Using MikroTik DHCP Server for Network Management

Engr. Norberto F. Inlayo III

MUM VIETNAM 2019

BULLET

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Mikrotik Academy Trainer | Siena College of Taytay

Philippines

MikroTik ACADEMY

Siena College of Taytay

About MikroTik Academy

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

Philippines
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

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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:

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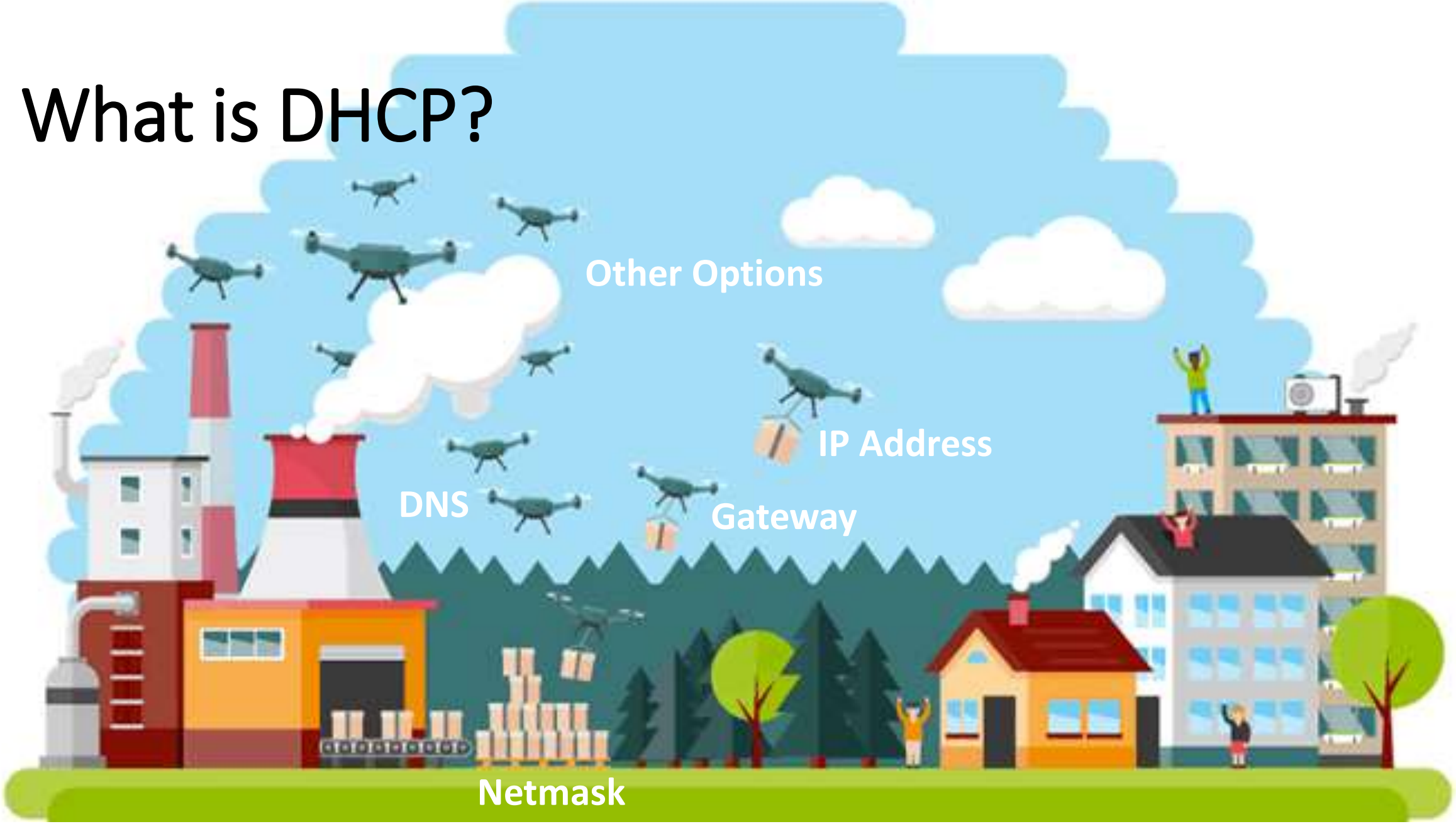
What is DHCP?



What is DHCP?

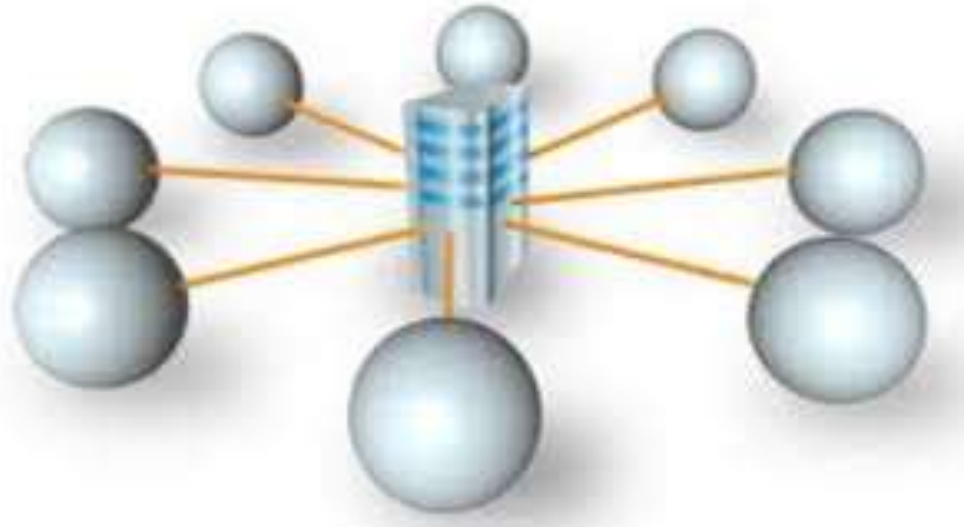
Dynamic Host Configuration Protocol:

- ❑For easy distribution of IP in a network
- ❑IP Assignment
- ❑Obtaining IP Settings/Options
- ❑Client-Server Protocol

Must only be used in TRUSTED Networks!

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: 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

DHCP Servers

DHCP: Offer

DHCP Server Addr:port
<192.168.100.1:67>

CLIENT

<DHCP Server: Src MAC Addr>
<Broadcast>

SERVER

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>

Dst IP addr:port
<192.168.100.1:67>

SERVER

DHCP: ACK

The DHCP server that the client responds to acknowledges the client

CLIENT

DHCP Server Addr:port
<192.168.100.1:67>

<DHCP Server: Src MAC Addr>
<Broadcast>

Dst IP addr:port
<255.255.255.255:68>

SERVER

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

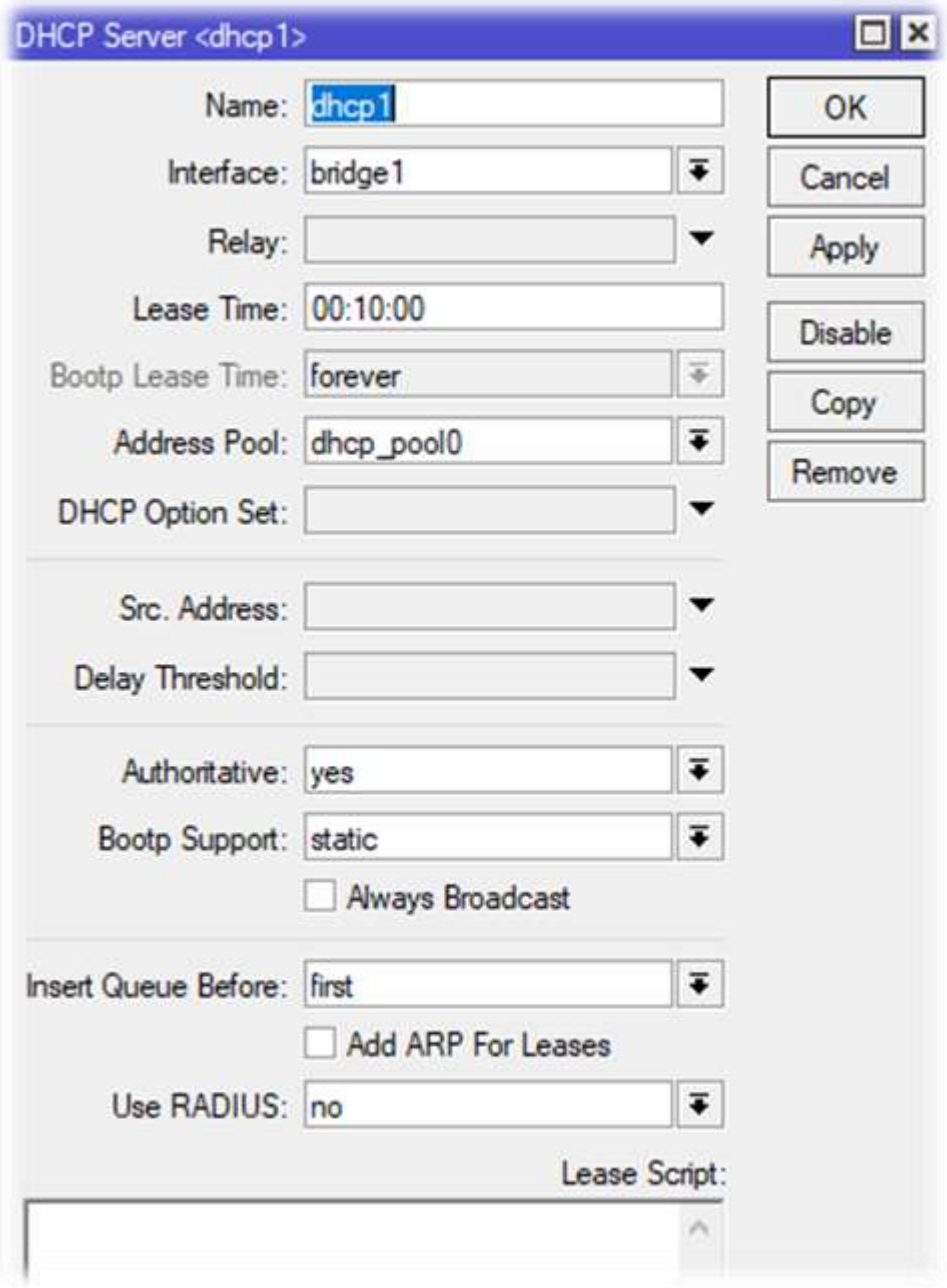
- ❑ DHCP Server
- ❑ DHCP Network
- ❖ DHCP Lease

For this presentation we focus on DHCP Lease Submenu

DHCP Server

Can Assign/Modify:

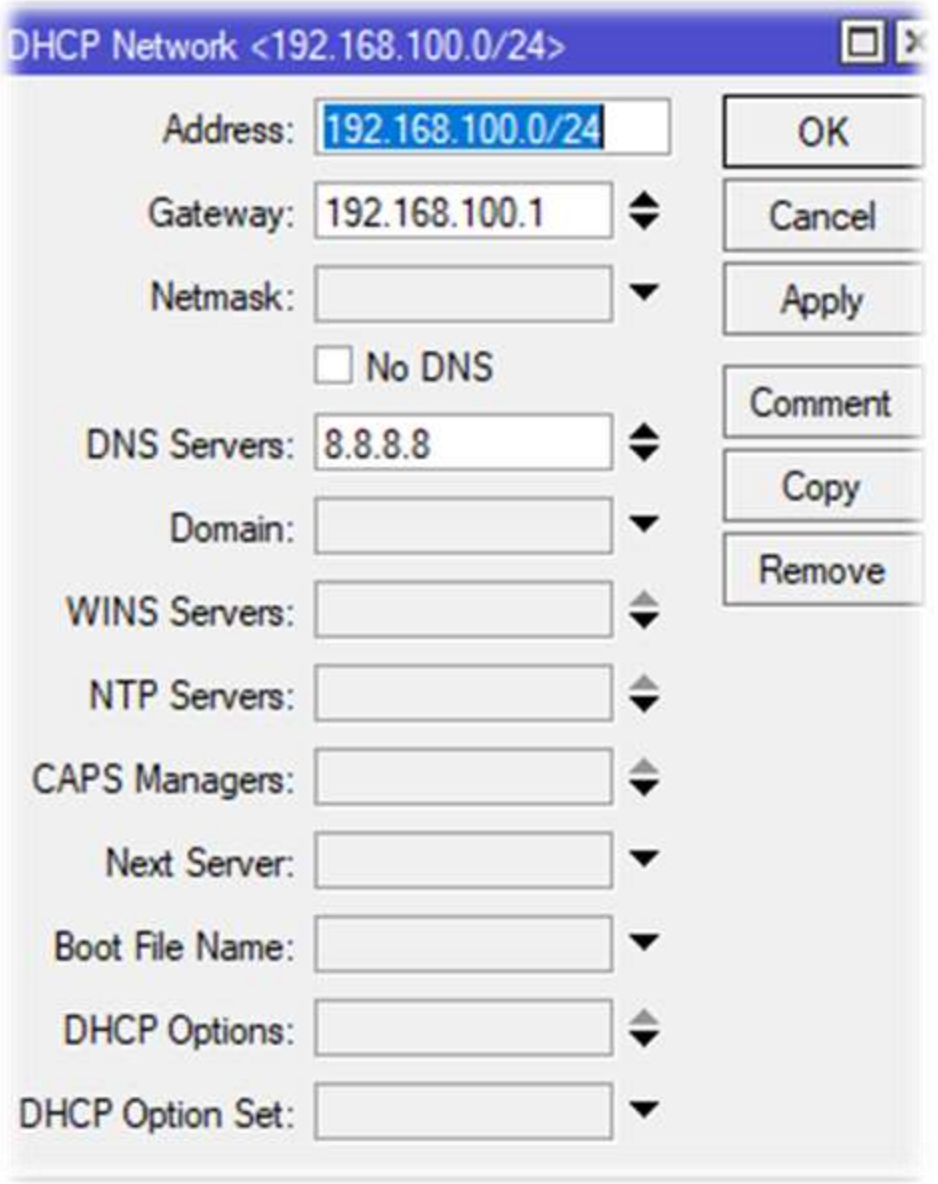
- Name
- Interface
- Add Relay
- Lease Time
- Address Pool
- DHCP Option Set
- Src. Address
- Delay Threshold
- Authoritative
- Bootp Support
- Always Broadcast
- Insert Queue
- Add ARP for Leases
- Use Radius
- Lease Script



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 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.

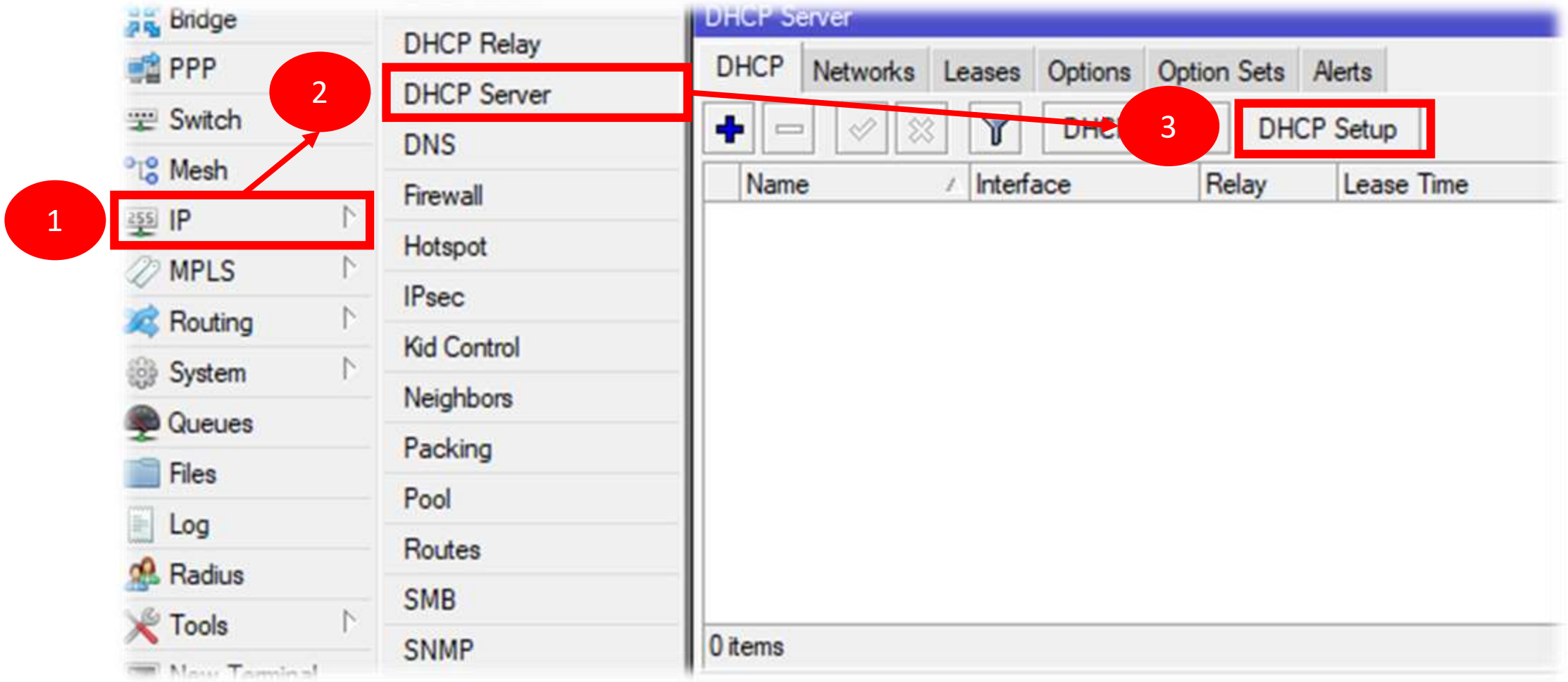
Activity Pre-requisite:

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

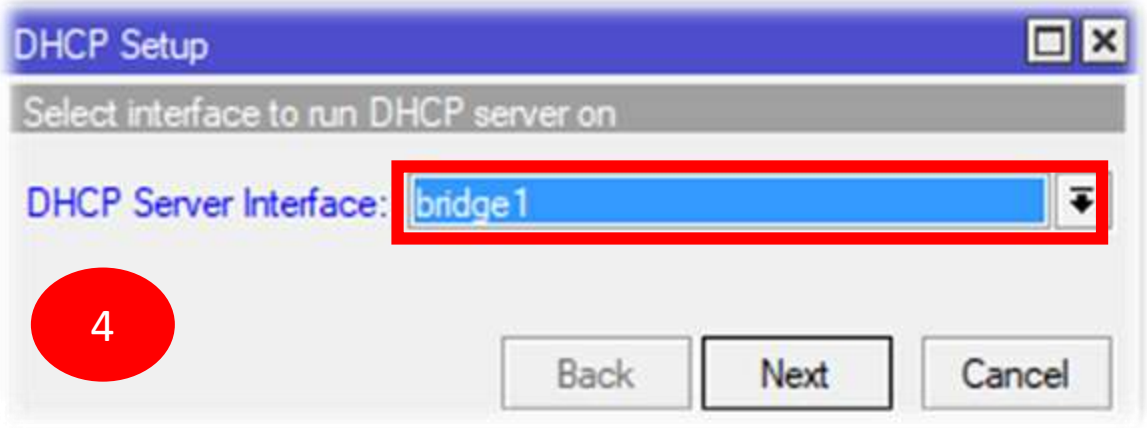
Note: Devices with manually configured IP cannot be probed in the DHCP lease.

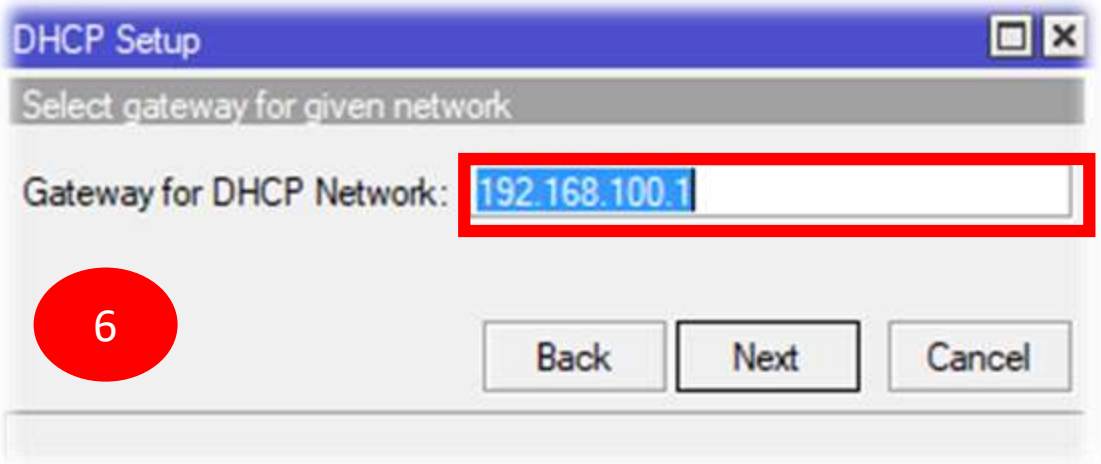
DHCP Configuration: Wizard Setup

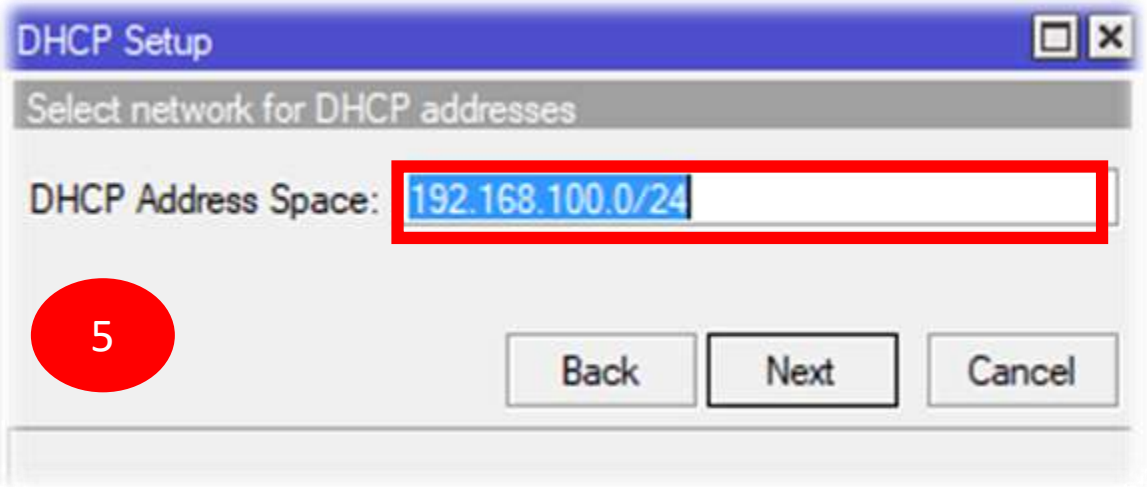
DHCP Server – Setup Wizard

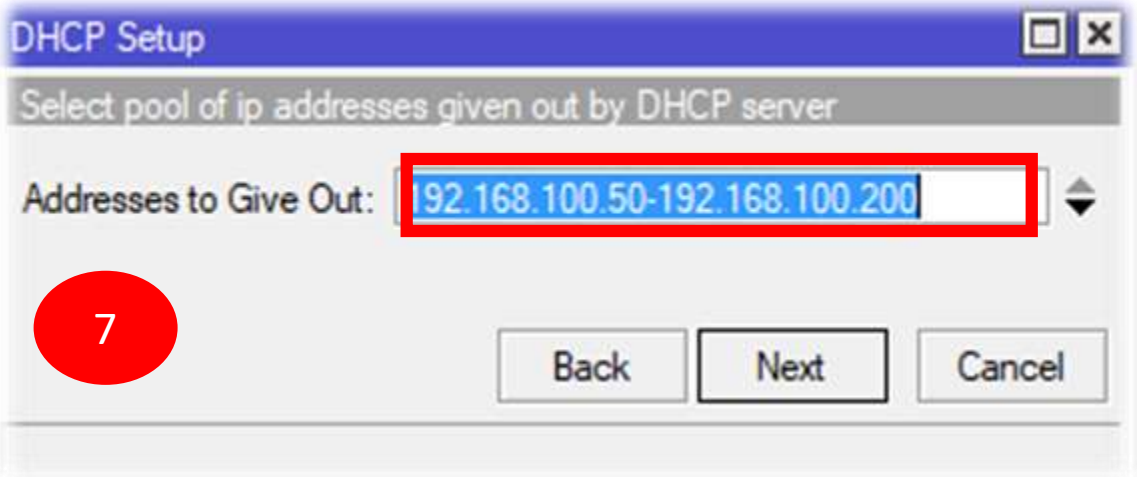


DHCP Server – Setup Wizard

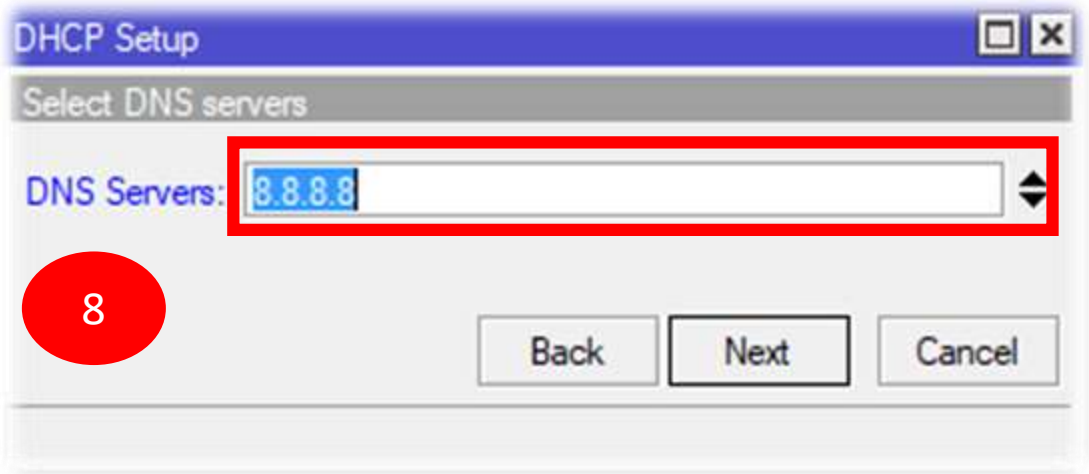


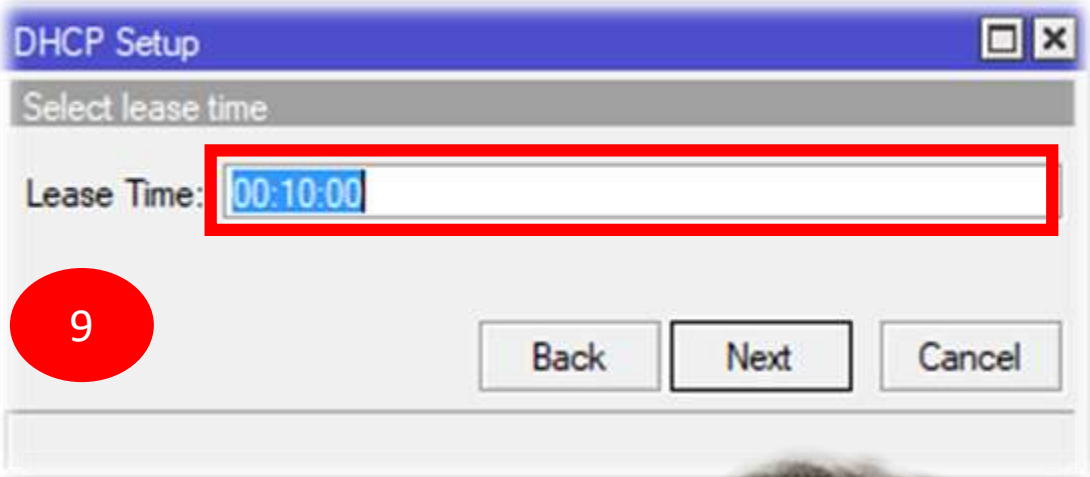






DHCP Server – Setup Wizard

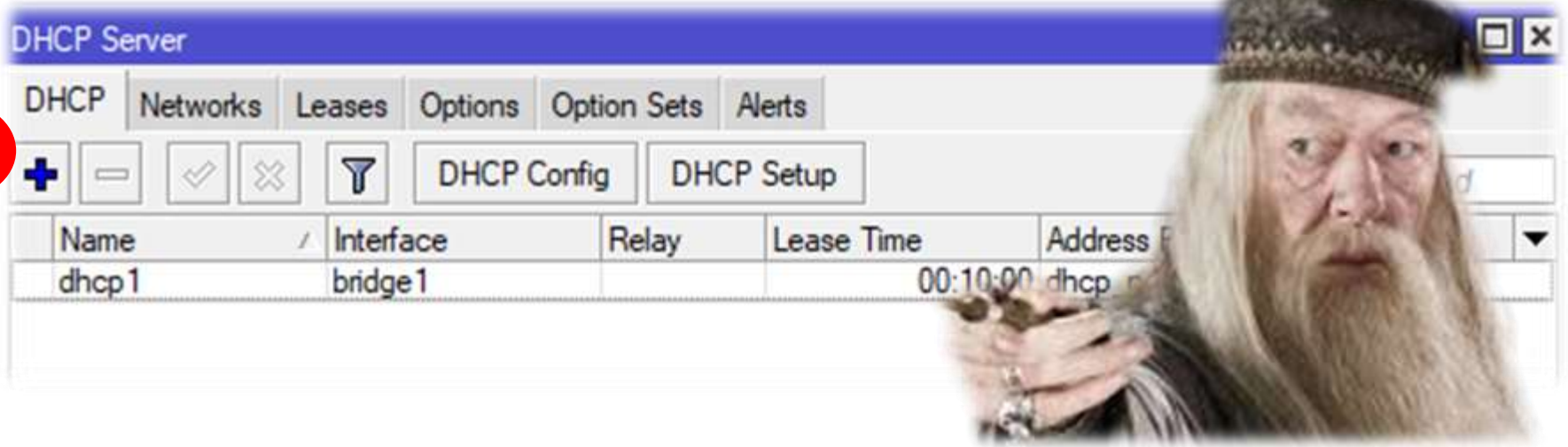




Congrats!

You have setup a DHCP Server.

10



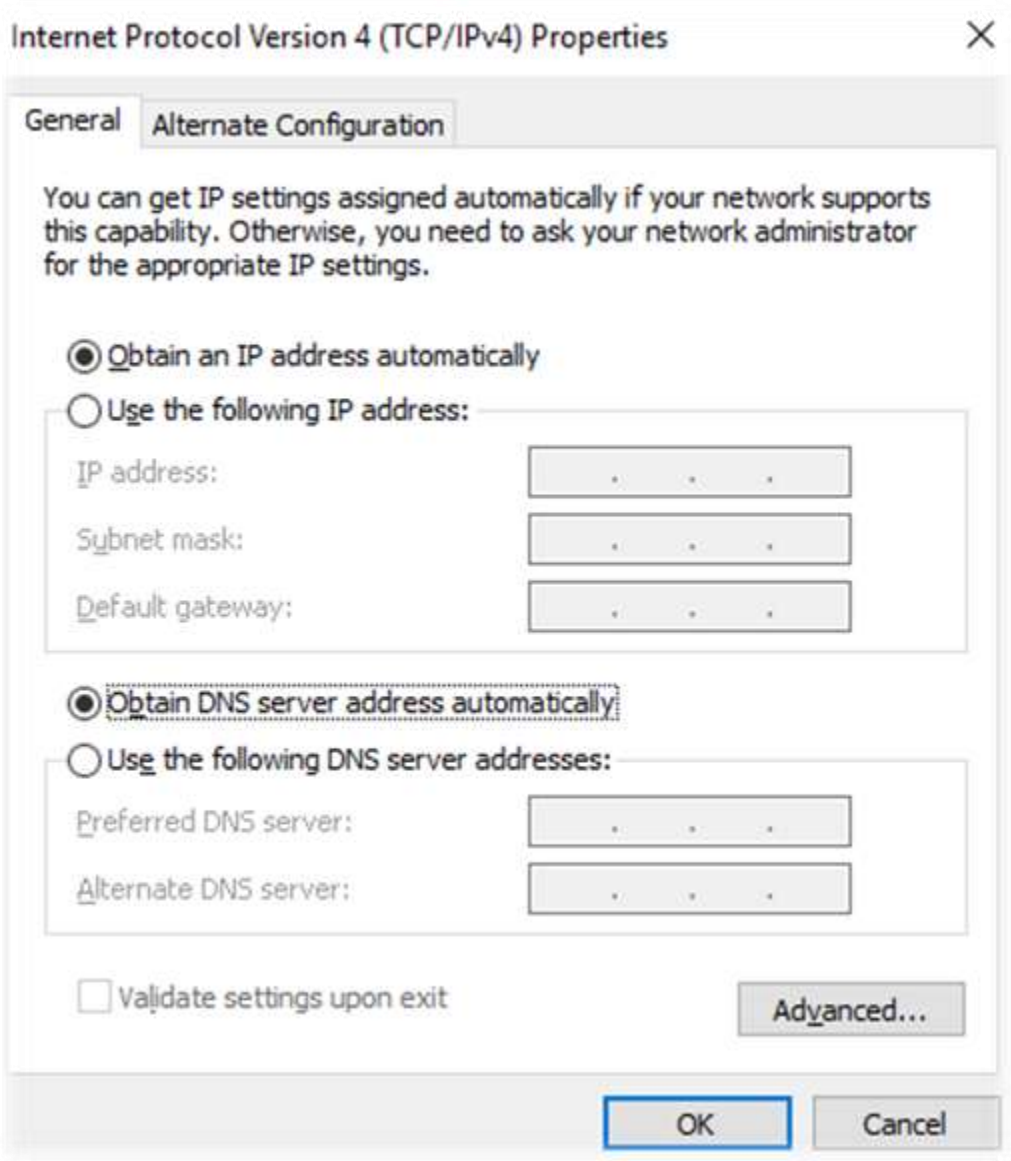
IP Address Pool

Used:

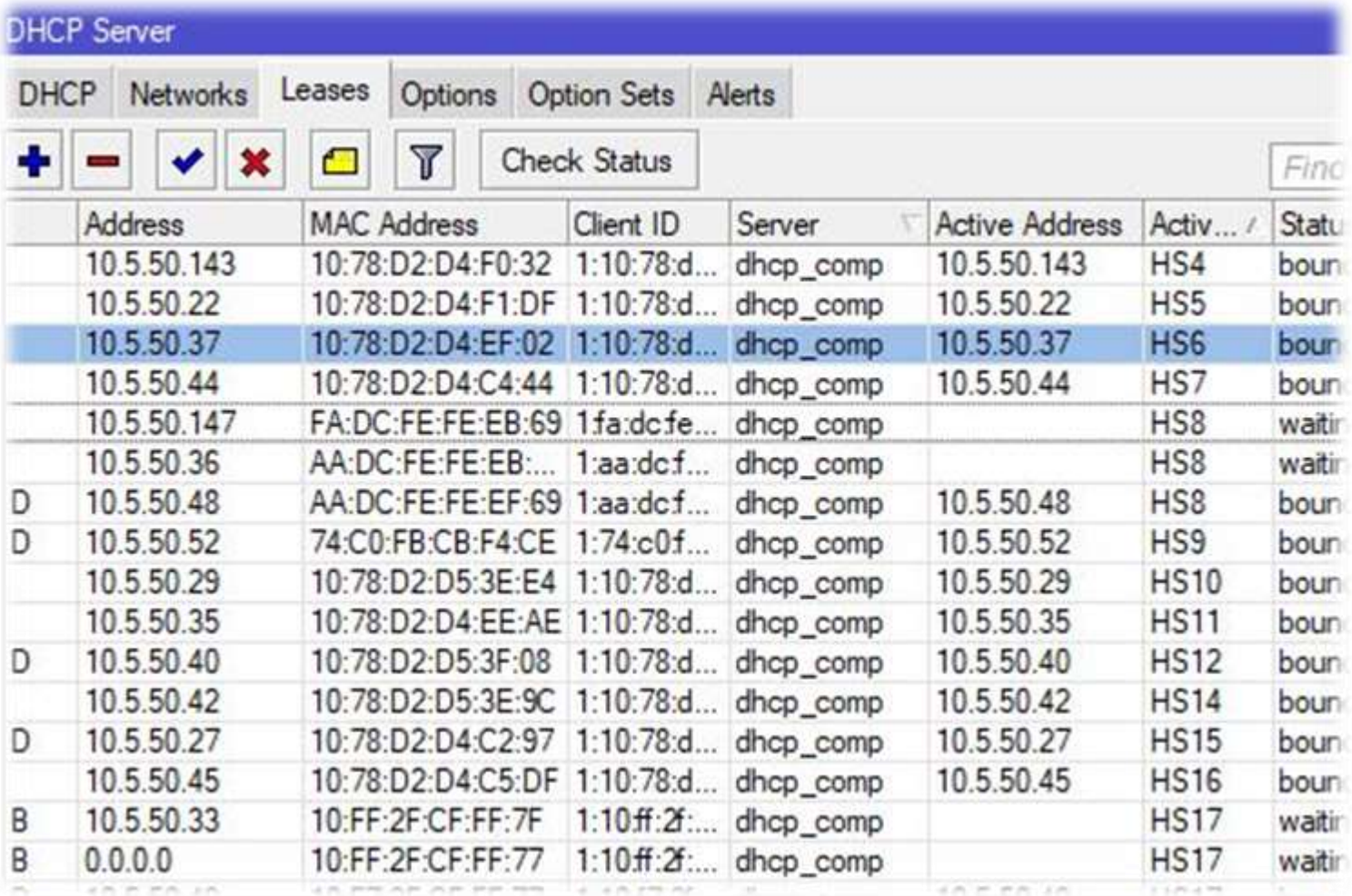
- To define IP address range.
- In DHCP Server and Point to Point Server.
- To group IP address for further usage.

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

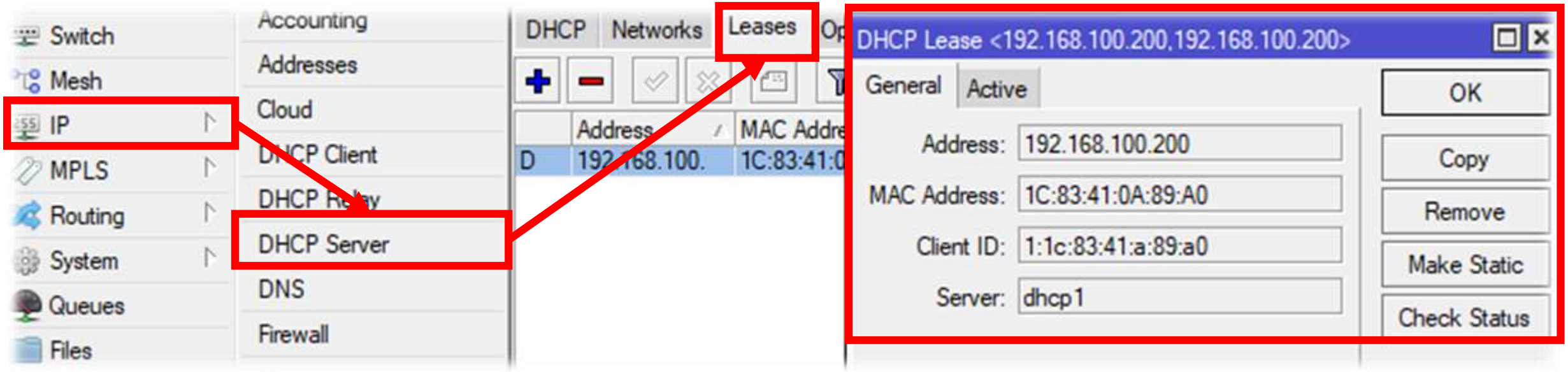


	Address	MAC Address	Client ID	Server	Active Address	Activ...	Statu
	10.5.50.143	10:78:D2:D4:F0:32	1:10:78:d...	dhcp_comp	10.5.50.143	HS4	boun
	10.5.50.22	10:78:D2:D4:F1:DF	1:10:78:d...	dhcp_comp	10.5.50.22	HS5	boun
	10.5.50.37	10:78:D2:D4:EF:02	1:10:78:d...	dhcp_comp	10.5.50.37	HS6	boun
	10.5.50.44	10:78:D2:D4:C4:44	1:10:78:d...	dhcp_comp	10.5.50.44	HS7	boun
	10.5.50.147	FA:DC:FE:FE:EB:69	1:fa:dc:fe...	dhcp_comp		HS8	waiti
	10.5.50.36	AA:DC:FE:FE:EB:...	1:aa:dc:f...	dhcp_comp		HS8	waiti
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:c0:f...	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	waiti
B	0.0.0.0	10:FF:2F:CF:FF:77	1:10:ff:2f:...	dhcp_comp		HS17	waiti

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

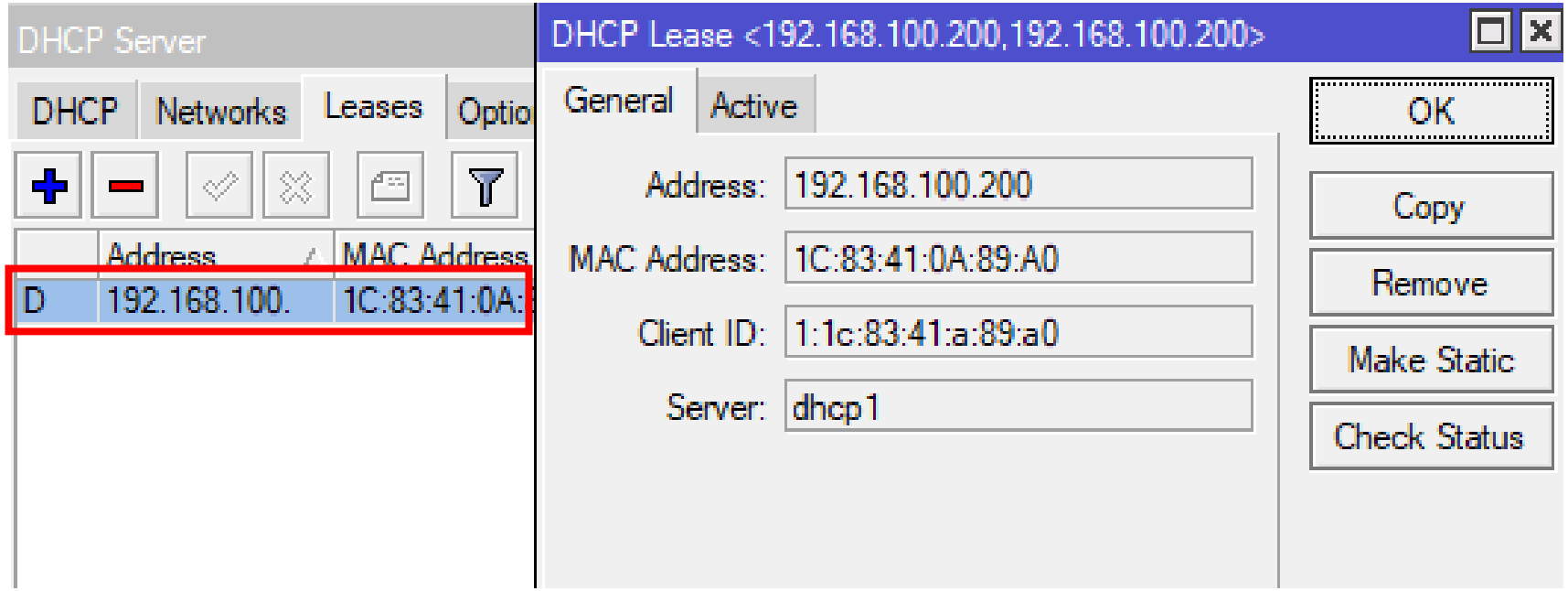
Sub-menu: `/ip dhcp-server lease`

DHCP Leases

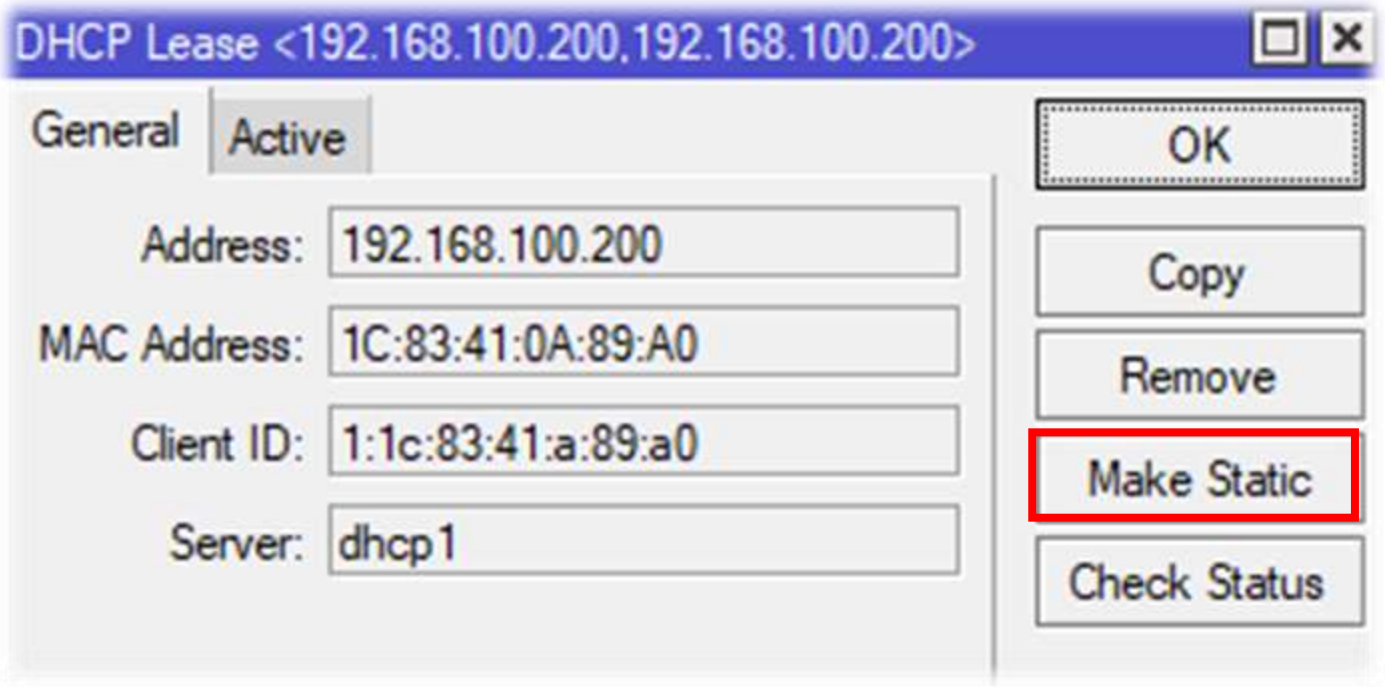

Switch
Mesh
IP
MPLS
Routing
System
Queues
Files
Accounting
Addresses
Cloud
DHCP Client
DHCP Server
DNS
Firewall
DHCP
Networks
Leases
Address
MAC Addre
D
192.168.100.
1C:83:41:0
DHCP Lease <192.168.100.200,192.168.100.200>
General
Active
Address: 192.168.100.200
MAC Address: 1C:83:41:0A:89:A0
Client ID: 1:1c:83:41:a:89:a0
Server: dhcp1
OK
Copy
Remove
Make Static
Check Status

DHCP Leases: How to Make Static?

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



DHCP Leases: How to Make Static?

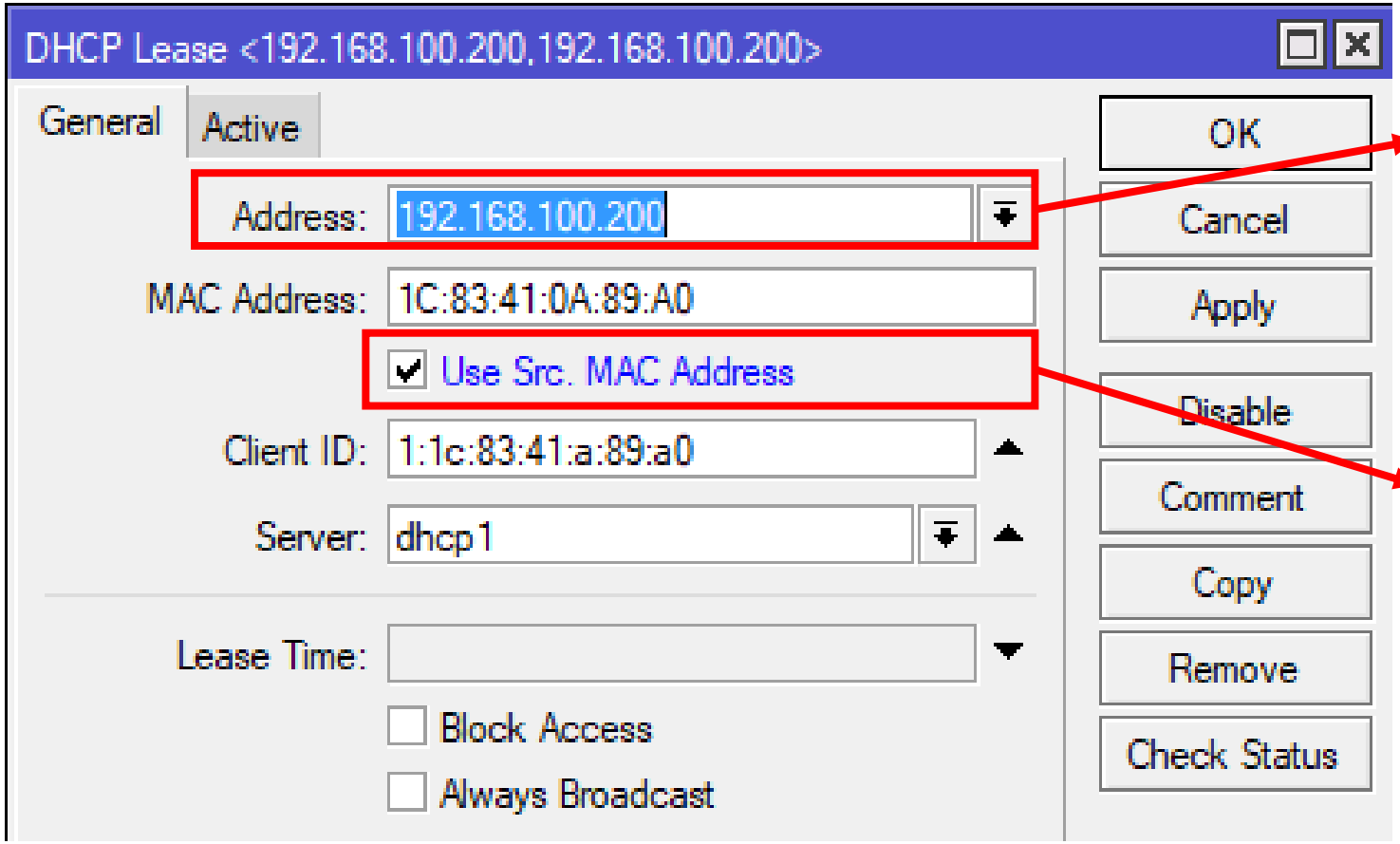


2

Click Make Static.

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

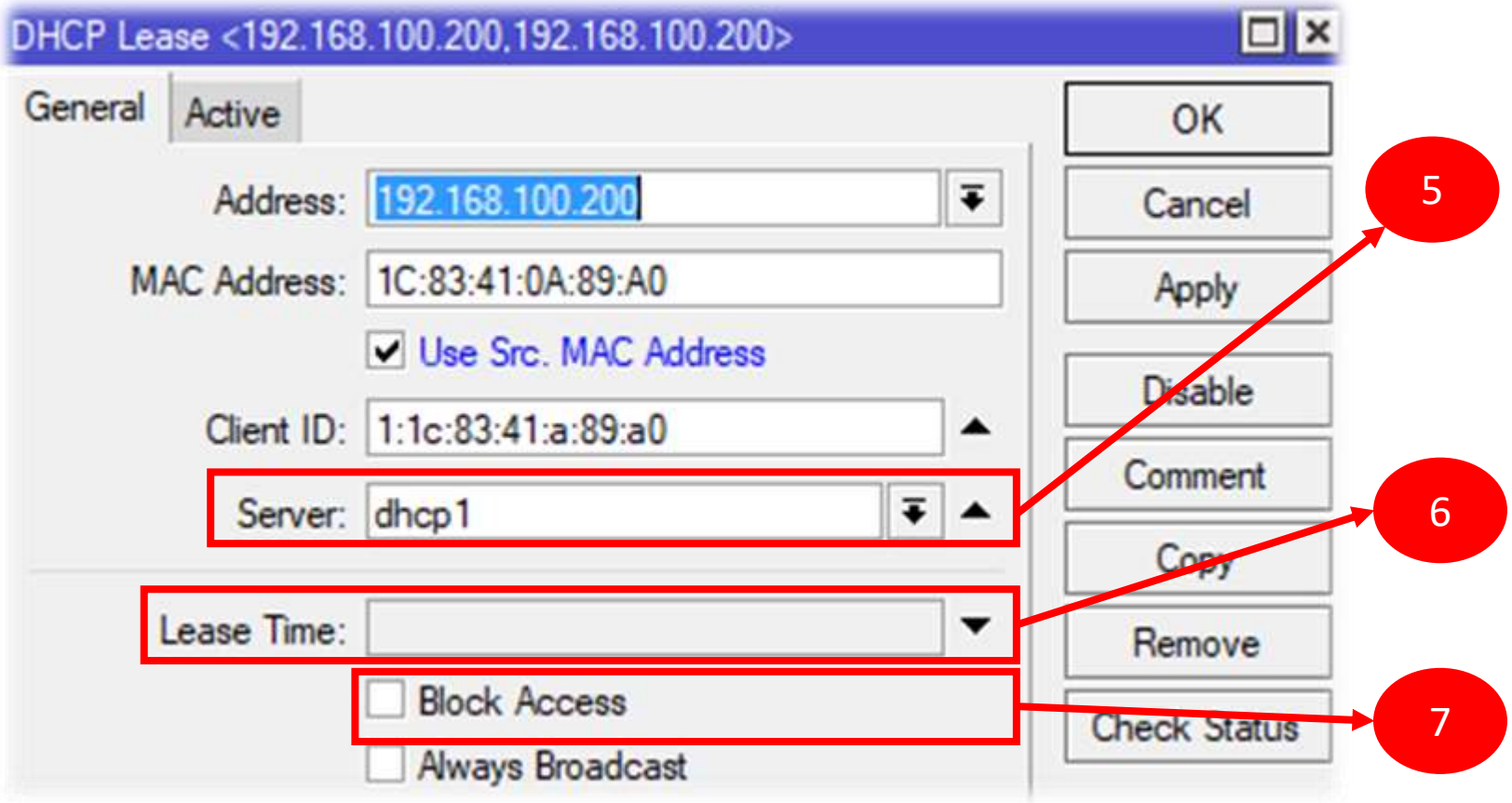
DHCP Leases: Static



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

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

DHCP Leases

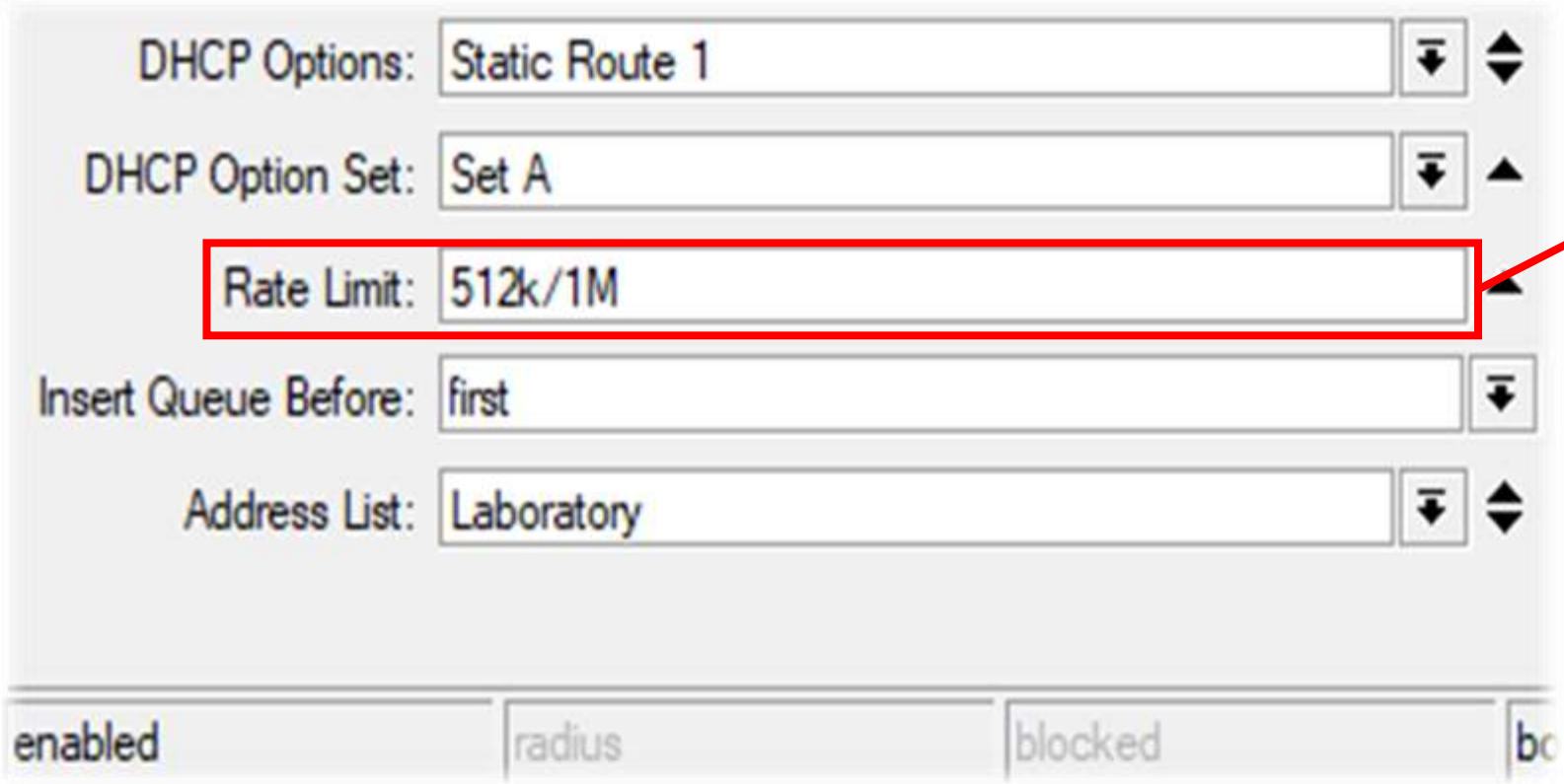


Server name which serves this client

Time that the client may use the address

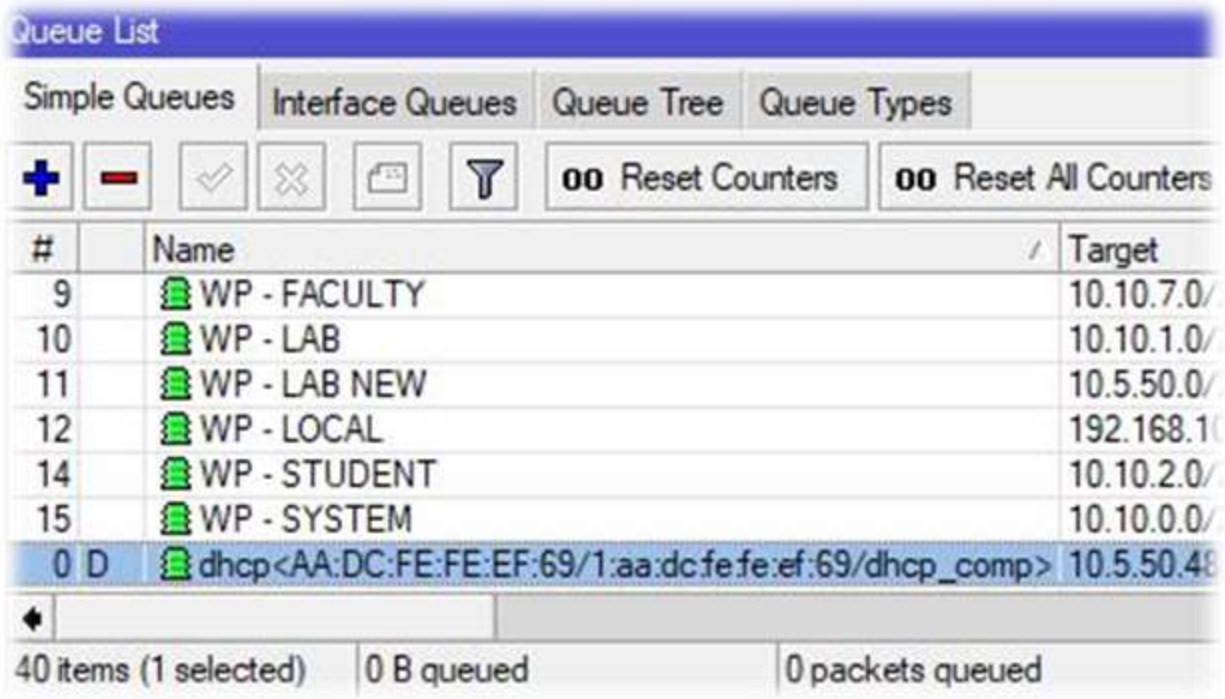
Block access for this client

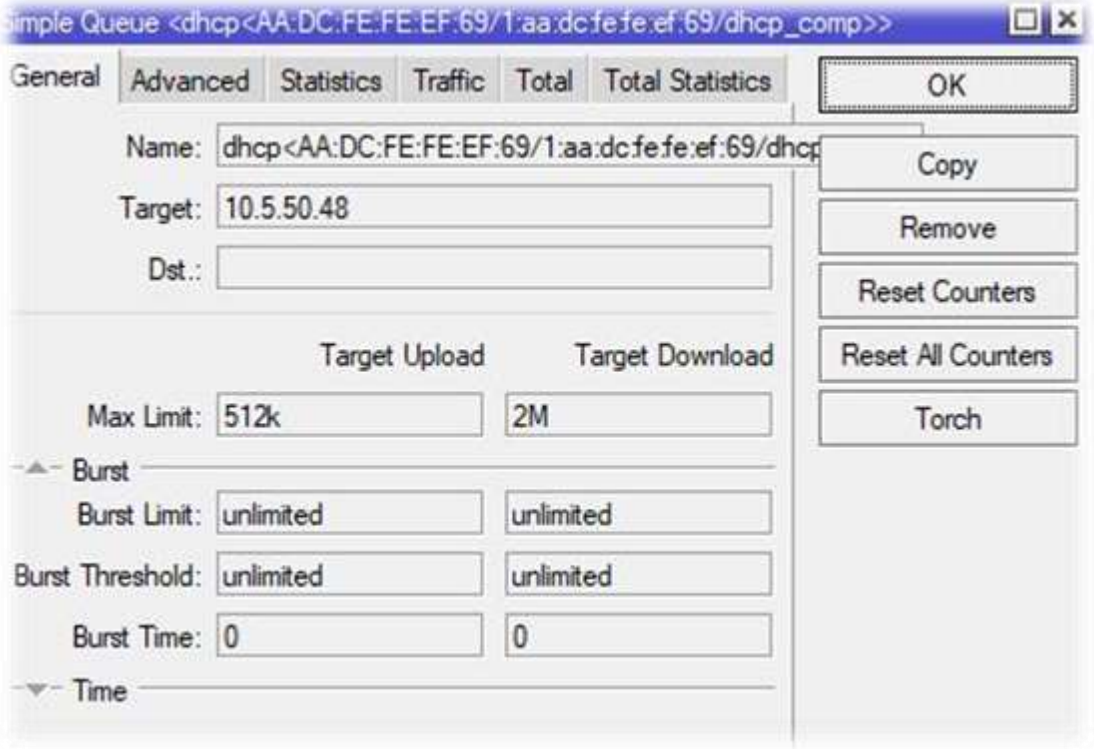
DHCP Leases



Upload/Download Limit

DHCP Leases: Rate Limit

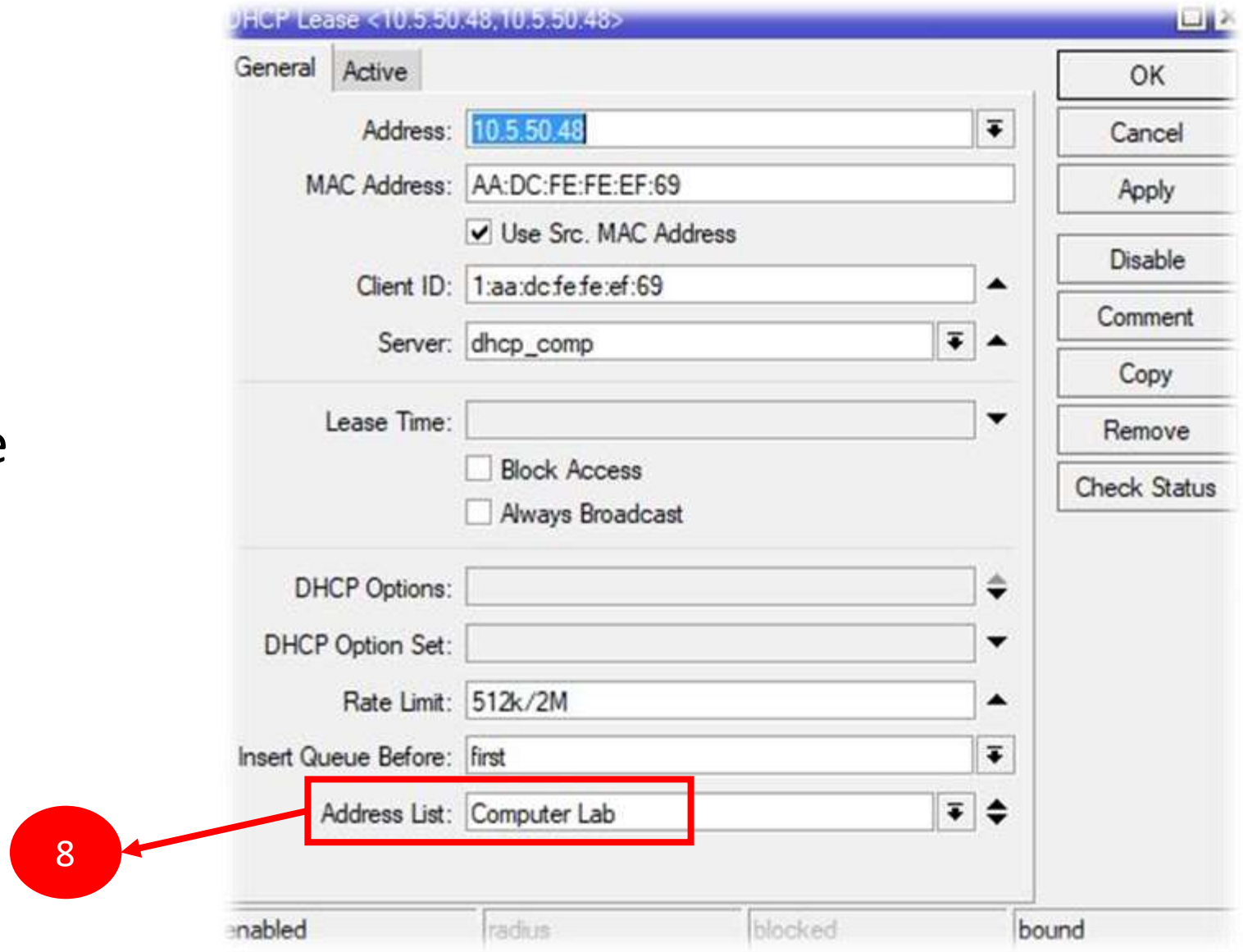




- It will be automatically be added on the Queue List

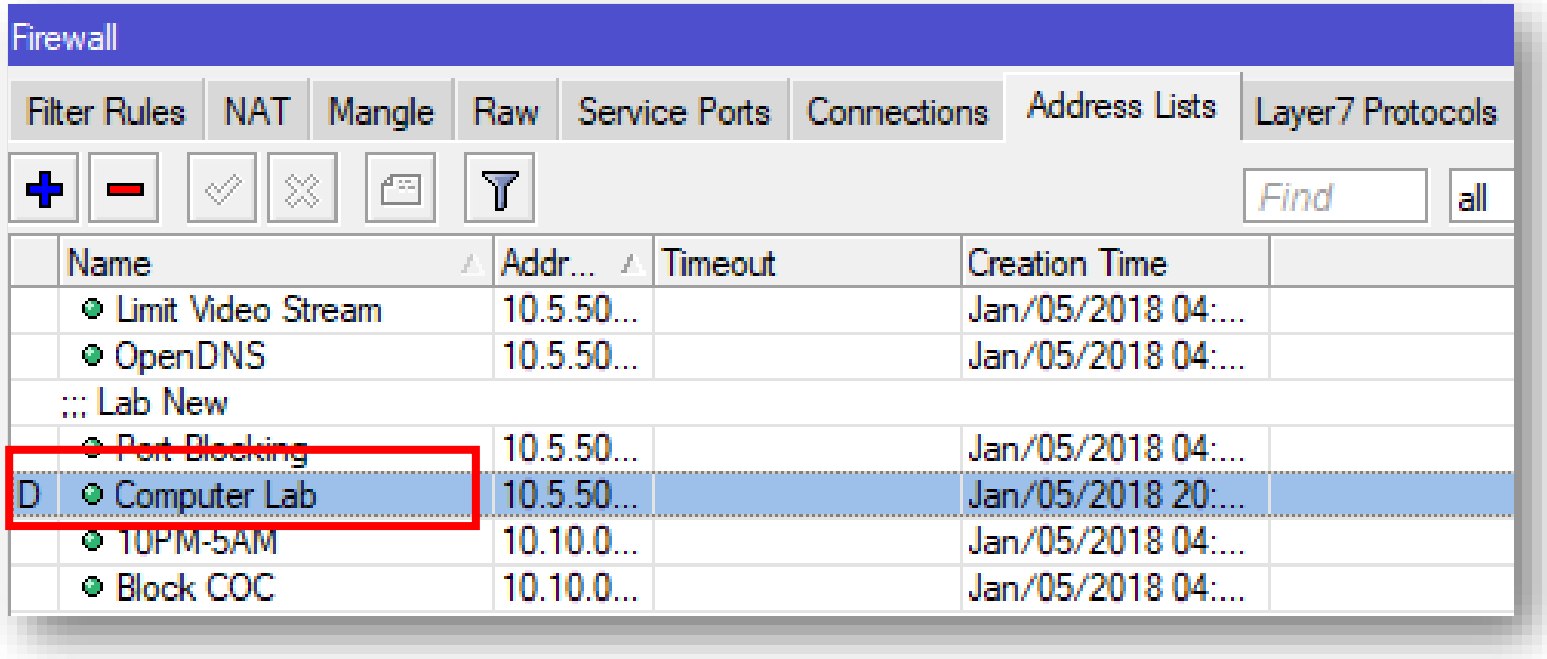
DHCP Leases: Address List

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

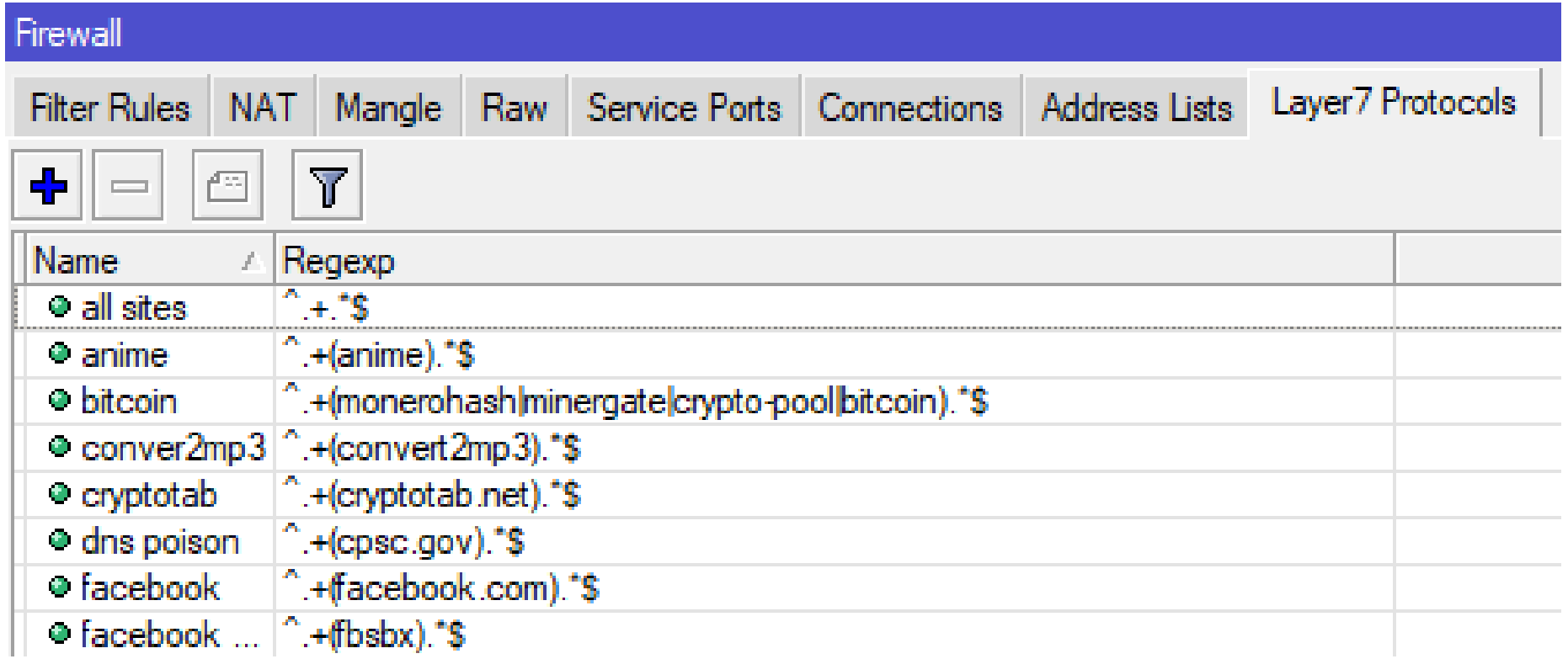


DHCP Leases: Address List

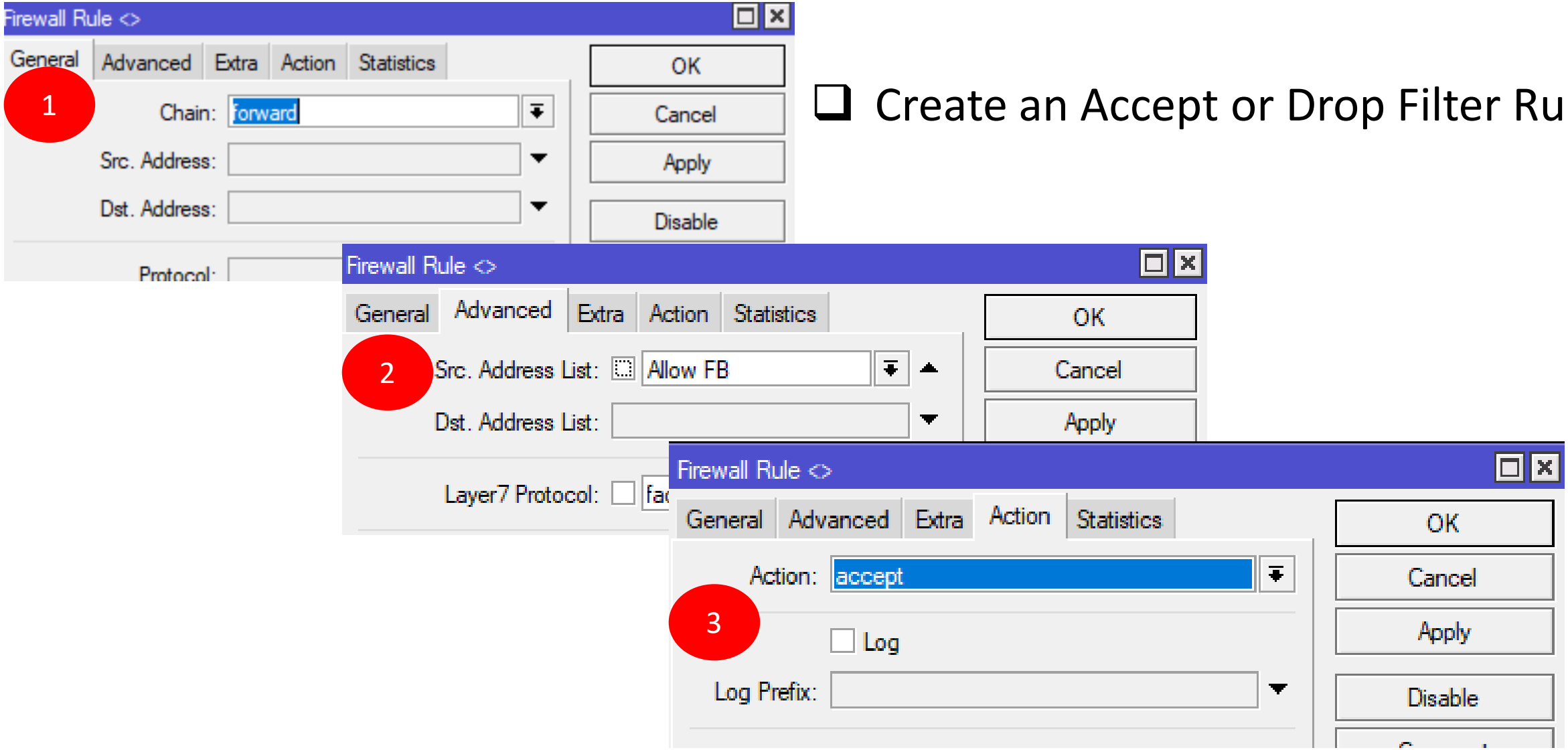
- It will automatically be added in the Address list which can be used in creating filter rules.



DHCP Leases: Address List



- ❑ Create a Layer 7 Protocol



❑ Create an Accept or Drop Filter Rule

SCRIPT: Extracting Leases

- This script will help you extract the necessary information form 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 Tab 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]) }
```

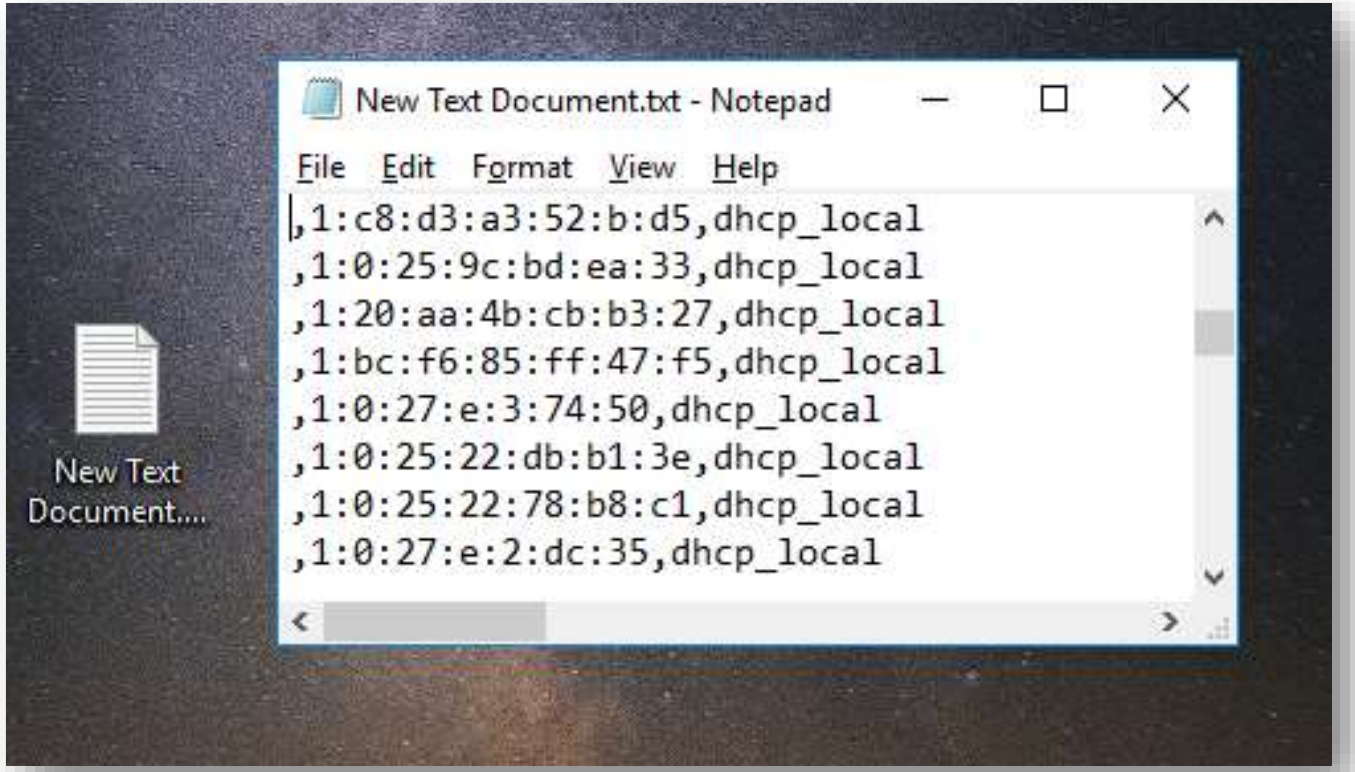
SCRIPT: Extracting Leases

```
[siena@SCT RB1100AHx2 Main Router] /ip dhcp-server lea
,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
```

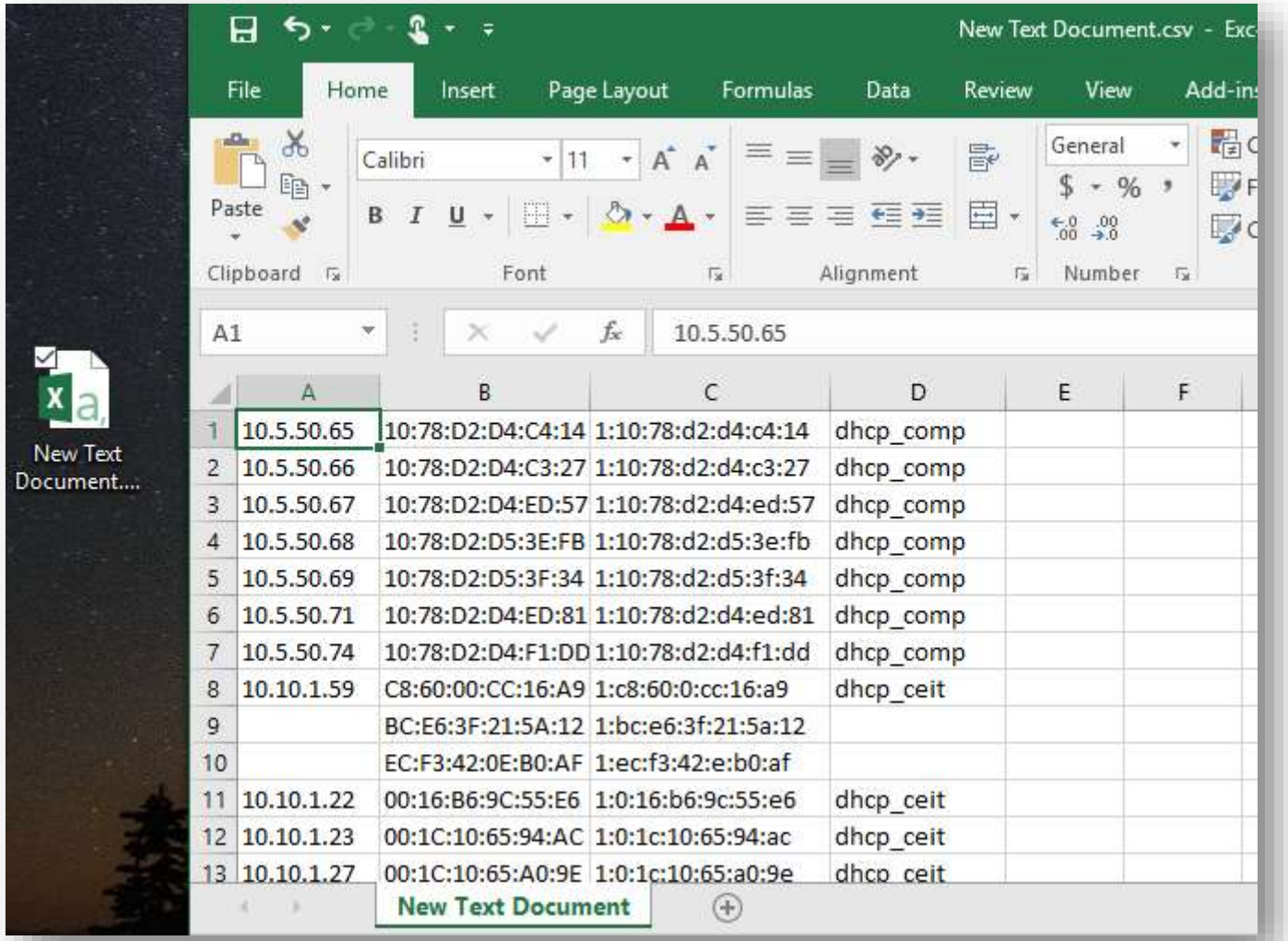
SCRIPT: Extracting Leases



- 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
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	dhcp_ceit

Special Thanks to the Following:

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Nice People
Nice Country

Special Thanks to the Following:

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

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

Thank You!

Let’s be friends:

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