

Using MikroTik DHCP Server for Network Management

Engr. Norberto F. Inlayo III

MUM VIETNAM 2019



BULLET

Engr. Norberto F. Inlayo III

Mikrotik Academy Trainer | Siena College of Taytay
Philippines



MikroTik

A C A D E M Y



Siena College of Taytay

About MikroTik Academy



1st in **Luzon**
3rd in the **Philippines**

MikroTik
ACADEMY

Siena College of Taytay

<http://www.mikrotik.com/>
<http://www.belajarmikrotik.com/>
<http://www.mikrotikphilippines.com/> | unitedplexus.com | www.sct.edu.ph

The MikroTik Academy Program is for educational institutions such as:

- Universities
- Technical Schools
- Colleges
- Vocational schools
- Other educational institutions.

About MikroTik Academy

Benefit for Students

Opportunity to acquire the basic knowledge in RouterOS and MTCNA certificate during academic studies.

Benefit for Educational Institutions

Opportunity to attract more students by offering MikroTik certification.



About MikroTik Academy

MikroTik offers

- Course outline
- Certification test
- Equipment (RouterBOARD routers) for the class
- Support and information



About MikroTik Academy

Requirements

- Motivation and resources
- Space and all the equipment needed for the labs
- Appropriate Internet access
- **MikroTik Academy Trainer***
- Approved training materials



About MikroTik Academy



*Requirements for Academy Trainers

- Lecturer at the educational institution
- MTCNA certificate (score at least 75%)
- Any engineer level MikroTik certificate (score at least 75%).

About MikroTik Academy



Evaluation procedure

(performed by Appointed Coordinators or MikroTik)

- Validation check of the educational institution
- Verification of the Academy Trainer:
 - Status at the educational institution
 - Presence of required certifications
- Verification of training materials
- Verification of students

About MikroTik Academy



LUZON

Siena College of Taytay - Taytay, Rizal

VISAYAS

Foundation University - Dumaguete City, Negros Oriental

MINDANAO

Inquirinity Computer Academy - Tagum Campus Tagum City

Iligan Medical Center College - Iligan City

Jose Rizal Memorial State University - Main Campus, Dapitan City

Jose Rizal Memorial State University - Sibuco, Zamboanga del Norte

Jose Rizal Memorial State University - Katipunan, Zamboanga del Norte

Jose Rizal Memorial State University - Siocon, Zamboanga del Norte

Jose Rizal Memorial State University - Dipolog City

Jose Rizal Memorial State University - Tampilisan, Zamboanga del Norte

Iligan Computer Institute - Bonifacio Avenue, Tibanga, 9200 Iligan City

Mindanao State University - Iligan Institute of Technology, Iligan City

Mindanao State University - Main Campus Marawi City, Lanao del Sur

Mindanao State University - Jolo, Sulu

As of October 2018



About MikroTik Academy



Government Funded Project

*CURRICULUM ENHANCEMENT THROUGH
ACADEMIC INDUSTRY PARTNERSHIP WITH
MIKROTIK ACADEMY FOR INCREASED
EMPLOYABILITY OF GRADUATES*

Institutional Development and Innovation Grants (IDIG)

Concept Paper - Siena College of Taytay



Using MikroTik DHCP Server for Network Management

Engr. Norberto F. Inlayo III

MUM VIETNAM 2019



Objectives

For the Network Administrator

- To be able to understand DHCP
- To be able to secure the DHCP network
- To be able to have an idea on how to use of RouterOS DHCP in managing and monitoring devices in the network

Reference:

❑ wiki.mikrotik.com

❑ forum.mikrotik.com

❑ www.iana.org

Disclaimer:

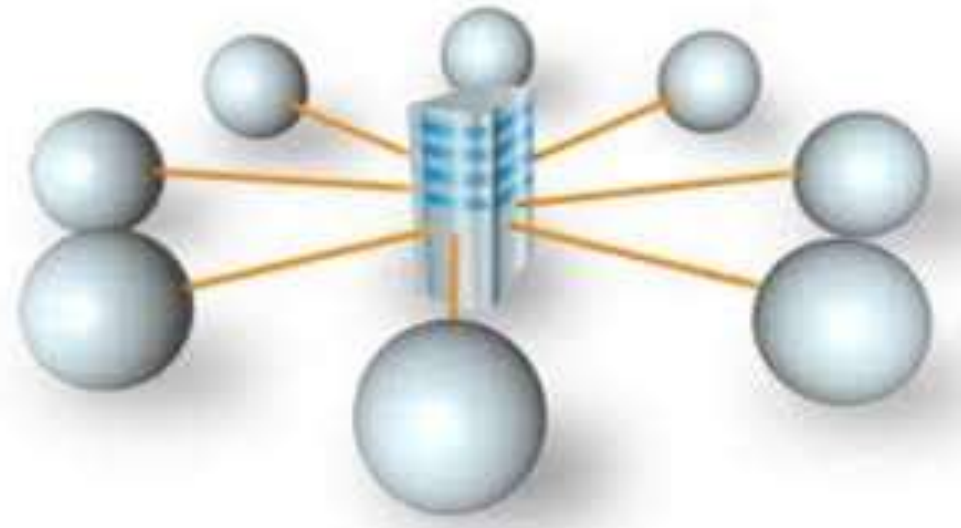
All photos are copyright of their respective owners.

What is DHCP?



Why is it Important?

- ❑ It let you manage the network in a central place.



DHCP Port

UDP Port:

□ 67 for Server

□ 68 for Client



DHCP: How does it work?



- DHCP **D**iscover
- DHCP **O**ffer
- DHCP **R**equest
- DHCP **A**ck

DHCP Servers

DHCP: Discover

The client broadcasts a request for a DHCP server.



CLIENT

<Client: Src MAC Addr>
<Broadcast>

Src IP Addr:port
<0.0.0.0:68>

Dst IP addr:port
<255.255.255.255:67>



SERVER



Asia Hotel Bangkok



Asia Airport Hotel



Asia Pattaya Hotel



Asia Cha Am Hotel

DHCP: Offer

DHCP Server Addr:port
<192.168.100.1:67>



<DHCP Server: Src MAC Addr>
<Broadcast>



Dst IP addr:port
<255.255.255.255:68>



DHCP servers on the network offer an address to the client.

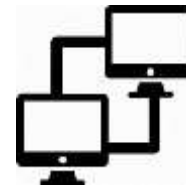


DHCP: Request

The client broadcasts a request to lease an address from one of the offering DHCP servers.



Src IP Addr:port
<0.0.0.0:68>



CLIENT

<Client: Src MAC Addr>
<Broadcast>



SERVER

Dst IP addr:port
<192.168.100.1:67>



Asia Airport Hotel

DHCP: ACK



CLIENT

DHCP Server Addr:port
<192.168.100.1:67>

<DHCP Server: Src MAC Addr>
<Broadcast>



SERVER

Dst IP addr:port
<255.255.255.255:68>



The DHCP server that the client responds to acknowledges the client



Securing the DHCP Network

❖ For Wireless Network:

- Setting a Strong WIFI Password
- Connect and Access List Registration

❖ For Wireless and Wired Network

- Setting the MikroTik Interface to ARP reply only
- Creating a Login Captive Portal through Hotspot



DHCP Settings For Network Management

□ DHCP Server

□ DHCP Network

❖ DHCP Lease

For this presentation we focus on DHCP Lease Submenu

DHCP Server

Can Assign/Modify:

- Name
- Interface
- Add Relay
- Lease Time
- Address Pool
- DHCP Option Set
- Src. Address
- Delay Threshold
- Authoritative
- Bootp Support
- Always Broadcast
- Insert Queue
- Add ARP for Leases
- Use Radius
- Lease Script

The screenshot shows the 'DHCP Server <dhcp1>' configuration window. The fields are as follows:

- Name: dhcp1
- Interface: bridge1
- Relay: (empty)
- Lease Time: 00:10:00
- Bootp Lease Time: forever
- Address Pool: dhcp_pool0
- DHCP Option Set: (empty)
- Src. Address: (empty)
- Delay Threshold: (empty)
- Authoritative: yes
- Bootp Support: static
- Always Broadcast
- Insert Queue Before: first
- Add ARP For Leases
- Use RADIUS: no
- Lease Script: (empty text area)

Buttons on the right side: OK, Cancel, Apply, Disable, Copy, Remove.

DHCP Network

Can Assign/Modify:

- Address
- Gateway
- Netmask
- No DNS
- DNS Servers
- Domain
- WINS Servers
- NTP Servers
- CAPS Managers
- Next Server
- Boot File Name
- DHCP Options
- DHCP Options Set

DHCP Network <192.168.100.0/24>

Address: 192.168.100.0/24

Gateway: 192.168.100.1

Netmask: []

No DNS

DNS Servers: 8.8.8.8

Domain: []

WINS Servers: []

NTP Servers: []

CAPS Managers: []

Next Server: []

Boot File Name: []

DHCP Options: []

DHCP Option Set: []

OK

Cancel

Apply

Comment

Copy

Remove

DHCP Options

- Parameters sent by DHCP Server to the Client
- Custom Options / Vendor Extension
- Parameters must be included in the Parameter-List Attribute found at <https://www.iana.org/assignments/bootp-dhcp-parameters/bootp-dhcp-parameters.xhtml>

[file](#)

DHCP Options

Tag	Name	Data	Meaning	Reference
110	REMOVED/Unassigned			[RFC3679]
111	Unassigned			[RFC3679]
112	Netinfo Address	N	NetInfo Parent Server Address	[RFC3679]
113	Netinfo Tag	N	NetInfo Parent Server Tag	[RFC3679]
114	URL	N	URL	[RFC3679]
115	REMOVED/Unassigned			[RFC3679]
116	Auto-Config	N	DHCP Auto-Configuration	[RFC2563]
117	Name Service Search	N	Name Service Search	[RFC2937]
118	Subnet Selection Option	4	Subnet Selection Option	[RFC3011]
119	Domain Search	N	DNS domain search list	[RFC3397]
120	SIP Servers DHCP Option	N	SIP Servers DHCP Option	[RFC3361]
121	Classless Static Route Option	N	Classless Static Route Option	[RFC3442]
122	CCC	N	CableLabs Client Configuration	[RFC3495]
123	GeoConf Option	16	GeoConf Option	[RFC6225]
124	V-I Vendor Class		Vendor-Identifying Vendor Class	[RFC3925]
125	V-I Vendor-Specific Information		Vendor-Identifying Vendor-Specific Information	[RFC3925]

How to use DHCP Server Lease to monitor and managed your network

- ❖ LAB Pre-requisite
- ❖ DHCP Lease
- DHCP Options
- Dynamic to Static
- Adding Rate Limit
- Address Listing
- Extracting DHCP Lease Information thru SCRIPTING.



Activity Pre-requisite:

- DHCP Server should be configured.
- There should be an IP Pool.
- IPv4 for the devices should be set to obtain an IP address automatically.

Note: Devices with manually configured IP cannot be probed in the DHCP lease.

DHCP Configuration: Wizard Setup

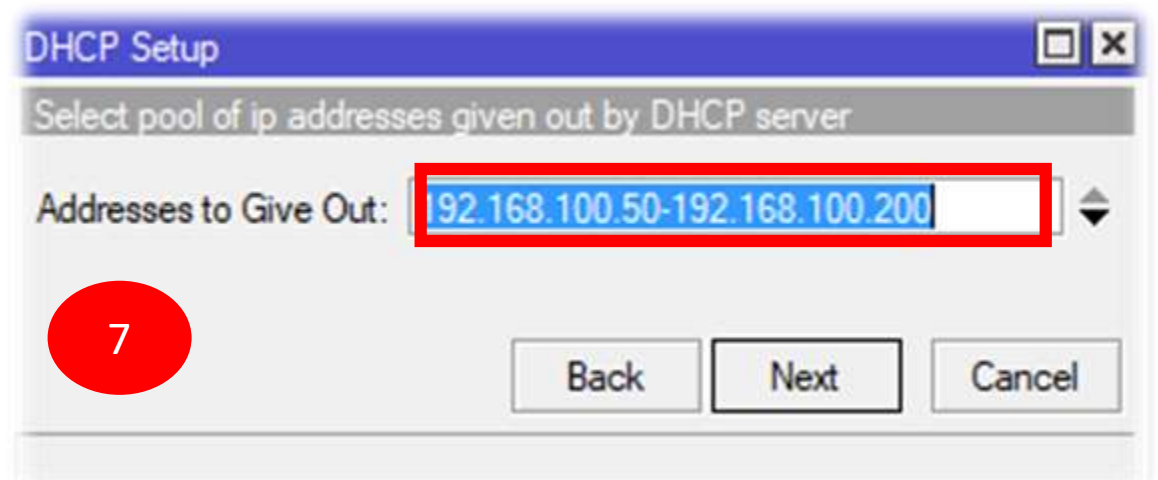
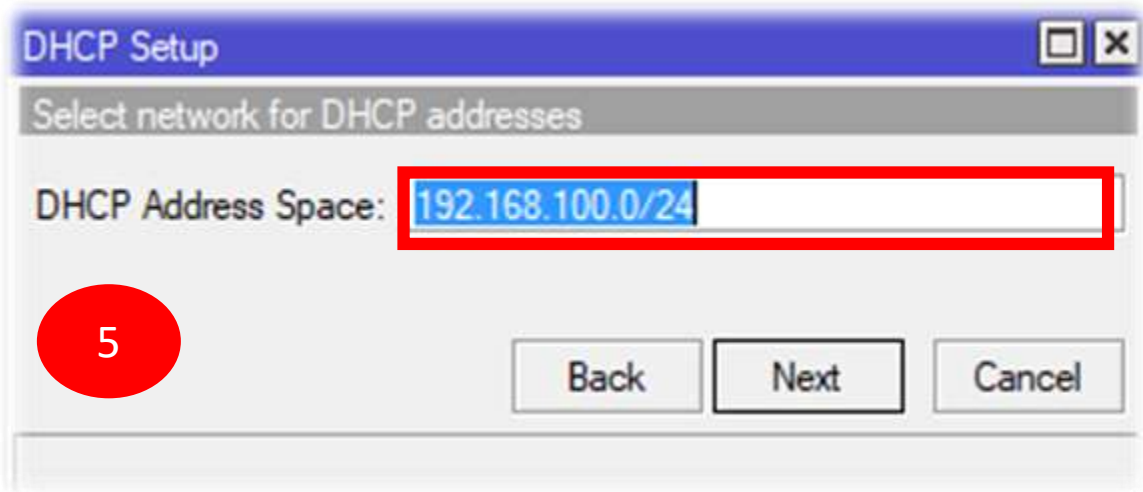
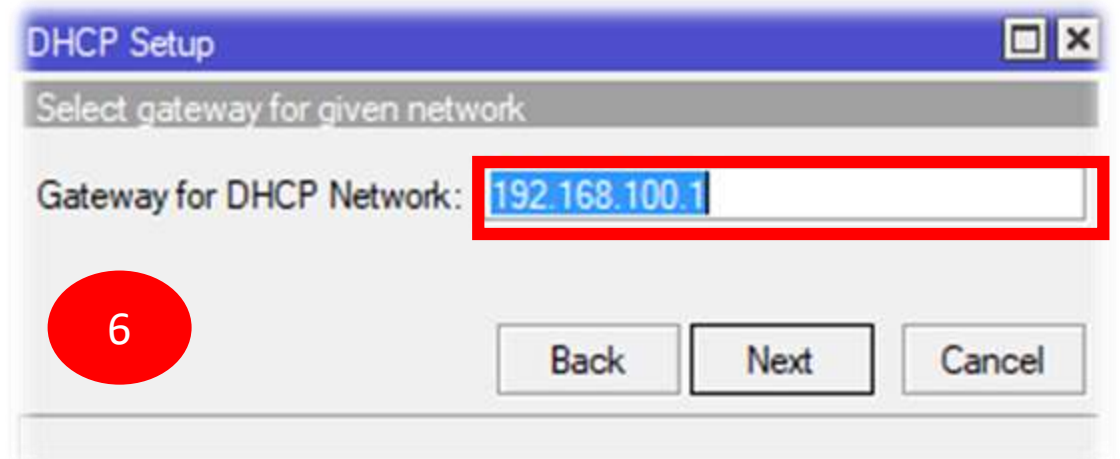
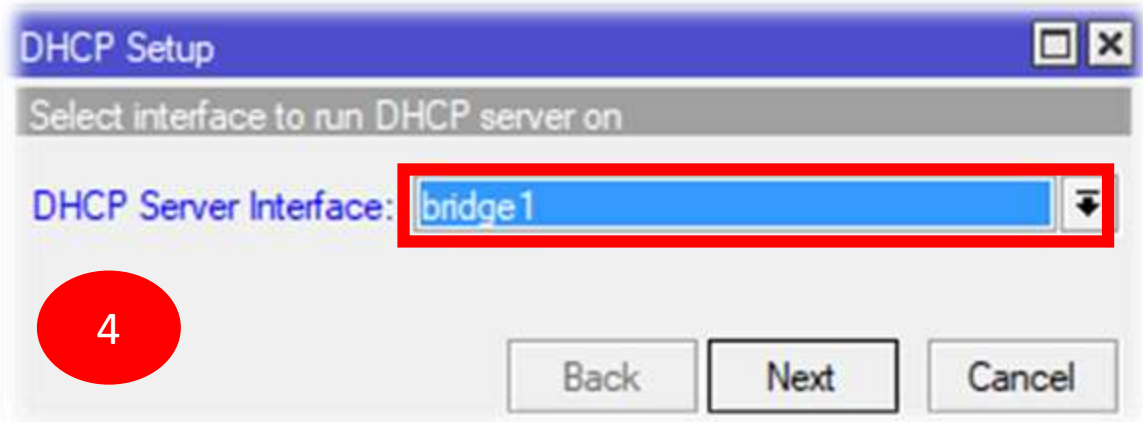


DHCP Server – Setup Wizard

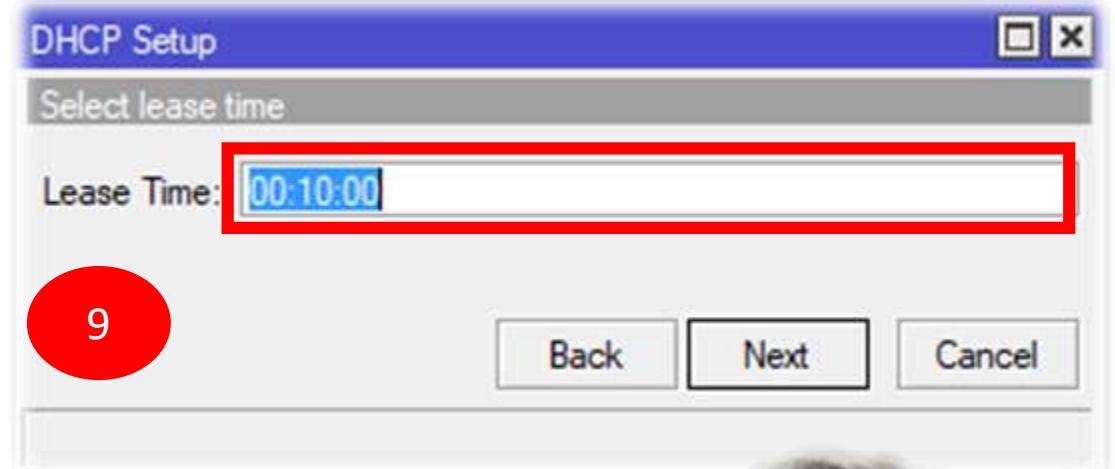
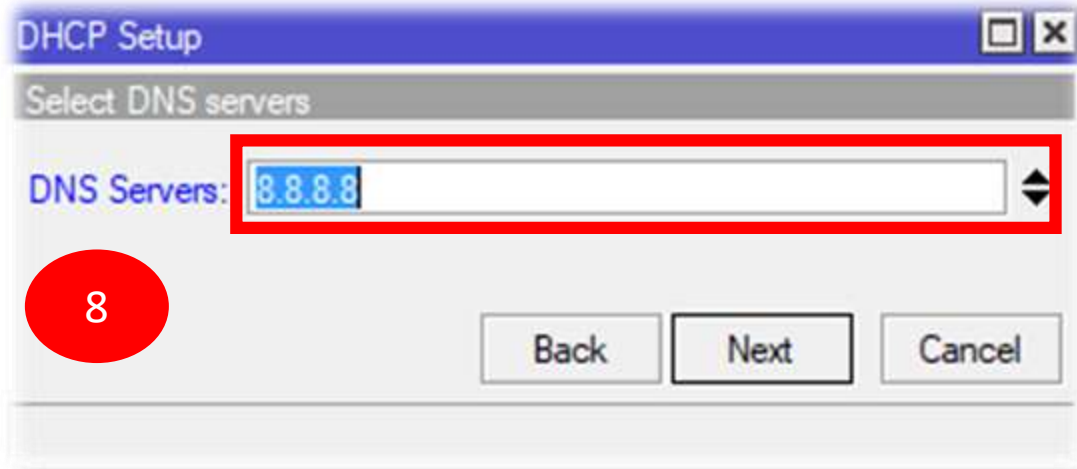
The screenshot shows the Mikrotik WinBox interface for the DHCP Server Setup Wizard. The left sidebar contains a tree view of system services, with 'IP' highlighted by a red box and a red circle labeled '1'. A red arrow points from this box to a red circle labeled '2' which highlights the 'DHCP Server' option in the main menu. Another red arrow points from the 'DHCP Server' menu item to a red circle labeled '3' which highlights the 'DHCP Setup' button in the top toolbar of the DHCP Server configuration window.

Name	Interface	Relay	Lease Time
0 items			

DHCP Server – Setup Wizard

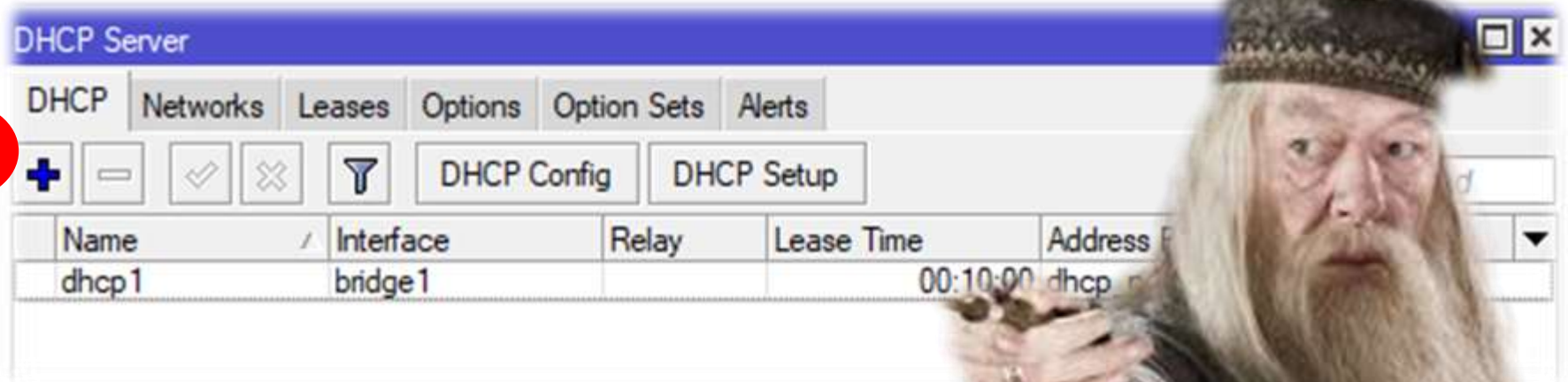


DHCP Server – Setup Wizard



Congrats!

*You have setup
a DHCP Server.*



IP Address Pool



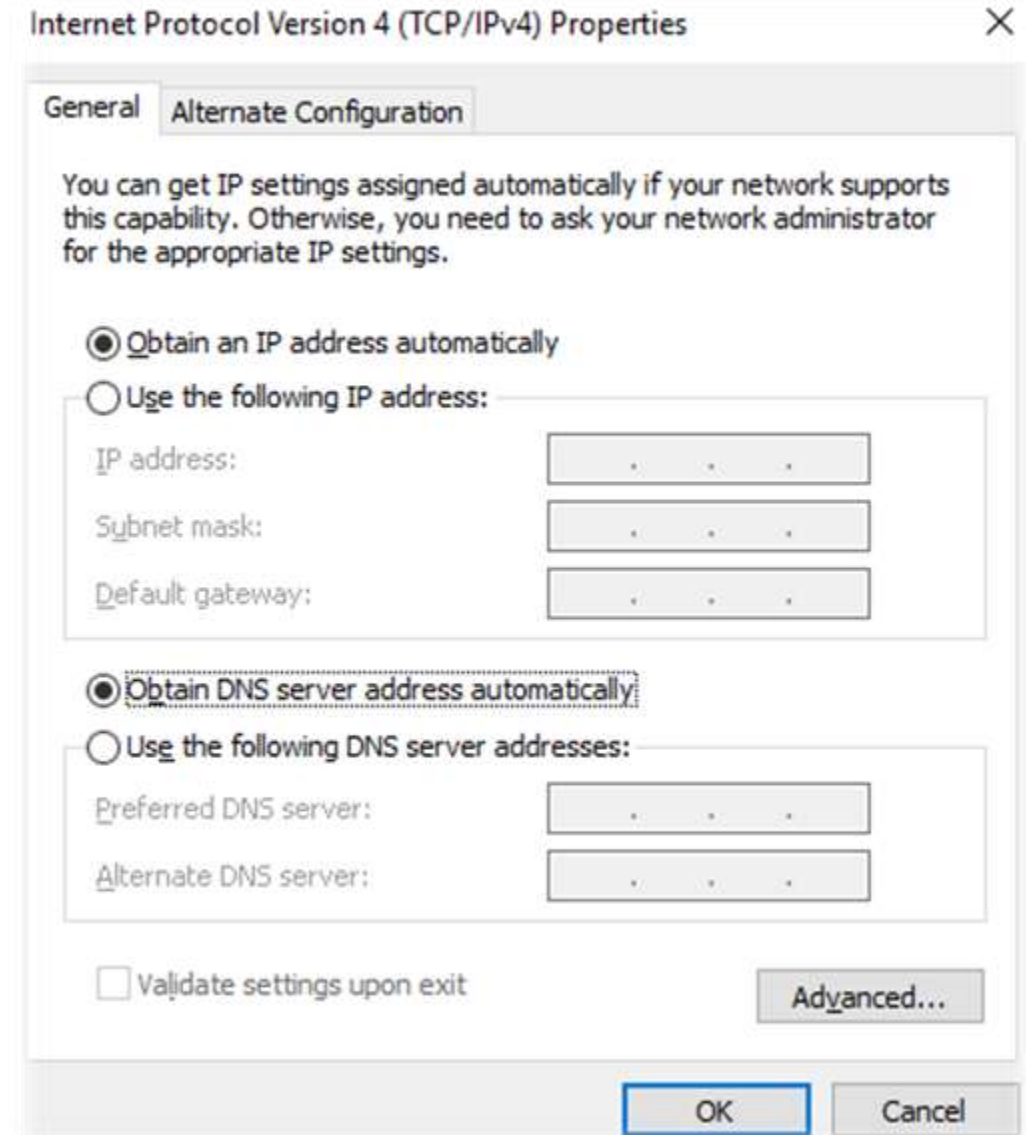
Used:

- To define IP address range.
- In DHCP Server and Point to Point Server.
- To group IP address for further usage.

Activity

Pre-requisite:

- IPv4 for the devices should be set to obtain an IP address automatically.
- For MikroTik Devices DHCP Client should be enabled.



DHCP Server Lease

	Address	MAC Address	Client ID	Server	Active Address	Activ... /	Statu
	10.5.50.143	10:78:D2:D4:F0:32	1:10:78:d...	dhcp_comp	10.5.50.143	HS4	boun
	10.5.50.22	10:78:D2:D4:F1:DF	1:10:78:d...	dhcp_comp	10.5.50.22	HS5	boun
	10.5.50.37	10:78:D2:D4:EF:02	1:10:78:d...	dhcp_comp	10.5.50.37	HS6	boun
	10.5.50.44	10:78:D2:D4:C4:44	1:10:78:d...	dhcp_comp	10.5.50.44	HS7	boun
	10.5.50.147	FA:DC:FE:FE:EB:69	1fa:dcfe...	dhcp_comp		HS8	waitir
	10.5.50.36	AA:DC:FE:FE:EB:...	1:aa:dc:f...	dhcp_comp		HS8	waitir
D	10.5.50.48	AA:DC:FE:FE:EF:69	1:aa:dc:f...	dhcp_comp	10.5.50.48	HS8	boun
D	10.5.50.52	74:C0:FB:CB:F4:CE	1:74:c0f...	dhcp_comp	10.5.50.52	HS9	boun
	10.5.50.29	10:78:D2:D5:3E:E4	1:10:78:d...	dhcp_comp	10.5.50.29	HS10	boun
	10.5.50.35	10:78:D2:D4:EE:AE	1:10:78:d...	dhcp_comp	10.5.50.35	HS11	boun
D	10.5.50.40	10:78:D2:D5:3F:08	1:10:78:d...	dhcp_comp	10.5.50.40	HS12	boun
	10.5.50.42	10:78:D2:D5:3E:9C	1:10:78:d...	dhcp_comp	10.5.50.42	HS14	boun
D	10.5.50.27	10:78:D2:D4:C2:97	1:10:78:d...	dhcp_comp	10.5.50.27	HS15	boun
	10.5.50.45	10:78:D2:D4:C5:DF	1:10:78:d...	dhcp_comp	10.5.50.45	HS16	boun
B	10.5.50.33	10:FF:2F:CF:FF:7F	1:10:ff:2f:...	dhcp_comp		HS17	waitir
B	0.0.0.0	10:FF:2F:CF:FF:77	1:10:ff:2f:...	dhcp_comp		HS17	waitir

□ DHCP server lease submenu is used to monitor and manage server's leases.

Sub-menu: `/ip dhcp-server lease`

DHCP Leases

The screenshot displays the Mikrotik WinBox interface. On the left, the 'IP' menu is highlighted with a red box. A red arrow points from 'IP' to 'DHCP Server', which is also highlighted. Another red arrow points from 'DHCP Server' to the 'Leases' tab in the main window. The 'Leases' tab shows a table with the following data:

	Address	MAC Address
D	192.168.100.	1C:83:41:0A:89:A0

A dialog box titled 'DHCP Lease <192.168.100.200,192.168.100.200>' is open, showing the following details:

- General | Active
- Address: 192.168.100.200
- MAC Address: 1C:83:41:0A:89:A0
- Client ID: 1:1c:83:41:a:89:a0
- Server: dhcp1

Buttons on the right side of the dialog include OK, Copy, Remove, Make Static, and Check Status.

DHCP Leases: How to Make Static?

Double click on any dynamically assigned IP to view the DHCP Lease options.

1

The screenshot shows the DHCP Server console with the 'Leases' tab selected. A table of leases is visible, with one entry highlighted in blue and a red box around it. A red circle with the number '1' is placed to the left of this entry. To the right, the 'DHCP Lease <192.168.100.200,192.168.100.200>' configuration window is open, showing fields for Address, MAC Address, Client ID, and Server, along with buttons for 'Make Static', 'Check Status', 'Copy', 'Remove', and 'OK'.

	Address	MAC Address
D	192.168.100.200	1C:83:41:0A:89:A0

DHCP Lease <192.168.100.200,192.168.100.200>

General Active

Address: 192.168.100.200

MAC Address: 1C:83:41:0A:89:A0

Client ID: 1:1c:83:41:a:89:a0

Server: dhcp1

OK

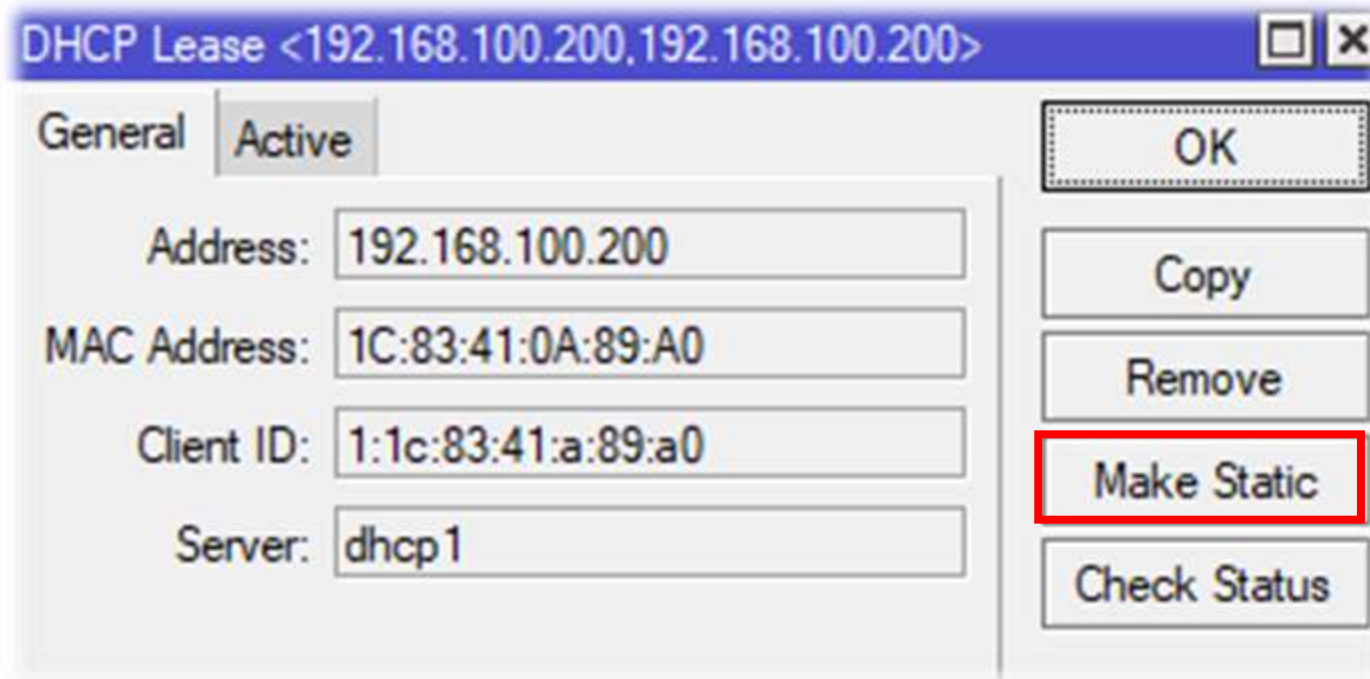
Copy

Remove

Make Static

Check Status

DHCP Leases: How to Make Static?



2

Click Make Static.

Close the DHCP Lease window and re-open it again.

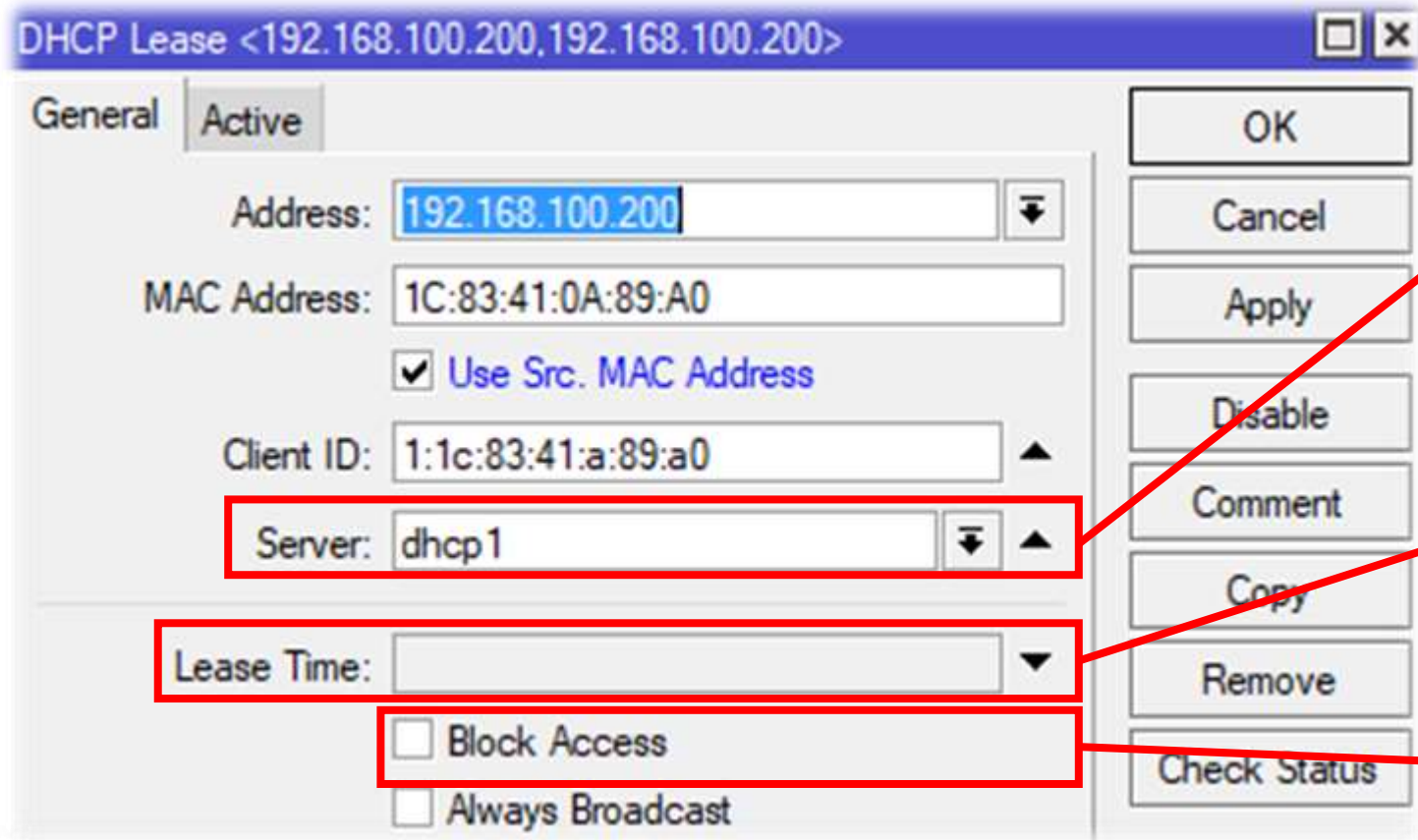
DHCP Leases: Static

The screenshot shows a window titled "DHCP Lease <192.168.100.200,192.168.100.200>". It has two tabs: "General" and "Active". The "Active" tab is selected. The "Address" field is highlighted with a red box and contains "192.168.100.200". Below it, the "MAC Address" field contains "1C:83:41:0A:89:A0". A checkbox labeled "Use Src. MAC Address" is checked and also highlighted with a red box. Other fields include "Client ID" (1:1c:83:41:a:89:a0), "Server" (dhcp1), and "Lease Time". There are also checkboxes for "Block Access" and "Always Broadcast". On the right side, there are buttons: "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", "Remove", and "Check Status".

3 Type the IP address that will be assigned to the client.

4 Tick the box of Use Src. MAC Address to bind the IP to the MAC Address

DHCP Leases



5 Server name which serves this client

6 Time that the client may use the address

7 Block access for this client

DHCP Leases

DHCP Options: Static Route 1

DHCP Option Set: Set A

Rate Limit: 512k/1M

Insert Queue Before: first

Address List: Laboratory

enabled | radius | blocked | bc

8

Upload/Download Limit

DHCP Leases: Rate Limit

#	Name	Target
9	WP - FACULTY	10.10.7.0/
10	WP - LAB	10.10.1.0/
11	WP - LAB NEW	10.5.50.0/
12	WP - LOCAL	192.168.1.0/
14	WP - STUDENT	10.10.2.0/
15	WP - SYSTEM	10.10.0.0/
0 D	dhcp<AA:DC:FE:FE:EF:69/1:aa:dc:fe:fe:ef:69/dhcp_comp>	10.5.50.48

40 items (1 selected) | 0 B queued | 0 packets queued

Simple Queue <dhcp<AA:DC:FE:FE:EF:69/1:aa:dc:fe:fe:ef:69/dhcp_comp>>

General | Advanced | Statistics | Traffic | Total | Total Statistics

Name: dhcp<AA:DC:FE:FE:EF:69/1:aa:dc:fe:fe:ef:69/dhcp_comp>

Target: 10.5.50.48

Dst.:

Target Upload: 512k | Target Download: 2M

Max Limit: 512k | 2M

Burst: unlimited | unlimited

Burst Limit: unlimited | unlimited

Burst Threshold: unlimited | unlimited

Burst Time: 0 | 0

Time:

OK | Copy | Remove | Reset Counters | Reset All Counters | Torch

□ It will be automatically be added on the Queue List

DHCP Leases: Address List

- Type a name/group where the client device will be assigned.

DHCP Lease <10.5.50.48,10.5.50.48>

General Active

Address: 10.5.50.48

MAC Address: AA:DC:FE:FE:EF:69

Use Src. MAC Address

Client ID: 1:aa:dc:fe:fe:ef:69

Server: dhcp_comp

Lease Time: []

Block Access

Always Broadcast

DHCP Options: []

DHCP Option Set: []

Rate Limit: 512k/2M

Insert Queue Before: first

Address List: Computer Lab

OK

Cancel

Apply

Disable

Comment

Copy

Remove

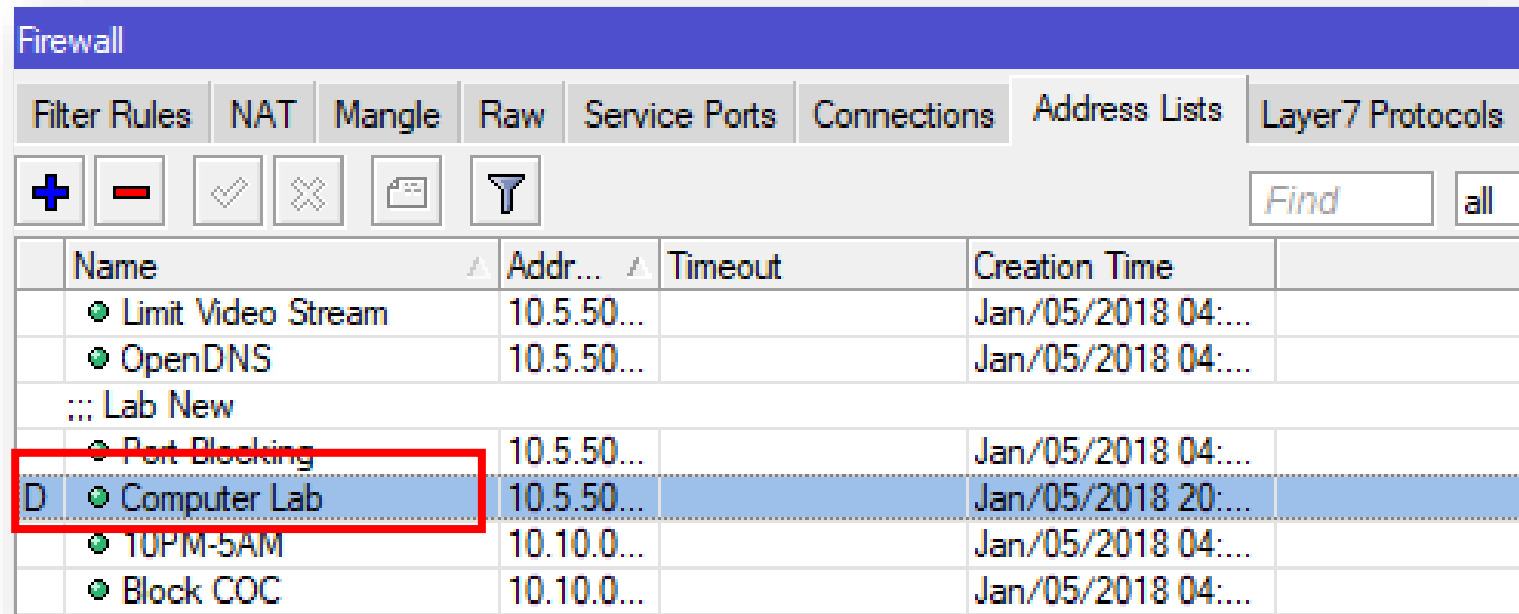
Check Status

enabled radius blocked bound

8

DHCP Leases: Address List

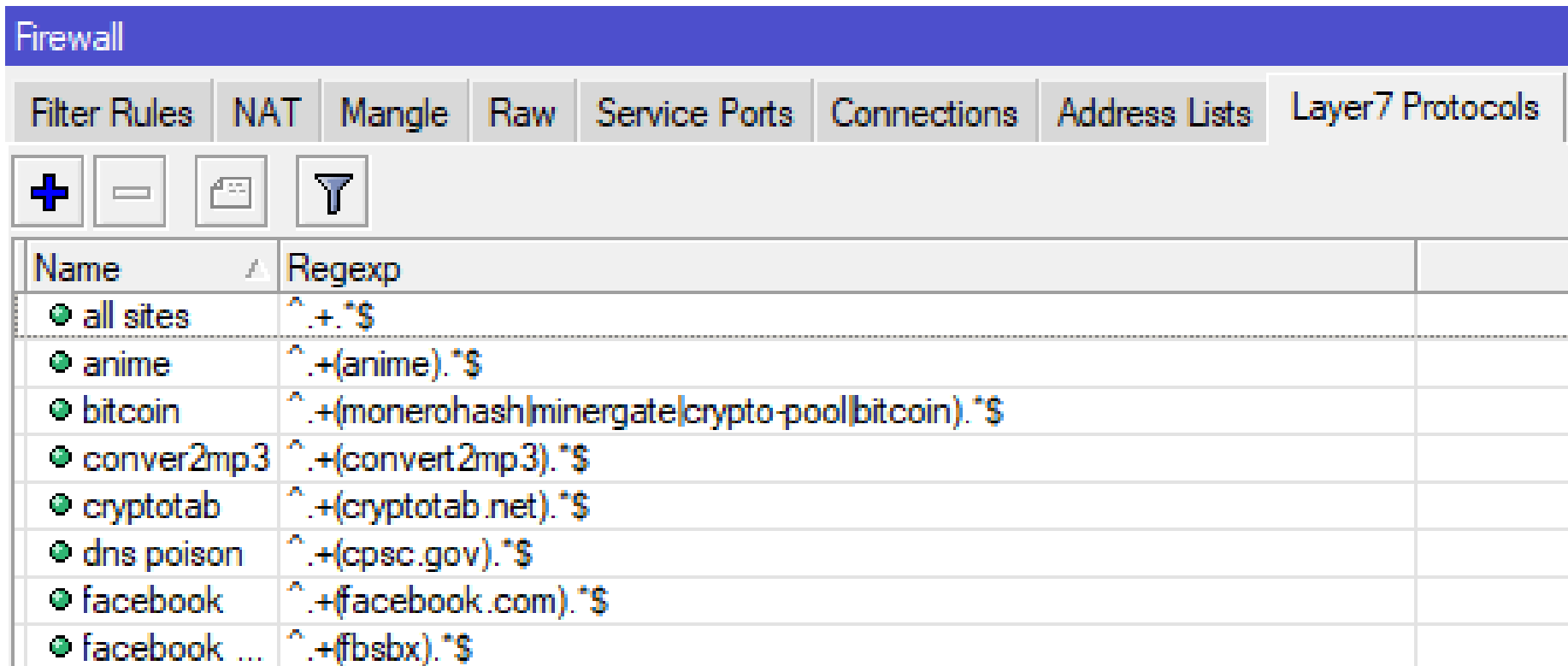
- ❑ It will automatically be added in the Address list which can be used in creating filter rules.



The screenshot shows the Mikrotik WinBox Firewall configuration interface, specifically the 'Address Lists' tab. The interface includes a toolbar with icons for adding (+), deleting (-), enabling (checkmark), disabling (X), saving (floppy), and filtering (funnel), along with a search box labeled 'Find' and a dropdown menu set to 'all'. Below the toolbar is a table listing address lists. The table has columns for Name, Address, Timeout, and Creation Time. The entry 'D Computer Lab' is highlighted in blue and enclosed in a red rectangular box. Other entries include 'Limit Video Stream', 'OpenDNS', 'Port Blocking', 'TOPM-5AM', and 'Block COC'.

Name	Addr...	Timeout	Creation Time
Limit Video Stream	10.5.50...		Jan/05/2018 04:...
OpenDNS	10.5.50...		Jan/05/2018 04:...
::: Lab New			
Port Blocking	10.5.50...		Jan/05/2018 04:...
D Computer Lab	10.5.50...		Jan/05/2018 20:...
TOPM-5AM	10.10.0...		Jan/05/2018 04:...
Block COC	10.10.0...		Jan/05/2018 04:...

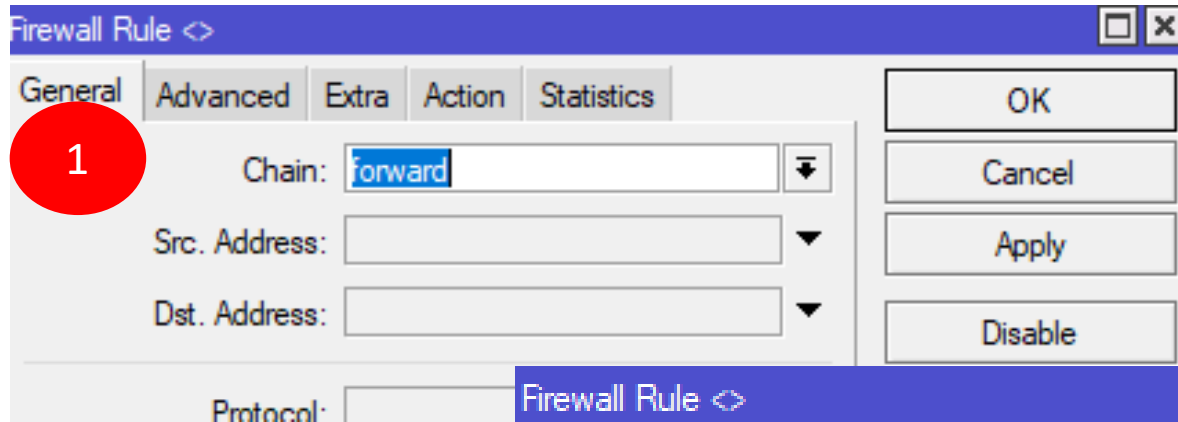
DHCP Leases: Address List



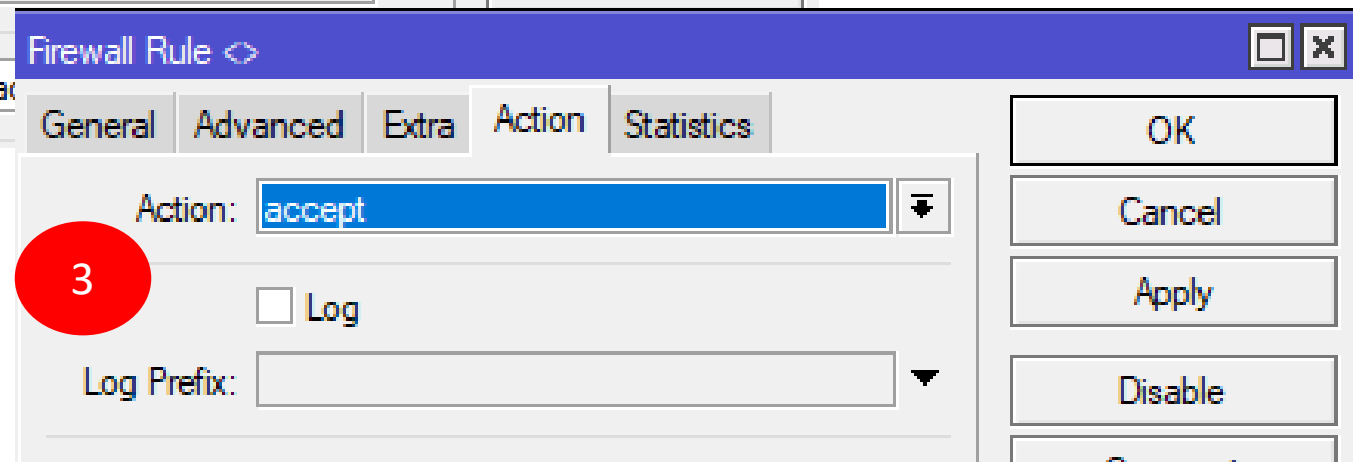
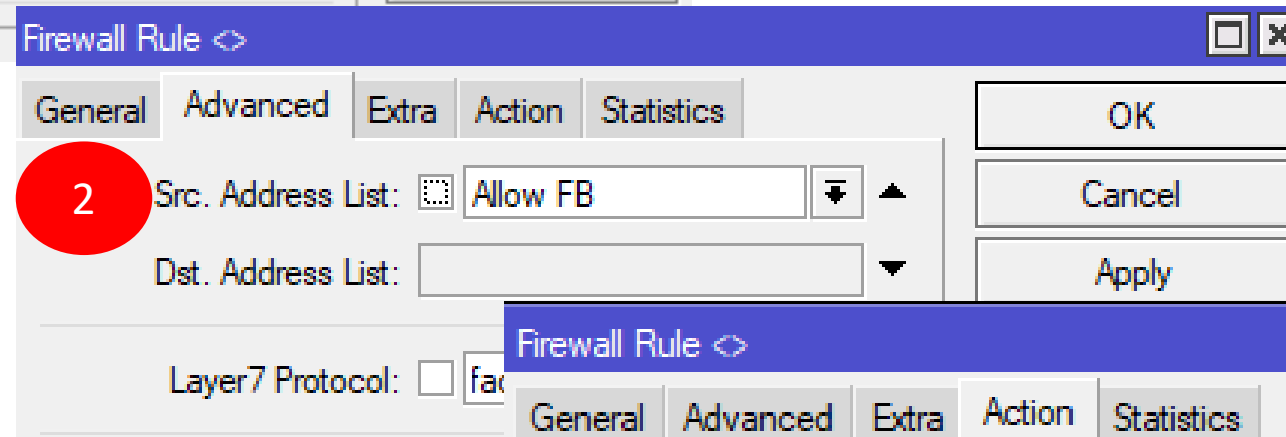
The screenshot shows the Mikrotik WinBox interface for configuring Firewall Address Lists. The 'Address Lists' tab is selected. Below the navigation tabs, there are icons for adding (+), deleting (-), and filtering. The main table lists several address lists with their names and corresponding regular expressions.

Name	Regexp
all sites	^.*\$
anime	^.*(anime).*\$
bitcoin	^.*(monerohash minergate crypto-pool bitcoin).*\$
conver2mp3	^.*(convert2mp3).*\$
cryptotab	^.*(cryptotab.net).*\$
dns poison	^.*(cpsc.gov).*\$
facebook	^.*(facebook.com).*\$
facebook ...	^.*(fbsbx).*\$

Create a Layer 7 Protocol



❑ Create an Accept or Drop Filter Rule



SCRIPT: Extracting Leases

- ❑ This script will help you extract the necessary information from the lease that you want to include in your CSV file.

```
/ip dhcp-server lease
:foreach i in=[find] do={
:put ([get $i address].",", "[get $i mac-address].",", "[get $i client-id].",", "[get $i server])
}
```



BIG THANKS to **skot** for this
post contribution @ Mikrotik Forum


SCRIPT: Extracting Leases

```
@SCT RB1100AHx2 Main Router] /ip dhcp-server lease> :foreach i in=[find] do={ :put {[get $i  
active-address      address-lists      blocked          disabled          last-seen        server  
active-client-id    agent-circuit-id  client-id        dynamic           lease-time       src-mac-address  
active-mac-address  agent-remote-id   comment          expires-after     mac-address      status  
active-server       always-broadcast  dhcp-option      host-name         radius           use-src-mac  
address             block-access      dhcp-option-set  insert-queue-before rate-limit       value-name
```

/ip dhcp-server lease>

:foreach I in=[find] do=(:put {[get \$i



Note: Typing this script and pressing  will show the available options that you may include in the command.

SCRIPT: Extracting Leases

- ❑ Here is the script if we want to extract the list of block-access client with client-id and dhcp-server included

```
:foreach i in=[find] do={ :put ([get $i block-access].",",".[get $i  
client-id].",",".[get $i server]) }
```

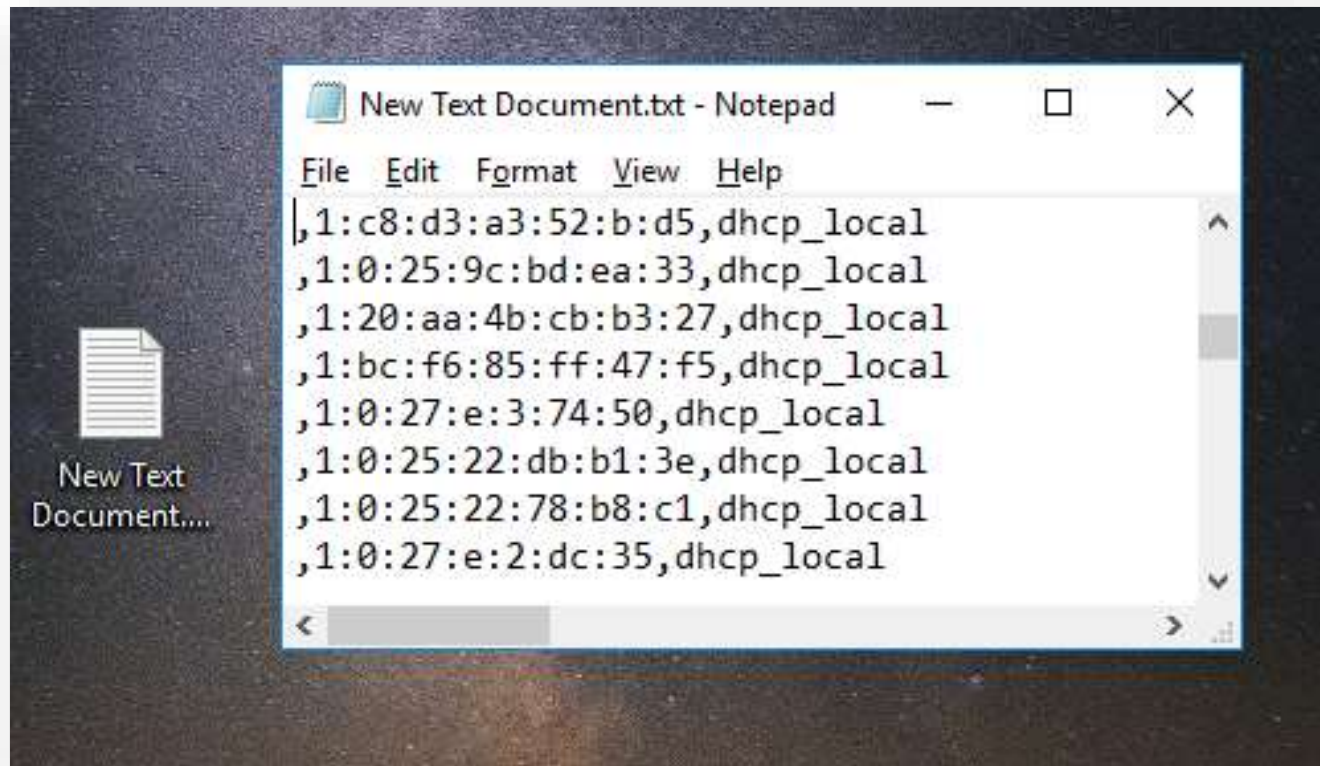
SCRIPT: Extracting Leases

```
[siena@SCT RB1100AHx2 Main Router] /ip dhcp-server lease  
,1:78:54:2e:a1:ca:7f,dhcp_local  
,1:c8:d3:a3:52:b:d5,dhcp_local  
,1:0:25:9c:bd:ea:33,dhcp_local  
,1:20:aa:4b:cb:b3:27,dhcp_local  
,1:bc:f6:85:ff:47:f5,dhcp_local  
,1:0:27:e:3:74:50,dhcp_local  
,1:0:25:22:db:b1:3e,dhcp_local  
,1:0:25:22:78:b8:c1,dhcp_local  
,1:0:27:e:2:dc:35,dhcp_local  
,1:54:be:f7:8:69:9e,dhcp_local  
,1:bc:5f:f4:36:47:6,dhcp_local
```

- Highlight the extracted information and copy paste it in a text file in your desktop.


```
,1:f0:3:8c:26:a1:63,dhcp_faculty  
,1:cc:b0:da:8e:9:93,dhcp_faculty  
,1:78:fd:94:bb:8d:39,dhcp_library  
,1:0:26:82:10:b6:59,dhcp_local  
,,dhcp_ceit  
,1:c:d2:92:73:f7:21,dhcp_library  
,1:40:b8:37:c1:f2:b2,dhcp_faculty  
,1:c:8f:ff:83:b8:1c,dhcp_faculty  
,1:40:b8:37:c1:f2:b2,dhcp_local  
,1:b8:86:87:db:51:f3,dhcp_ceit  
,1:c8:38:70:83:86:15,dhcp_library  
,,dhcp_local  
,1:f8:d0:bd:1:68:3e,dhcp_local  
,,dhcp_faculty
```

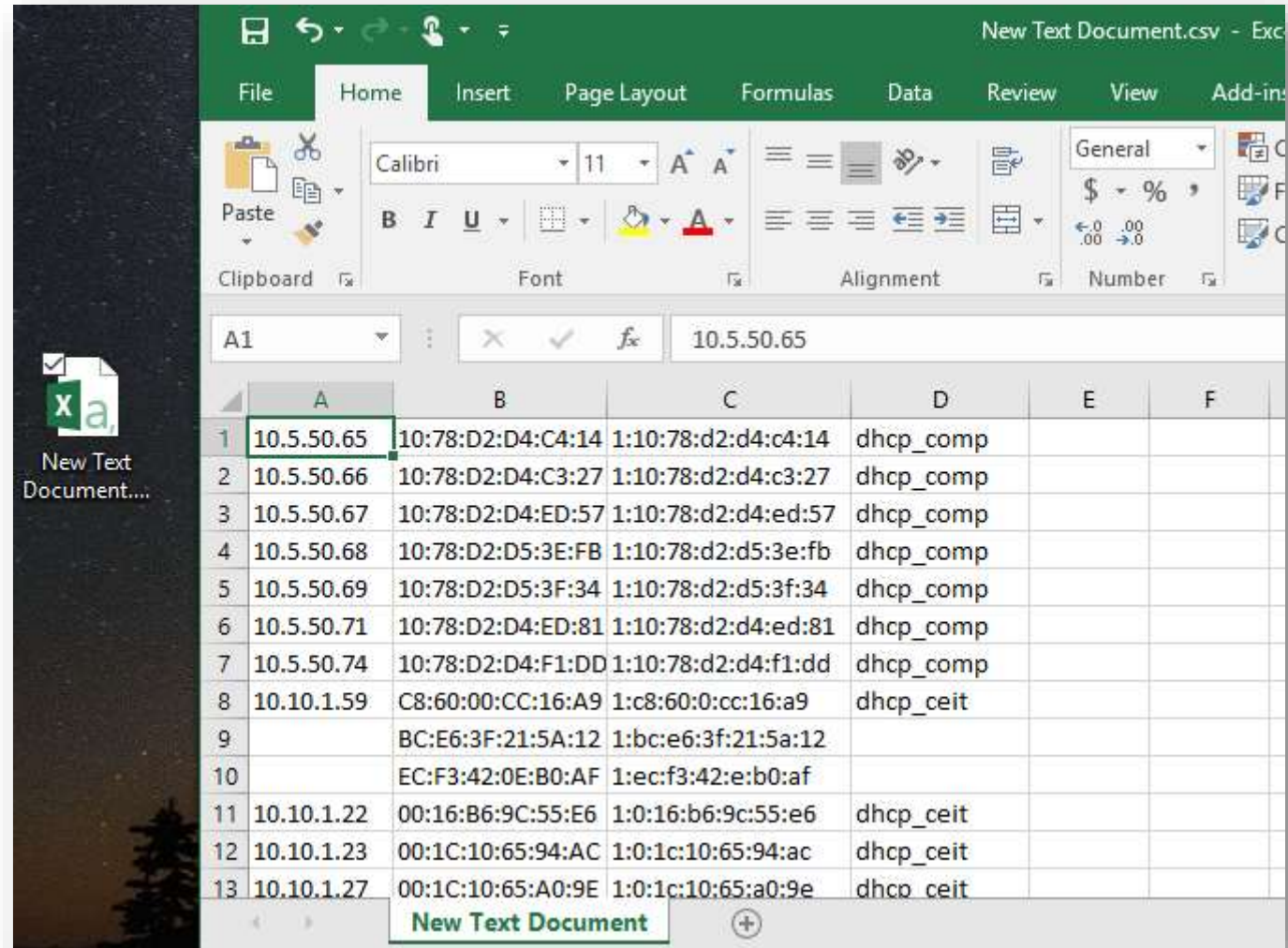
SCRIPT: Extracting Leases



- ❑ Create a text file in your desktop.
- ❑ Copy paste the extracted fields from the terminal.

SCRIPT: Extracting Leases

- ❑ Change the Extension Name of the Text File to CSV File
- ❑ Open the CSV file.
- ❑ You successfully extracted the list in your desktop 



	A	B	C	D	E	F
1	10.5.50.65	10:78:D2:D4:C4:14	1:10:78:d2:d4:c4:14	dhcp_comp		
2	10.5.50.66	10:78:D2:D4:C3:27	1:10:78:d2:d4:c3:27	dhcp_comp		
3	10.5.50.67	10:78:D2:D4:ED:57	1:10:78:d2:d4:ed:57	dhcp_comp		
4	10.5.50.68	10:78:D2:D5:3E:FB	1:10:78:d2:d5:3e:fb	dhcp_comp		
5	10.5.50.69	10:78:D2:D5:3F:34	1:10:78:d2:d5:3f:34	dhcp_comp		
6	10.5.50.71	10:78:D2:D4:ED:81	1:10:78:d2:d4:ed:81	dhcp_comp		
7	10.5.50.74	10:78:D2:D4:F1:DD	1:10:78:d2:d4:f1:dd	dhcp_comp		
8	10.10.1.59	C8:60:00:CC:16:A9	1:c8:60:0:cc:16:a9	dhcp_ceit		
9		BC:E6:3F:21:5A:12	1:bc:e6:3f:21:5a:12			
10		EC:F3:42:0E:B0:AF	1:ec:f3:42:e:b0:af			
11	10.10.1.22	00:16:B6:9C:55:E6	1:0:16:b6:9c:55:e6	dhcp_ceit		
12	10.10.1.23	00:1C:10:65:94:AC	1:0:1c:10:65:94:ac	dhcp_ceit		
13	10.10.1.27	00:1C:10:65:A0:9E	1:0:1c:10:65:a0:9e	dhco_ceit		

Special Thanks to the Following:

MUM Vietnam
Nice People
Nice Country



Special Thanks to the Following:

To God Almighty and
my Family for
Supporting me with all
of my activities.

MikroTik



Special Thanks to the Following:



Special Thanks to the Following:



To all my classmates in Train
the Trainer Thailand 2018.
To the Smaller and Bigger
Group

MikroTik



Thank You!

Let's be friends:

+639053529751 | norberto.inlayoiii@sct.edu.ph

The MikroTik logo features the word "MikroTik" in a bold, italicized sans-serif font. A stylized white arc is positioned above the letter "i" in "Mikro".