configured at the factory on the ether1 port of every router. "**admin**" is the default username and there is no password. After your initial login, please make a new user in the "full" group with a password, log in again, and remove the default admin account. Connect your PC to ether2 and the router's ether1 port to the WAN cable. We need the WinBox setup tool to allow MikroTik configuration properly.

#### 4.3.2 VMware:

VMware allows us to run multiple application and operating system workloads on the one server – thus enabling better resource management. By creating a virtual machine that behaves exactly like an actual MikroTik – VMware also allows everything running on that virtual machine to run in its own window.



Figure 11: Installing RouterOS to VMware.

Sometimes it is easy to use VMware to virtually work as the RouterBOARD. We need to install RouterOS to VMware first. It is convenient for practicing and learning purposes.

#### 4.3.3 WinBox setup:

WinBox is a small tool that enables MikroTik RouterOS management through a quick and straightforward GUI. It is a local Win32 two-fold, but Wine allows it to operate on Linux and macOS (OS X). There are no regions in the handbook because all interface capabilities are as near to accurately representing console operations as is humanly possible. Some of WinBox's high-level and fundamental framework concepts are unworkable, much like changing the MAC address on an interface changelog.

You must complete the following steps to configure a MikroTik for the first time:

- a) Connect MikroTik to your laptop or PC with an Ethernet connection.
- b) Any MikroTik port from ether2 to ether5 should be used for the connection (ether1 is a PoE port and should be avoided).
- c) Look at the window of WinBox next.
- d) To log into MikroTik, choose the "neighbors" page and look up the router's MAC address.

Sajal-1552 - VMware Workstation	S WinBox (64bit) v3.28 (Addresses)	– 🗆 X
Guide Sajal-1552 - VMware Workstation         File Edit View VM Tabs Help         Ibirary         Type here to search         Image: Type here	WinBox (64bit) v3.28 (Addresses)         File       Tools         Connect To:       00.00:29:49:80.AE         Login:       admin         Password:	Keep Password     Open In New Window
Wallpapers - References Shortcut	1 item	

Figure 12: Setting up WinBox to log into MikroTik.

- e) Then navigate to MAC address and log in with admin. After that, click the Connect button to log in.
- f) The plugins will then start to load, allowing you to access MikroTik.

Sadmin@[fe80::20c:2	9ff:fe48:80ae%9] (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) —	
ession Settings Da	ihboard	
Safe Mode	Session: [fe80::20c:29ff.fe48:80ae:9]	
💓 Quick Set		
CAPsMAN		
Interfaces		
Wireless		
310 Bridge		
The PPP		
°T <mark>°</mark> Mesh		
💵 IP 🗈 🗈		
IPv6 🗅		
MPLS ▷		
J Routing ▷		
System 🗅		
🐢 Queues		
Files		
🚊 Log		
RADIUS		
🔪 🔀 Tools 🛛 🗠		
🛤 New Terminal		
LoRa		
🔹 🚸 Dot 1X		
) 🕓 Dude 🗈 🗠		
2 💻 кум		
Make Supout.rif		
Manual		
🖆 🕥 New WinBox		

#### Figure 13: WinBox interface at start up

#### 4.4 Static Configuration of MikroTik

Simply said, a static IP address is an address that never changes unless you deactivate the device or your network architecture alters. Servers and other significant equipment typically utilize static IP addresses. Internet Service Providers are responsible for assigning static IP addresses. First we have to set up the device name. It is the identification of the device also known as hostname.

```
System>>Identity>>Identity=MikroTik>>Apply>>OK
```

255	IP	$\triangleright$	Identity			
4	IPv6	$\triangleright$	LCD			
C	MPLS	$\triangleright$	LEDs		11 19	
3	Routing	$\triangleright$	License	•	Identity	
10	🕴 System 🛛 🔴	$\triangleright$	Logging		Identity: MikroTik	ОК
- 2	Queues		NTP Client			Cancel
	Files		NTP Server			
	Log		Note			Арріу
<u></u>	P RADIUS		Packages			
<u> </u>	Tools	$\triangleright$	Password			
<u> </u>	New Terminal		Porto			

Figure 14: Setting up hostname

**Step 1:** First open WinBox

IP>> Addresses>> Add [+]>>Address= 192.168.0.200/24>>Interface\_ether1>>

Comment=WAN>>Apply>>OK

IP>>Addresses>> Add [+]>>Address= 192.168.10.10/24>>Interface\_ether2>>

Comment=LAN>>Apply>>OK

Session Settings Dashboard       Session     Safe Mode       Safe Mode     Session:       Quick Set     CAPsMAN       Interfaces     Address List	– – ×
Safe Mode     Session: 00:0C:29:48:80:AE       CAPsMAN     Address List	
CAPsMAN     Address List     CAPsMAN	
CAPsMAN Im Interfaces Address List	
Address List	
	Find
Address / Network Interface	
* _ Mesh = 132.166.10.10/24 132.166.10.0 ether2	
MPLS N	
P Routing	
System P	
Queues	
Per Files	
P and the second	
🔁 🗙 Tools 🗅	
To Day New Terminal	
C LoRa 2 tems	
to the second se	

👒 admin@[fe80:20c:29ff:fe48:80ae%9] (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) — 🛛 🗙								
Session Settings Dashboard								
ら 🖓 Safe Mode	Session: [fe80::20c:29ff.fe48:80ae:9]			=				
Cuick Set CAPsMAN CAP	Address <192.168.0.200/24> Address: 192.168.0.200/24 Network: 192.168.0.0 ▲ Interface: ether1 ▼	OK Cancel Apply Disable Comment Copy Remove	Comment for Address <192.168.0.200/24>       WAN     OK       Cancel       ietwork     Interface       92.168.0.0     ether1       92.168.10.0     ether2					
System N	enabled							
Files	Address <192.168.10.10/24>		Comment for Address <192.168.10.10/24>					
Log RADIUS Tools New Terminal LoRa Dot1X ODude KVM Make Supout.rff Manual	Address: 192.168.10.10/24 Network: 192.168.10.0 ▲ Interface: ether2 ▼	OK Cancel Apply Disable Comment Copy Remove	OK Cancel	]				
🖉 🚫 New WinBox	enabled							

Figure 15: Static WAN & LAN configuration using WinBox

#### **Step 2: Configuration for Default Gateway:**

IP>>Routes>> Add [+] New Routes

Dst Address=0.0.0/0>>

Gateway=192.168.0.1>>

#### Apply>>OK

🔕 admin@00:0C:29:48:80:AE (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) - 🗆 🗙										
Session Settings Das	shboard									
Safe Mode	Session: 00:0C:29:48:80:AE									
🏏 Quick Set	Route List				٦×					
CAPsMAN	Route <0.0.0/0>									
Interfaces	General Attributes				OK					
Wireless	Autobiles									
💢 Bridge	Dst. Address: 0.0.0.0/0				Cancel					
The second secon	Gateway: 192.168.0.1	<b>▼</b>	eachable ether1	\$	Apply					
°∐ <mark>°</mark> Mesh	Chaele Cateman									
🐺 IP 🗈 🗅				•	Disable					
🛫 IPv6 🛛 🗅	Type: unicast				Comment					
O MPLS ▷	Distance: 1			▲	Сору					
📑 Routing 🗈	Scope: 30				Permeter					
System 🗅	Tarret Scope: 10				Nemove					
🙅 Queues										
Files	Routing Mark:			<b>*</b>						
õ 🗏 Log	Pref. Source:			•						
🚆 🔐 RADIUS										
🗧 🗙 Tools 🛛 🗅										
New Terminal	enabled		active	static						
🜔 🎮 LoRa	-	1	1	1						
🕐 Dot 1X										
🗧 🔘 Dude 🛛 🗅										
More ►	3 items (1 selected)									

#### **Figure 16: Default Gateway Configuration**

#### **Step 3: DNS server configuration**

The hierarchical and decentralized naming scheme used to identify machines available over the Internet or other Internet Protocol (IP) networks is called the Domain Name System (DNS). [10] ISP will give required DNS server addresses. If the DNS address from the ISP is not available, we may utilize public DNS like 8.8.8 or 8.8.4.4 IP>>DNS>>DNS Setting>>servers=**8.8.8.8** + servers=**8.8.4.4**>>Apply>>OK

Note: We will not enable the "Allow Remote Requests" option.

Sadmin@[fe80::20c:29	9ff:fe48:80ae%9] (MikroTik	:) - WinBox (64bit) v6.47.10 on x8	6 (x86)			_	$\times$
Session Settings Das	hboard						
Safe Mode	Session: [fe80::20c:29ff.fe4	8:80ae:9]					
🖉 🏏 Quick Set							
CAPsMAN							
Interfaces							
Wireless		DNS Settings					
🚉 Bridge	ARP	Conversion	0.0.0.0	1			
A PPP	Accounting	Servers:	8.8.8.8	-	ок		
°T <mark>°</mark> Mesh	Addresses		8.8.4.4	÷	Cancel		
😇 IP 🔹 🗅	DHCP Client	Dynamic Servers:			Apply		
😴 IPv6 🗈	DHCP Relay	Use DoH Server:		1 -			
O MPLS ▷	DHCP Server	Cae Don Server.		_ ·	Static		
C Routing ►	DNS •		Venty DoH Certificate		Cache		
💭 System 🗅	Firewall	•	Allow Remote Requests				
🗬 Queues	Hotspot	Max UDP Packet Size	4096				
Files	IPsec		1000				
Log	Kid Control	Query Server Timeout:	2.000	s			
and RADIUS	Neighbors	Query Total Timeout:	10.000	s			
🚬 🔀 Tools 🛛 🔿	Packing			_			
O 🔤 New Terminal	Pool	Max. Concurrent Queries:	100	_			
😤 📖 LoRa	Routes	Max. Concurrent TCP Sessions:	20	_			
Dot 1X	SMB	Cache Size:	2048	KIB			
0 Dude	SNMP	Casha May TTL	71 00:00:00				
О 💻 КУМ	Services	Cache Max TTE:	78 00:00:00				
🛛 ⊵ Make Supout.rif	Settings	Cache Used:	24 KiB				
B Manual	Socks						
New WinBox	TFTP						
	Turffin Flaur						

Figure 17: Configuration of Domain Name System (DNS)

# **Step 4: Setting up NAT on Firewall**

IP>Firewall>>NAT>>Add [+] >>general>>chain= srcnat>>Apply>OK

IP>Firewall>>NAT>> **Add** [+] >>action=masquerade>>Apply>>OK

admin@[fe80::20c:29ff:fe48:80ae%9] (MikroTi	k) - WinBox (64bit) v6.47.10 on x86 (x86)	🕲 admin@[fe80::20c:29ff:fe48:80ae%9] (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)					
Session Settings Dashboard							
Safe Mode Session: [fe80::20c:29ff.fe	48:80ae:9]		Session Settings Das	shboard			
🏏 Quick Set			K) CM Safe Mode	Session: Ife80::20c:29fffe48	3/80ae:91		
CAPsMAN	NAT Rule 🔿			Control P			
Interfaces	General Advanced Extra Action	ОК	🏏 Quick Set				
Wireless     Firewall	Chain: errenat	Cancel	CAP-MAN		NATE I		
Filter Rules NAT Ma			L CARSMAN		NAT Hule 🗢		
• Mach	Dat Address	Apply <b>6</b>	Interfaces		Advanced Extra Action Statistice	OK	
ARP		Disable		Dermal	nuvariccu Litila a silvin Statistica	UN	
IPv6 Accounting	Protocol:	Comment	M not	Firewall	Action: masquerade 🌒 🛛 🐺	Cancel	
MPLS Addresses	Src. Port:	Сору	2% brage	Filter Rules NAT Man			
CHCP Client	Dst. Port:	Bamaura	🏣 PPP	The Holes Many		Apply 🖕	
System N DHCP Relay	Any. Port:	Trenove	°T° Mesh	🎙 - 🗸 🗶 🖸			
Queues     DHCP Server	In. Interface:	Reset Counters		ARP	Log Prefix: 🔻	Disable	
Files Firewall	Out. Interface:	Reset All Counters	₩ <b>₽</b> ₽	744			
Log Hotspot	la latafaa liiti		🗹 IPv6 🛛 🗅	Accounting	To Ports:	Comment	
Tach N IPsec	Oct Interface List			Addresses			
Kid Control			O MILLO	DUCD Client		Сору	
LoRa Neighbors	Packet Mark:		📑 Routing 🗈 🗅	Unor cient			
Dot 1X Packing	Connection Mark:		101 System	DHCP Relay		Hemove	
0 Dude N Pool	Routing Mark:			DHCP Server		Reset Counters	
Routes	Routing Table:		🐙 Queues	DND		nooc councia	
Make Supout if	· · · · · · · · · · · · · · · · · · ·		📔 Files	UNS		Reset All Counters	
Manual Services			E las	Firewall 🖲			
Services	enabled		lin Lug				

Figure 18: Setting up NAT on Firewall

#### **Step 5: Time Setup**

System >> Clock >> Time >> Time Zone Name=Asia/Dhaka

GMT Offset= +06:00>>Apply>>OK

● admin@[fe80::20c:29ff:fe48:80ae%9] (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)									
Session Settings Dashboard									
Safe Mode Session: [fe80::20c:29ff fe48:80ae:9]									
Quick Set		Auto Upgrade Certificates							
Bridge		Console Disks							
IP IPv6	1	GPS Health	Time Manual Time Zone Time: 06:42:53	OK Cancel					
MPLS     Routing	4	History Identity	Date: Sep/03/2022 Time Zone Autodetect	Apply 🖕					
Queues	1	LEDs License	Time Zone Name: Asia/Dhaka						
		Logging NTP Client	DST Active						
X Tools	⊳ al	NTP Server Note							
C LoRa		Fackages							

Figure 19: Time and zone setup of RouterOS

#### **Step 6: Password setup for Admin**

System >> Users >> Double Click on **admin** 

Admin >> Set the Password>>New Password>>Confirm Password>>Apply>>OK

0	admin@[fe80::2	0 <b>c:</b> 2	ff:fe48:80ae%9] (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)	- 0
Ses	ssion Settings	Das	nboard	
Ю	Ca Safe Mod	e	Session: [fe80::20c:29ff fe48:80ae:9]	
			User List USers Groups SSH Keys SSH Private Keys Active Users Name / Group Allowed Address System default user admin full Change Password Change Password	OK Cancel Apply Disable Comment Copy
Xo	X Tools	Þ		Remove     Password
l de	LoRa		enabled	,
<u>Ni</u>	Dot 1X			
S	🔇 Dude	1	1 item (1 selected)	
Ó	KVM			

Figure 20: Setting Up New Password for Admin.

#### 4.5 DHCP Server Configuration

Step 1: IP >> DHCP Server >> DHCP > Add [+] > Generic >>

Name=dhcp1552 >> Interface=ether2 >>Apply>> OK

DHCP Server >>Networks>>address= 192.168.10.0/24>>gateway=192.168.10.10>>

Select "no DNS">> Apply >> OK



Figure 21: DHCP Server and Network configuration.

#### Step 3: Configuring a PC/Laptop as DHCP client

- PC Control Panel>> Network and Internet>> Network and Sharing Center
- >> Change adapter settings>> Internet Protocol Version 4 (TCP/IPv4)>>Properties
- >> Select "Obtain an IP address automatically"
- >> Select "Obtain DNS server address automatically"
- >>OK



Figure 22: Configuring a PC/Laptop as a DHCP client.

#### **4.6 PPPoE Configuration:**

PPPoE means Point-to-Point Protocol over Ethernet. Service providers may manage several client systems, authenticate their access to its services, and monitor client data use via PPPoE. Additionally, PPPoE includes functions like data compression and encryption.



Step 1: PPP>>Interface>>Add [+]>>PPPoE Server Binding>>OK

Figure 23: PPPoE Server Binding

# Step 2: PPPoE Server:

PPP >> PPPoE Servers >>Add [+] >>Service Name=service1 >> Interface >>ether2

>>Select One Session per Host >> Set the Authentication Parameters.

admin@192.168.0.200 (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) — 🗆 🗙											
Session Settings Dashboard											
CM Safe Mode Session: 192.168.0.200											
CAPSMAN     Interface     PPPOE Servers     Secrets	Profiles Active Connections L2TP Secrets										
Wireless     Image: Service / Interface     Max	MTU Max MRU MRRU Default Profile Authentication PPPoE Service <service1></service1>	Find									
IP       N         IP <t< td=""><td>Service Name: service Interface: ether2</td><td></td></t<>	Service Name: service Interface: ether2										
Image: New Terminal         1 item (1 selected)	Authentication: v mschap2 v mschap1 v chap v pap enabled										

Figure 24: PPPoE Server setting

#### **Step 3: PPPoE Profiling for different packages:**

#### Package 1:

PPP >> Profiles >>General >>name=default>>DNS=8.8.8, 8.8.4.4>>apply

Limits>>Rate Limit (rx/tx) =1024000/1024000 (Bandwidth Control)



Figure 25: PPPoE Profiling for package 1. (With 1 Mbps limit)

#### Package 2:

PPP >> Profiles >>General >>name=default>>DNS=none>>apply

Limits>>Rate Limit (rx/tx) =2048000/2048000 (Bandwidth Control)

	🔇 admin@192.168.0.200 (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)								
S	ession	n Settings Das	hboard						
K	0	Safe Mode	Session: 192.168.0.200						
	*	Quick Set	PPP	PPP Profile <default-encryption></default-encryption>					
	Ω	CAPsMAN	Interface PPPoE Servers Secrets Profiles	General Protocols Limits Queue Scripts	ок				
		Interfaces		Name: defends anomation	Canaal				
	Ŧ	Wireless			Cancel				
	25	Bridge	Name Address Remote Ad	Local Address:	Apply				
		PPP	* 😝 default-encr	Remote Address:	Comment				
	255	Mesh		Remote IPv6 Prefix Pool:	Conv				
	-			DHCPv6 PD Pool:	copy				
	Ŧ	MPLS N		Bridge:	Remove				
	$\breve{\mathbf{z}}$	Routing		Bridge Port Priority:					
	107	System		Bridge Path Cost:					
		Queues							
		Files							
		Log		Incoming Filter:					
	<b>4</b> 9	RADIUS		Outgoing Filter:					
	×	Tools D		Address List:					
>	<	New Terminal	2 items (1 selected)	Interface List:					
B	- I	LoRa							
i,		Dot1X		DNS Server:					
3	9	Dude P		WINS Server:					
		Make Supert of							
L L		Make Supour.ni		C no (• yes C default					
H		New WinBox		•					
B		Exit		default					
	🥃 ad	min@192.168.0.20	JU (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x	86)					
S	essioi	n Settings Das	hboard						
	20	Safe Mode	Session: 192.168.0.200						
	X	Quick Set	PPP	PPP Profile <default-encryption></default-encryption>					
	<u></u>	CAPsMAN	Interface PPPoE Servers Secrets Profiles	General Protocols Limits Queue Scripts	ОК				
	-	Interfaces		Session Timeout:	Cancel				
	<u>+</u>	Wireless			Caricer				
	25	Bridge	* 😝 default		Apply				
	•	Mesh	* 😝 default-encr	Rate Limit (rx/tx): 2048000/2048000	Comment				
	255	IP D		- Only One	Сору				
	<b>∞6</b>	IPv6 D		C no C yes 🖲 default	Remove				
	0	MPLS D							

Figure 26: PPPoE Profiling for package 2 (with 2 Mbps limit).

#### Step 4: **PPPoE Secret:**

PPP >> Secrets >> Add [+] >>Name=test 1>>Password=123456>>Service=pppoe>> Profile=default>>Local Address=192.168.1.1>>Remote Address=192.168.1.2>>apply>>OK

	Sadmin@192.168.0.200 (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)										
Se	Session Settings Dashboard										
6	Safe Mode Session: 192.168.0.200										
	🚀 Quick Set		PPP								
	🗘 CAPsMAN		Interface	PPPo	PPP Secret <test 1=""></test>						
	Wireless		+ -	<b>~</b> >	Name:	test 1		ОК			
	31 Bridge		Name	A P	Password:		<b></b>	Cancel			
	🛓 PPP		🛛 🖯 test 1	•	Service:	рррое	₹	Apply			
	°∎ <mark>°</mark> Mesh				Caller ID:		•				
	IP	Þ			Profile:	default	₹	Disable			
	🛒 IPv6	Þ						Comment			
	MPLS				Local Address:	192.168.1.1	<b></b>	Conv			
	3 Routing	$\sim$			Remote Address:	192.168.1.2	<b></b>	Сору			
	💭 System	Þ			Remote IPv6 Prefix:		•	Remove			
	👰 Queues										
	Files				Routes:		•				
	📋 Log				Limit Bytes In:		-				
	RADIUS				Limit Bytes Out:		•				
	🔀 Tools	Þ									

Figure 27: PPPoE Username & Password setup

#### **Step 5: Connecting PC via Dial-up**

We need to test the PPPoE connection by simply set up a dial-up connection to the PC. We have to disable the current internet connection for better understanding.

PC Settings>>Network & Internet>>Dial-up>> Set up a new connection>>connect to the internet>>Broadband (PPPoE) >>user name=test 1 >>password=123456 >>Connect

©Daffodil International University



Figure 28: PPPoE Configuration testing via dial-up connection.

#### 4.7 Bridge Configuration

A bridge allows you to connect two or more network segments together allowing devices to join the network if it's not possible to connect them directly. First I add an IP address to my PC for testing purposes.

- PC Control Panel>> Network and Internet>> Network and Sharing Center
- >> Change adapter settings>> Internet Protocol Version 4 (TCP/IPv4)>>Properties
- >> Select "use the following IP address"
- >> Select "use the following DNS server addresses"

#### >>OK

VMware Network Adapte	Internet Protocol Version 4 (TCP/IPv4) Properties	$\times$
Networking Sharing	General	
Connect using:	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.	
This connection uses the follo	<ul> <li>Obtain an IP address automatically</li> <li>Use the following IP address:         <ul> <li>IP address:</li> <li>I92.168.1.10</li> <li>Subnet mask:</li> <li>255.255.255.0</li> </ul> </li> <li>Default gateway:</li> <li>I92.168.1.1</li> </ul>	
Install	<ul> <li>Obtain DNS server address automatically</li> <li>Use the following DNS server addresses:</li> <li>Preferred DNS server:</li> <li>9.9.9.9</li> </ul>	
Description Transmission Control Protoco wide area network protocol across diverse interconnec	Alternate DNS server:       149 . 112 . 112 . 112         Validate settings upon exit       Advanced	
	OK Cancel	

Figure 29: IP setup in PC for Bridge configuration.

# **Step 1: Creating Bridge on RouterOS**

Bridge >> Add [+] >> Name=bridge1552 >>Apply>>OK

📚 admin@192.168.0.200 (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) — 🗆 X										
Session Settings Dashb	Session Settings Dashboard									
Safe Mode S	Session: 192.168.0.200									
💓 Quick Set										
CAPsMAN	,									
Interfaces		New Interface								
Wireless		General STP VLA	AN Status Traffic		ОК		_			
👯 Bridge 😐	Bridge	Name:	bridge 1552		Cancel					
The second secon	Bridge Ports VLANs MS	Tane.	Didge 1332		Caricer					
°T° Mesh	<b>\$</b>   -   <  ×  2   7	Type:	Bridge		Apply 💧		Fin	d		
뿌 IP ト	Name / Typ	MTU:		<b>-</b>	Disable	(s) Bx	Packet (n/s)			
🛫 IPv6 🛛 🖻	Traine Typ	Actual MTU:			Commont	c) 10.	donter proj			
MPLS N		L2 MTU:			Comment					
J\$ Routing ►		MAC Address:			Сору					
System P		ARP:	enabled	₹	Remove					
P Queues		ARP Timeout:			Torch					
Files		Admin MAC Address		<b></b>						
ADIUS		Ageing Time:	00:05:00							
Nous P										
			<ul> <li>Fast Forward</li> </ul>							
	•							•		
Make Supput rf	U items out of 3									
0 Manual		enabled	aupping	elave						
New WinBox		Chabica	Including	lange						
Exit										



#### **Step 2: Bridge port adding**:

Bridge>> Ports >> Add [+] >> Interface=ether1>>bridge=bridge1552>>Apply>>OK Bridge>> Ports >> Add [+] >> Interface=ether2>> bridge=bridge1552>>Apply>>OK

New Bridge Port		New Bridge Port	
General STP VLAN Status	ОК	General STP VLAN Status	K
Interface: ether1	Cancel	n Interface: ether2	cel
Bridge: bridge1552 ₹	Apply	Bridge: bridge 1552 T	oly
Horizon:	Disable	Horizon: 📃 🔻 Disa	ible
Leam: auto	Comment	Leam: auto Comm	nent
✓ Unknown Unicast Flood	Сору	Unknown Unicast Flood	ру
<ul> <li>Unknown Multicast Flood</li> </ul>	Remove	✓ Unknown Multicast Flood	
✓ Broadcast Flood		✓ Broadcast Flood	ove
Trusted		Trusted	
✓ Hardware Offload		✓ Hardware Offload	
enabled inactive Hw. Offl	oad	enabled inactive Hw. Offload	

Figure 31: Members port adding in Bridge configuration

# **Step 3: IP address assigning in Bridge configuration:**

IP >> Addresses >> Add [+] >> Address = 192.168.1.10/24 >> Interface = bridge 1552

>>Apply>>OK.

Sadmin@192.168.0.200 (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)									
Session Settings Dashboard									
Safe Mode Session: 192.168.0.200									
	💓 Quick Set	Address List			Address <192.168.1.10/24>				
	CAPsMAN	+ - / × 2	7		Address: 192.168.1.10/24	ОК			
	Wireless	Address	Network	Interface	Network: 192.168.1.0	Cancel			
	St Bridge	+ 192.168.0.200/24	192.168.0.0	ether1	Interface: bridge1552	Apply			
	E PPP	+ 192.168.1.10/24 ;;; LAN	192.168.1.0	bridge1552		Disable			
	Mesh	+ 192.168.10.10/24	192.168.10.0	ether2		Comment			
	IPv6 D					Copy			
	MPLS ▷					Bemove			
	📑 Routing					- Hemove			
	🔯 System 🗅				enabled				
	🙅 Queues								
	📄 Files								
	🚊 Log								
	RADIUS								
	🔀 Tools 🛛 🗅	3 items							
	📼 New Terminal	·							

Figure 32: IP address assigning in Bridge configuration

#### 4.8 ARP / AP Configuration

If the ARP of an IP is set to reply only, the router would not be able to connect to the internet because the router only replies to ARP requests. It is done for the security reason of clients. We need to manually bind the IP and Mac address.

Sadmin@00:0C:29:48	80:AE (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)			– 🗆 🗙			
Session Settings Da	hboard						
Safe Mode	Safe Mode         Session:         00:0C:29:48:30:AE         Memory         225.8 MiB         CPU:0%						
💓 Quick Set	Interface <ether2></ether2>		Interface List				
CAPsMAN	General Ethernet Loop Protect Status Traffic	ок	Interface Interface List Ethemet EoIP Tunnel	IP Tunnel GRE Tunne			
Wireless	Name: ether2	Cancel	🕂 - 🖌 🗶 🗂 🍸 Detect Interne	*t			
👯 Bridge	Type: Ethemet	Apply	Name / Type	Actual MTU L2 MTU T			
T <sup>®</sup> Moob	MTU: 1500	Disable	R of ether1 Ethemet	1500			
	Actual MTU: 1500	Comment	R 🚸 ether2 Ethernet	1500			
Pv6 P	MAC Address: 00:0C:29:48:80:B8	Torch	Area poppoe PPPoE Server Binding				
Routing	ARP: reply-only •	Cable Test					
System ►	ARP Timeout:	Blink					
🙅 Queues 📄 Files		Reset MAC Address					

Figure 33: ARP set to reply-only.

IP>>ARP>> **Add** [+]>>ip address=192.168.0.105>>MAC address= **00:D8:61:36:DF:16** >>interface=bridge1552>>Apply>>OK

To perform the same procedures on the DHCP Server, click IP and then DHCP Server next.



Figure 34: ARP / AP Configuration.

#### 4.9 Bandwidth Management & Queue Setup

Bandwidth management is the act of monitoring and managing the communications (traffic, packets) over a network link in order to prevent the link from being overloaded or filled to its maximum capacity, which would cause network congestion and subpar performance. We use bandwidth management for the benefit of overall experience of clients. In MikroTik we use a technique called Queue Setup. Queue setup is used to limit and prioritize traffics. We also use it to limit data rate to certain IPs.

We will create multiple queues for each client and a total usage queue where it shows the total bandwidth. For testing purpose lets create a queue to which we will give a better bandwidth.

#### Step 1:

Queues>> Simple Queues >> Add [+] >> General >> Name=VIP user >> Target=192.168.1.20>>Max Limit=Upload 5M & Download 5M>>Apply>> OK

🧶 admin@00:0C:29:48:80:AE (MikroTik) - WinBox (64bit) v6.47.10 on x	86 (x86)	- 0
Session Settings Dashboard		
Safe Mode Session: 00:0C:29:48:80:AE	1	Memory: 225.9 MiB CPU: 0
🔀 Quick Set Queue List	Simple Queue <vip user=""></vip>	
CAPsMAN Simple Queues Interface Queues Queue Tre	General Advanced Statistics Traffic Total Total Statistics	ОК
Interfaces		
🖵 Wireless 🕂 🛨 🗸 🖾 🍸 🥨 Reset Co	Name: VIP user	Cancel
# Name Target	Target: 192.168.1.20 🗣 🖨	Apply
0 Sajal 1 192.168.1.10	Dst.:	
Sajal 2 192.168.1.1		Disable
Image: Second control of the second control	Target Upload Target Download	Comment
VE IPv6	Max Limit: 5M ∓ 5M ∓ bits/s	Conv
MPIS N	- A · Burst	Сору
Routing	Burst Limit: unlimited ∓ unlimited ∓ bits/s	Remove
System N	Burst Threshold: unlimited	Reset Counters
Queues	Burst Time: 0 0 s	Reset All Counters
Files	-▼. Time	Truch
K I Log		Torch
P RADIUS	enabled	

Figure 35: General Queue setup in Bandwidth management.

By the setup for **"VIP user"** will create slow bandwidth problem for other users in the queue like **"Sajal 1"** and **"Sajal 2"**. We will also notice dropdown at download speed.

#### Step 2:

Queues>>simple queue>> double click **"VIP user"**>>Advanced>>Priority=1 & 1>>bucket size=0.100 & 0.100>>apply>>OK

Sadmin@00:0C:29:48	80:AE (MikroTik) - WinBox (64bit) v6.47.10 on	x86 (x86)		– 🗆 X
Session Settings Das	hboard			
Safe Mode	Session: 00:0C:29:48:80:AE		Ν	1emory: 225.9 MiB CPU: 0%
🏏 🖉 Quick Set	Queue List	Simple Queue <vip user=""></vip>		
CAPsMAN	Simple Queues Interface Queues Queue 1	re General Advanced Statistics Traffic Total	Total Statistics	ОК
Interfaces				
Wireless	🕈 🗕 🖌 🚺 Υ 🧿 Reset C	Packet Marks:		Cancel
Bridge	# Name Target	- Target Upload	Target Download	Apply
🛓 PPP	1 Sajal 1 192.168.1.10	Limit At: unlimited	unlimited Thits/s	Disable
°T <mark>°</mark> Mesh	2 📕 Total usage 192.168.1.0/24	District I		Disable
🐺 IP 🛛 🗅	3 📕 VIP user 192.168.1.20	Fibrity.		Comment
🐺 IPv6 🛛 🗅		Bucket Size: 0.100	0.100 ratio	Сору
🕑 MPLS 🛛 🗅		Queue Type: default-small	default-small Ŧ	Pomovo
📑 Routing 🗈 🗈		Parent: none		nemove
🔯 System 🗅		rucht.		Reset Counters
🙅 Queues				Reset All Counters
Files				Torch
👸 🗐 Log				
😐 🔐 RADIUS		enabled		
🗧 🗙 Tools 🛛 🔿				
🕺 🔤 New Terminal	1			
🙆 🚥 LoRa	4 items (1 selected) 0 B queued	0 packets queued		
Dot1X				
🗧 🔇 Dude 🛛 🗎				
More N				

Figure 36: Advanced Queue setup in Bandwidth management.

#### 4.10 MikroTik Firewall

A firewall is a type of network security device that keeps track of incoming and outgoing network traffic and makes decisions about which traffic to allow or deny in accordance with a set of security rules. The first line of defense for network security is a firewall. They provide a barrier between trustworthy internal protected and regulated networks from shady external networks like the Internet. Firewall gives very good stealth scan defenses and it blocks more DoS attacks [11]

#### **Port Filtering Firewall:**

IP>>Firewall>>Filter rules>>Add[+]>>General>>Chain=forward>>Src. Address=192.168.1.0/24>>Protocol=6(tcp)>>Dst. Port=80>>Apply>>OK Action>>Action=drop>>Apply>>Ok

📚 admin@00:0C:29:24:ED:9A (MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86) — 🗆 🗙								
Session Settings Dashboard								
Cri         Safe Mode         Session: 00:0C:29:24:ED:9A								
🖌 🖉 Quick Set	New Firewall Rule							
CAPsMAN Firewall	General Advanced Extra Action Statistics	ОК	General Advanced Extra Action Statistics		ок			
Interfaces Filter Rules NAT Man	Chain: forward	Cancel	Action: drap	in l	Cancel			
		Curicci		<u> </u>	Curicci			
# Bridge # Action Chain	Src. Address: 192.168.1.0/24	Apply			Apply			
PPP	Dst. Address:	Disable	Log Prefix:	] 🗸 📗	Disable			
Is IP	Protocol: 6 (tcp) 🔻 🔺	Comment		_	Comment			
	Src. Port:							
	Dst. Port: 80	Сору			Сору			
Bauting N	Any Port	Remove			Remove			
System		Reset Counters			Reset Counters			
A Queues		Reset All Counters			Reset All Counters			
Files	Out. Interface:	- Hodder a codantero			- Hoder / ar Codintero			
∑ E Log	In. Interface List:							
RADIUS	Out, Interface List:							
🗧 🔀 Tools 🛛 🗅								
New Terminal	Packet Mark:							
LoRa Olamo	Connection Mark:							
Onterns	Routing Mark:							
🗧 🕒 Dude 🗈	•							
More N	enabled		enabled					

**Figure 37: Firewall Port dropping in a determined network** 

To accept port we need to follow the exact rules.

IP>>Firewall>>Filter rules>>Add[+]>>General>>Chain=forward>>Src.

```
Address=192.168.1.139>>Protocol=6(tcp)>>Dst. Port=80>>Apply>>OK
```

Action>>Action=accept>>Apply>>Ok

Sadmin@00:0C:29:24:ED:9A (1	MikroTik) - WinBox (64bit) v6.47.10 on x86 (x86)	-		
Session Settings Dashboard				
Safe Mode Session	: 00:0C:29:24:ED:9A			
💉 Quick Set	New Firewall Rule		New Firewall Rule	
CAPsMAN Firewall	General Advanced Extra Action	Statistics OK	General Advanced Extra Action Statistics	OK
Interfaces Filter F	Rules NAT Man			
🖵 Wireless	Chain: torward	Cancel	Action: accept	
C Bridge	Src. Address: 192.168.1	.139 Apply		Apply
2 PPP # 0	X drop forwar Dst. Address:	▼ Diaphle	Log Prefix:	T Disable
°∐ <mark>°</mark> Mesh	Protocol: C fron		Log Heix.	Disable
IP N		Comment		Comment
🖞 IPv6 🗈	Src. Port:	Сору		Сору
MPLS D	Dst. Port: 80	A Bemove		Remove
C Routing	Any. Port:	▼   <u></u>		Themove
System N	In. Interface:	✓ Reset Counters		Reset Counters
🙅 Queues	Out. Interface:	<ul> <li>Reset All Counters</li> </ul>		Reset All Counters
Files				
	In. Interface List:			
RADIUS	Out. Interface List:	<b>▼</b>		
	Packet Mark:			
New Terminal +	Connection Mark:			
C LoRa 1 item	Deutine Medu			
Dot 1X	Routing Mark:			
		Ľ	_	
More	enabled		enabled	

**Figure 38: Firewall Port accepting in a determined network** 

**Note:** We need to place the accept queue to #0 otherwise firewall will not work properly. First click on # then drag the accept queue to the top. Now the accept queue is on #0 queue.

🤘 adm	nin@00:0C:29:24	ED:9A (Mikro	oTik) - W	'inBox (6	4bit) v(	6.47.10 on x86 (x	(86)				—	
Session	Settings Das	hboard										
6	Safe Mode	Session: 00:0	0C:29:24:	ED:9A								
💓 🏏 🖉	Quick Set											
$\mathbf{P}$	CAPsMAN	Firewall										
inn ir	nterfaces	Filter Rules	NAT	Mangle	Raw	Service Ports	Connections	Address I	Lists Lay	yer7 Protocols		
Ф V	Nireless		<u></u>	[47]	7 10	Reset Counters	O Reset All	Counters	1	Find	a	
3 C B	Bridge					These counters						
i≟≘ P	PPP	•# Ac	tion	V Chain	end.	Src. Address	Dst. Address	Proto S	Src. Port	Dst. Port	In. Int	er Out 🔻
°T, N	Mesh	1	accept	forwar	rd rd	192.168.1.139		6 (tcp)		80		
255	P D				-			- (-r/				
🔕 adm	nin@00:0C:29:24	ED:9A (Mikro	oTik) - W	/inBox (6	4bit) v	6.47.10 on x86 ()	(86)				—	
Session	Settings Das	hboard										
6	Safe Mode	Session: 00:	0C:29:24:	:ED:9A								
20	Quick Set											
<b>P C</b>	CAPsMAN	Firewall										
an l	interfaces	Filter Rules	NAT	Mangle	Raw	Service Ports	Connections	Address	Lists La	ayer7 Protocol	8	
<b>v</b>	Wireless		1/2	-		Reset Counters	C Reset A	Counters		Find	ī	
3 C E	Bridge							D i		D + D +		
the F	PPP	# A	ction	Chair	n	Src. Address	Dst. Address	Proto	Src. Port	Dst. Port	In. Ir	iter Out 🔻
°T; M	Mesh		drop	forwa	ard	192.168.1.0/24		6 (tcp)		80		
255	P N					1021100110		C. C. P.				

Figure 39: Firewall filter rules priority queue for specific rule.

#### 4.12 Difficulties and Challenges

There were several problematic situation I would encounter during my internship. Then I'd make an effort to overcome every obstacle. My internship's main difficulties are: temporary, unpaid and competitive internship in a leading IT company. So I felt the pressure to work with talented senior employees. But I did not hesitate to ask for help from them. More difficulties and challenges are listed below:

- a) Some organizational strength was not enough.
- b) Password management issues
- c) Dealing with unsatisfied clients and their complains
- d) Security issues with both network and cable management.

- e) Building relationships with authorities and fellow colleagues in the region.
- f) Solutions for Hotspots
- g) Bandwidth management issues
- h) Time management problems in bad weather condition or traffic jam.

# **CHAPTER 05: ASSESSMENTS AND COMPETENCIES**

#### **5.1 Competencies Acquired**

After completing an internship at Daffodil Online Ltd., I gained knowledge of the various difficulties or problems that can arise during practical working. I evaluated and achieved several competencies during the course of my internship. I used to work hard to achieve such goals in an effective manner.

These acquired competencies are listed below:

- a) Troubleshoot, monitor, and supervise MikroTik routers.
- b) Look for answers to moderate problems.
- c) Develop my practical knowledge for real-world issues.
- d) Real-world exposure to a workstation.
- e) Install the MikroTik router OS.
- f) Comprehend bandwidth control.
- g) Maintain the MikroTik router.
- h) Utilize a hotspot.

#### 5.2 Assessments of the Internship

In the current situation of Bangladesh, getting a job is a real challenge without prior experience on that field. The post-covid19 condition of job market is at its worse. A productive internship can help me prepare for a career. I consider completing my internship to prepare for my impending reflection a success. DOL serves as a link between my personal lives and my work. This company gives me a lot of knowledge that will help me focus more effectively at work.

# **CHAPTER 06: CONCLUSION & FUTURE CAREER SCOPE**

#### 6.1 Scope for Future Career

In real life, finding a job may be quite difficult for all of us in our nation, especially if we lack experience. That is why I choose an internship—it will help me to increase my career prospects and gain experience. Therefore, this internship allows me to explore my options for future living. As a consequence, this internship will help me in the future to discover my scope in the corporate world. They are:

- a) Work on any ISP platform
- b) To work as an engineer in the security industry.
- c) Possibility of employment as a network engineer.
- d) Possibility of employment as an IT security engineer.
- e) Any IT-related position in corporate office or bank.

#### 6.2 Discussion & Conclusion

I have been thinking of constructing a MikroTik network during my internship. I've got a lot of thoughts on IP class and how to use the network to gain a lot of IP. I thought this internship would be a great way for me to learn modern skills. I learned a lot about the firm throughout my brief job. The method and diagram of computer organizations, information association, organization security, interface, and maintenance are the biggest openings in a wide range of applications. The most significant lessons I took away from my internship were how to set up an ISP link, how to manage bandwidth in various ways, how to establish bridge mode, how to set up a firewall and NAT and how to protect a network. My trainer and counselor were excellent, and I learnt a lot from them. They also gave me a lot of fresh ideas that I will use in the future. A variety of swaps that I was able to make will be useful in the future.

I've never used a reality networking system before, but doing so now provides me the chance to do so in the future. I can now manage a wide range of routers, which will be useful in the future. It enables me to connect with actual networking contacts that will be useful to me in the future.

# **APPENDICES**



# Daffodil Online Connect Your World

Name	Daffodil Online Limited
Address	102, Shukrabad (3rd floor), Mirpur Road, Dhanmondi, Dhaka -
	1207, Bangladesh
Telephone	+8802-48119586 , 9143258, 9143259
Email	info@daffodilnet.com, noc@daffodilnet.com
Website	http://www.daffodilnet.com/
Types of	Leading Internet Service Provider (ISP) in Bangladesh
Organization	

# **INTERNSHIP CERTIFICATE**



www.daffodilnet.com

October 25, 2022

#### To Whom It May Concern

We have the pleasure to certify that **Rezwan Maruf Sajal, Id No: 142-19-1552,** is a student of Daffodil International University has successfully completed 12 weeks of internship program at "Systems & Network" Department in **Daffodil Online Limited** from December-2021 to March-2022.

During the internship period, the concerned was given all opportunities to come across most of the activities of the said department and gather some practical experience. The internship skill and performance of **Rezwan Maruf Sajal** was satisfactory during the internship period.

We wish him every success in life.

(Kazi Mahbubul Alam) Assistant General Manager Daffodil Online Ltd. Cell: 01713493097 Email: kazi@daffodilnet.com



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