Lab Topology



Step 1

Connect ether1 of the Mikrotik hEX BDR to a free port of the RENU CPE.

Download winbox application from the Mikrotik Website on link below

https://mikrotik.com/download

Connect your PC to the Mikrotik BDR and open the Winbox app

🕒 WinBox (64bit) v3.41 (Addresses)				
File Tools					
Connect To: D	4:01:C3:31:48:6F				
Login: D	dmin 🖪	2			
LOGIII. a					
Password:		4			
Managed Neighb	Add/Set	1			
MAC Address	IP Address	Identity	Version	Board	Uptime
D4:01:C3:31:48:6F	0.0.00	MikroTik	6.49.11 (s RB760iGS	00:04:13
	2				

Login to the Mikrotik BDR with the password at the back of the router

Remove the default configuration upon login

RouterOS Default Configuration	
The following default configuration has	been installed on your router:
Welcome to RouterOS! 1) Set a strong router password in the 2) Upgrade the software in the System 3) Enable firewall on untrusted netwo	ne System > Users menu m > Packages menu orks
RouterMode: * WAN port is protected by firewall and * Ethernet interfaces (except WAN port. LAN Configuration: Defense 102 162 88 1/24 is out of	d enabled DHCP client /s) are part of LAN bridge
DHCP Server: enabled; DNS: enabled; WAN (gateway) Configuration:	i pridĝe (LMM porc)
gateway: ether1; ip4 firewall: enabled; ip6 firewall: enabled; NAT: enabled; DHCP Client: enabled;	
Login admin user protected by password	
You can click on "Show Script" to see t and remove this default configuration.Tu click on "Remove Configuration" or clic	ne exact commands that are used to add o remove this default configuration k on "OK" to continue
NOTE: If you are connected using the abo disconnected.	ove IP and you remove it, you will be
	Remove Configuration Show Script OK

Step 2

Configure the login password for the router, in the formart Group@X; where X is group number

System>Password

Change Password		
Old Password:		Password
New Password:	******	Cancel
Confirm Password:	*****	

Step 3

Change the system name for the router to Group-X-BDR; where X is group-number

System>Identity

ОК
Cancel
Apply

P2P Communication with the ISP Provider

Step 4

Configure a P2P IP on ether1 to the ISP CPE in the form 137.63.239.6x/28 as shown below



Verify that you can "Ping" the CPE

Open the Terminal of the Mikrotik Router and ping the IP of the CPE (137.63.239.65)

ping 137.63.239.65



```
ping 1.1.1.1
```

```
[admin@Group-1-BDR] > ping 1.1.1.1
SEQ HOST SIZE TTL TIME STATUS
0 no route to host
1 sent=2 received=0 packet-loss=100%
```

Step 5: Configure Static Routing to your ISP

Configure a default route to the IP of the CPE (137.63.239.65)

Sadmin@D4:01:C3:	31:48:71 (Group-1-BDR	R) - WinBox (64bit) v6.49.11 on l	EX S (mmips)						-	Ð	×
Session Settings	Dashboard										
Safe Mode	Session: D4:01:C3:31:4	48:71									
Ouick Set											
CAPSMAN											
Interfaces											
				·							
💢 Bridge		Route	List								
The second secon		Rout	es Nexthons Rules	VRF							
T Switch								Find R. T			
°l [®] Mesh				(0.1			Distance Destination				
🖳 IP 🦰 👘	ARP	DAC	Dst. Address 137.63.239.64/.	ether1 reachable			Distance Routing Ma	137.63.239.66			
Ø MPLS	Accounting	DAC	▶ 192.168.1.0/24	bridge-LAN reacha	ble		0	192.168.1.1			
🐏 IPv6 🛛	Addresses									5	
📑 Routing	Cloud										
😂 System	DHCP Client										
Queues	DHCP Relay										
Files	DHCP Server				New Route						
🛄 Log	DNS				General Attribut	es					
RADIUS	Firewall										-
🗙 Tools 🛛	Hotspot				Dst. Address:	0.0.0/0		-		Canc	el
New Terminal	IPsec				Gateway:	137.63.239.65			\$	Appl	y
Dot1X	Kid Control				Check Gateway:				•	Disab	ke
Partition	Neighbors	_			Type:	unicast			-	Comm	ent
Make Supout.rif	Packing	2 2 item	s		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					Cop	v
New WinBox	Pool				Distance:				-	Bomo	,
🛃 Exit	Routes -				Scope:	30				rtemo	рм
	SMB				Target Scope:	10					
	SNMP				Routing Mark:				-		
💻 Windows					-						
🛄 Windows 🗅	SSH				Pref. Source:				-		
Windows	SSH Services				Pref. Source:				•		

IP>Routes>

Verify that the Route is reachable

Route List	t					×
Routes	Nexthops Rules	VRF				
+ -	×× = 7			F	ind all	₹
	Dst. Address	Gateway	Distance	Routing Mark	Pref. Source	-
AS	0.0.0/0	137.63.239.65 reachable ether1	1			
DAC	137.63.239.64/	ether1 reachable	0		137.63.239.66	
DAC	192.168.1.0/24	bridge-LAN reachable	0		192.168.1.1	
3 items						
Sitems						

ping 1.1.1.1

MMM M	MM	KKK					Т	TTTT	TTTTT	r	ккк	
MMMM MM	1MM	KKK					Т	TTTT	TTTTT	r	KKK	
MMM MMMM M	1 MM	II KKK	KKK	RRRF	RR	000	000	T	гт	III	KKK	KKK
MMM MM M	1MM I	II KKKE	KK	RRR	RRR	000	000	T	ГТ	III	KKKI	KK
MMM M	1MM I	II KKK	KKK	RRRF	RR	000	000	T	ΓT	III	KKK	KKK
MMM M	I MM	II KKK	KKK	RRR	RRR	000	0000	T	ГТ	III	KKK	KKK
MikroTik R	Router	os 6.49.	.11 (c) 199	9-202	23	htt	p://	ww.mi	ikroti	k.co	m/
?] ommand [?]	G G	ives the ives hel	e list lp on	of a the c	vaila	able c	command	ls of a	caumer	ate		
						ilu allu	. 1150	01 u.	guiller	10.5		
[ab]	C a	ompletes second	the [Tab]	comma give	und/wo	ord. I ssible	f the optic	inpu ns	t is a	ambigu	lous,	
[ab]	C a M	ompletes second ove up t	s the [Tab] to bas	comma give e lev	und/wo s pos vel	ord. I ssible	f the optic	inpu ns	t is a	ambigu	ious,	
Tab]	C a M M	ompletes second ove up t ove up (to bas	comma give e lev vel	und/wo s pos rel	ord. I ssible	f the optic	inpu ns	is a	ambigu	ious,	
Tab] command	C a M U	ompletes second ove up t ove up c se comma	s the [Tab] to bas one le and at	comma give e lev vel the	und/wo es pos vel base	ord. I ssible level	f the optic	inpu ns	is a	ambigu	ious,	
Fab] command admin@Group	С а М U 0-1-ВD	ompletes second ove up t ove up c se comma R] > pin	to bas bane leand at to 1.1	comma give e lev vel the .1.1	und/wo es pos vel base	ord. I ssible level	f the optic	inpu ns	is a	ambigu	ious,	
Tab] command admin@Group SEQ HOST	C a M U D-1-BD	ompletes second ove up t ove up o se comma R] > pin	to bas band at to 1:1	comma give e lev vel the .1.1	und/wo s pos rel base	ord. I ssible level	f the optic	inpu ns	TIME	ambigu STAT	uous,	
Fab] command admin@Group SEQ HOST 0 1.1.1.	С а М 0 0 -1-ВD .1	ompletes second ove up t ove up o se comma R] > pin	to basione leand at	comma give e lev vel the .1.1	nd/wo s pos rel base	ord. I ssible level	f the optio SIZE	inpu ns TTL	TIME 19ms	ambigu STAI	ious,	
<pre>Tab] . command admin@Group SEQ HOST 0 1.1.1. 1 1.1.1.</pre>	C a M U D-1-BD .1	ompletes second ove up t ove up o se comma R] > pin	to basione leand at	comma give e lev vel the .1.1	nd/wo s pos rel base	ord. I ssible level	f the optic SIZE	inpu ns TTL 52 52	TIME 19ms 19ms	ambigu STAI	ious,	
<pre>Tab] . command admin@Group SEQ HOST 0 1.1.1. 1 1.1.1. 2 1.1.1.</pre>	C a M D D - 1 - BD . 1 . 1 . 1	ompletes second ove up t ove up o se comma R] > pin	to bas one le and at	comma give e lev vel the .1.1	nd/wo s pos rel base	ord. I ssible level	f the optic SIZE 56 56 56	inpu ns TTL 52 52 52	TIME 19ms 19ms 19ms	ambigu STAI	ious, CUS	
<pre>Tab] . command admin@Group SEQ HOST 0 1.1.1. 1 1.1.1. 2 1.1.1. 3 1.1.1.</pre>	C a M U D-1-BD .1 .1 .1 .1 .1	omplete: second ove up t ove up o se comma R] > pin	to bas to bas one le and at ng 1.1	comma give e lev vel the .1.1	nd/wo s pos rel base	ord. I ssible level	f the optic SIZE 56 56 56	inpu ns TTL 52 52 52 52 52	TIME 19ms 19ms 19ms 19ms 19ms	ambigu STAI	ious, TUS	

Step 6: Create a bridge and name it "bridgeLAN" and add the necessary ports

Create a bridge for the LAN

🔘 admin@D4:01:C3:3	1:48:6F (Group-1-BDR) - WinBox (64bit) v6.49.11 on hEX S (mmips)				- 0 ×
Session Settings	Dashboard				
Safe Mode	Session: D4:01:C3:31:48:6F				
🎉 Quick Set					
CAPsMAN					
Interfaces					
T Wireless					
🐹 Bridge 🤺					
👍 PPP	2				
T Switch					
°l <mark>°</mark> Mesh		New Interface			
👜 IP 🗈 🗅	Bindge	General STP VLA	N Status Traffic	ок 📥	
Ø MPLS 🗈	Bridge Ports Port Extensions VLANs MSTIs Port MST Overrides Filters NAT Hosts MDB	Name:	bridgeLAN	3 Cancel	
IPv6 🗈	★ → × × ← ▼ Settings	Туре:	Bridge	Apply	Find
3 Routing	Name / Type L2 MTU Tx Rx	MTU:		Disable	FP Tx Packet (p/s) FP Rx F ▼
System		Actual MTU:		Disable	
Queues		L2 MTU		Comment	
Files		L2 MIO.		Сору	
Log		MAC Address:		Remove	
RADIUS		ARP:	enabled	Torch	
Tools		ARP Timeout:	▼		
New Terminal		Admin. MAC Address:			
Dot1X		Ageing Time	00:05:00		
Partition		Agoing mile.			
Make Supout.nr			IGMP Snooping		
New WINBOX			DHCP Snooping		
EXIL			East Easuard		
Mindaux N			rastroiwaid		•
- windows		enabled	running	slave	

Add four ports to the bridge i.e. ether2, ether3, ether4, ether5



Step 7: Configure the Private IP Subnet for the LAN (192.168.x.0/24)

Configure your LAN gateway (192.168.x.1/24) on the bridgeLAN interface.

IP>address>



Step 8: Configure DHCP for Dynamic allocation of the Private IPs

- Create an IP pool and name it Group-x-pool
- Configure the IPs you want given out by DHCP reserving the first 10 IP addresses

Sadmin@D4:01:C3	:31:48:6F (Group-1-BDI) - WinBox (64bit) v6.49.11 on hEX S (mmips)	-	D	×
Session Settings	Dashboard				
🔊 🕑 🛛 Safe Mode	Session: D4:01:C3:31:	48.6F			
Cluck Solt CAPSMAN Interfaces CAPSMAN Interfaces Wroless Wroless Wroless Prp Switch Prp Mesh Ip Ip Ip Ip Routing Ro	ARP Accounting Addresses Cloud DHCP Client DHCP Client DHCP Client DHCP Server DNS Firewall Hotspot IIPsec Kid Control Neighbors Packing Pool Routes SMB	Image: Second	6 OK Cancel Apply Comment Copy Remove		
Windows	SNMP	0 items			
	SSH				
	Services				
Xo	Settings				
ň	Socks				

- Create a DHCP server and name it **Group-x-server**
- Select the IP pool the server will use it assign IPs and select the bridgeLAN interface for DHCP.



Configure the Private Network under DHCP (192.168.x.0/24), assign it a gateway (192.168.x.1) and also configure DNS addresses (102.34.160.44, 196.43.185.73)

Session Settings (Dashboard										
Safe Mode	Seecion: D4:01:C3:31:48:6E										
	363301. 04.01.00.01.40.01]			_				_		ŝ
Quick Set											
m Internaces			_								
Vireless Pridae			_3						. 🤴 .		
											
		DHCD Server									
°le Mesh		Duop Networks	and a stress	Online Calls Mandaud		New DHCP Network	k 🖉				
🕮 IP 🔶 🗈	ARP	DHCP Networks	eases Options	Option Sets Vendor	asses Alerts	Address:	: 192.168.1.0/24 - 4		ок		
MPLS N	Accounting	• Y			Find	Gateway:	192.168.1.1 -	\$	Cancel		
1Pv6 N	Addresses	Address	Gateway	DNS Servers	Domain 🔻	Netmask:	24 6		Apply		
I Routing	Cloud						No DNS			_	
😂 System 🗈	DHCP Client					DNS Servers:	196.43.185.73	\$	Commer	m l	
🙅 Queues	DHCP Relay 2						102 34 160 44		Сору		
Files	DHCP Server					Domain:		;\	Remove	0	
🗒 Log	DNS					Domain.			8		
2 RADIUS	Firewall					wins servers:		T			
🔀 Tools 🛛 🗅	Hotspot					NTP Servers:		Ţ			
New Terminal	IPsec					CAPS Managers:					
Dot1X	Kid Control					Next Server:		•			
Partition	Neighbors					Boot File Name:		•			
Make Supout.rif	Packing					DHCP Options:		\$			
New WinBox	Pool	•				DHCP Option Set:					
Exit	Routes	0 items		F							
-	SMB		_								
Windows 🗅	SNMP										

- Confirm that your computer is obtaining IP addresses dynamically according to the DHCP configuration.
- > Open the terminal on your computer (Windows + R); type (cmd) and press enter.
- > On the terminal, type **ipconfig /all**

ipconfig /all

PS C:\Users\mugam> ipconfig /all	
Windows IP Configuration	
Host Name	. : RENU-NO-MUGAMBE . : . : Hybrid . : No . : No . : renu.ac.ug net.renu.ac.ug
Ethernet adapter Ethernet 5:	
Connection-specific DNS Suffix Description	<pre>.: renu.ac.ug .: Realtek USB GbE Family Controller .: AC-91-A1-8E-F3-D9 .: Yes .: Yes .: fe80::4a3e:abf7:3afe:a12f%8(Preferred) .: 192.168.1.253(Preferred) .: 255.255.255.0 .: Wednesday, 30 April 2025 09:41:41 .: Wednesday, 30 April 2025 17:41:40 .: 192.168.1.1 .: 192.168.1.1 .: 934056353 .: 00-01-00-01-2F-93-9B-83-F0-D4-15-B2-79-EC</pre>
NetBIOS over Topip.	. : +e80::4a3e:ab+7:3a+e:a12+%8 127.7.7.5 . : Enabled
Connection-specific DWS Suffix S	renu.ac.ug net.renu.ac.ug

Step 9: Configure NAT for the Private IPs (192.168.x.0/24) to the public IPs (102.34.20.x/24)





Confirm that the NAT rule is working by issuing ping 1.1.1.1 source-address 192.168.x.1

ping 1.1.1.1 source-address 192.168.x.1

admin@MikroTik]	>					
admin@MikroTik]	>					
admin@MikroTik]	>					
admin@MikroTik]	> pi	ng 1.1.1.1	src-address=192.168	.1.1		
SEQ HOST			SIZE	TTL	TIME	STATUS
0 1.1.1.1			56	52	63ms	
1 1.1.1.1			56	52	62ms	
2 1.1.1.1			56	52	62ms	
3 1.1.1.1			56	52	62ms	
4 1.1.1.1			56	52	62ms	

- After verifying that you can reach the internet from the router, its time to confirm that you can reach the internet from your laptop.
- > Issue the following commands on your computer terminal

ping 8.8.8.8

ping google.com

nslookup google.com

Open any browser on you computer and perform the following speed tests <u>https://pfs-raxio.renu.ac.ug/speedtest/</u> fast.com

speedtest.net

https://speed.cloudflare.com/

Also download PingPlotter from the url below <u>https://www.pingplotter.com/download/</u>

Step 10: Connecting Network equipment to the network

- Congratulations for reaching this far and configuring your own router to connect you to the global network
- > Now connect the provided access point, and confirm that it is picking an IP
- Confirm you can ping the AP's IP both on the router's terminal and on your computer's terminal.
- Repeat the procedure with any other peripherals available like printers, VoIP phones if any, cameras etc

Step 11: Questions from Participants and Troubleshooting Tips

- ➢ Loose cables
- ➢ Not picking an IP
- DNS not resolving??
- Can ping but can't browse
- > AP not picking an IP
- > Any other issues from the Participants