

University of Babylon, IT College

Information Network Dep., Third Class, Second Semester



MTCNA Course

MikroTik Certified Network Associate

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- **ARP**
- **RouterOS ARP table**
- **DHCP SERVER AND CLIENT**

ARP

Address Resolution Protocol

<https://www.youtube.com/watch?v=1jncvd6JDoc>

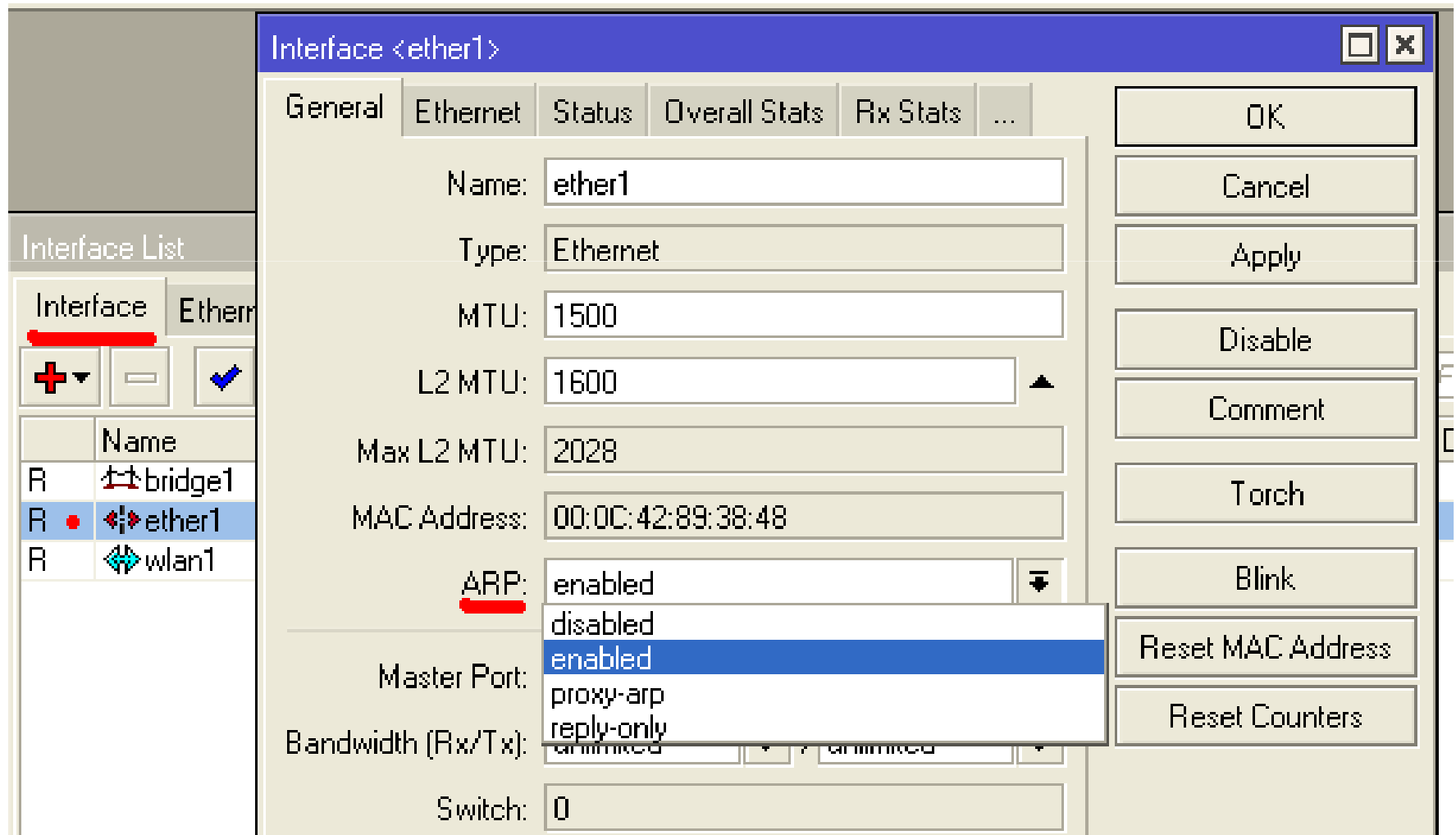
The Address Resolution Protocol is a request and reply protocol. It is communicated within the boundaries of a *single network*, never routed across internetwork nodes. This property places ARP into the Link Layer of the Internet Protocol Suite.

/ip arp

- Even though IP packets are addressed using IP addresses, hardware addresses must be used to actually transport data from one host to another. Address Resolution Protocol is used to **map OSI level 3 IP addresses to OSI level 2 MAC addresses**. Router has a table of currently used ARP entries. Normally the table is built dynamically, but to increase network security, it can be partially or completely built statically by means of adding static entries.

ARP Modes

- It is possible to set several ARP modes in *interface configuration*



1- Disabled

- If ARP feature is turned off on the interface ,i.e., *arp=disabled* is used, ARP requests from clients are not answered by the router. Therefore, *static arp entry should be added to the clients as well.*
- For example, the router's IP and MAC addresses should be added to the Windows workstations (PC) using the *arp* command :
- C:\> arp -s 10.5.8.254 00-aa-00-62-c6-09

2- Enabled

- This mode is enabled by default on all interfaces. ARPs will be discovered automatically and new dynamic entries will be added to ARP table of the PC automatically.

Proxy ARP

- A router with properly configured proxy ARP feature acts like a transparent ARP proxy *between directly connected networks*.
- **The Proxy-ARP feature means that the router will be listening to arp requests received at the relevant interface and respond to them with it's own MAC address, if the requests matches any other IP address of the router.**

- **Proxy ARP** is a technique by which a device on a given network answers the ARP queries for a network address that is *not on that network*. The ARP Proxy is aware of the location of the traffic's destination, and offers its own MAC address in reply, effectively saying, "**send it to me, and I'll get it to where it needs to go.**"
- Example:

Advantage

Proxy ARP can help machines on a subnet reach remote subnets *without the need to configure routing or a default gateway.*

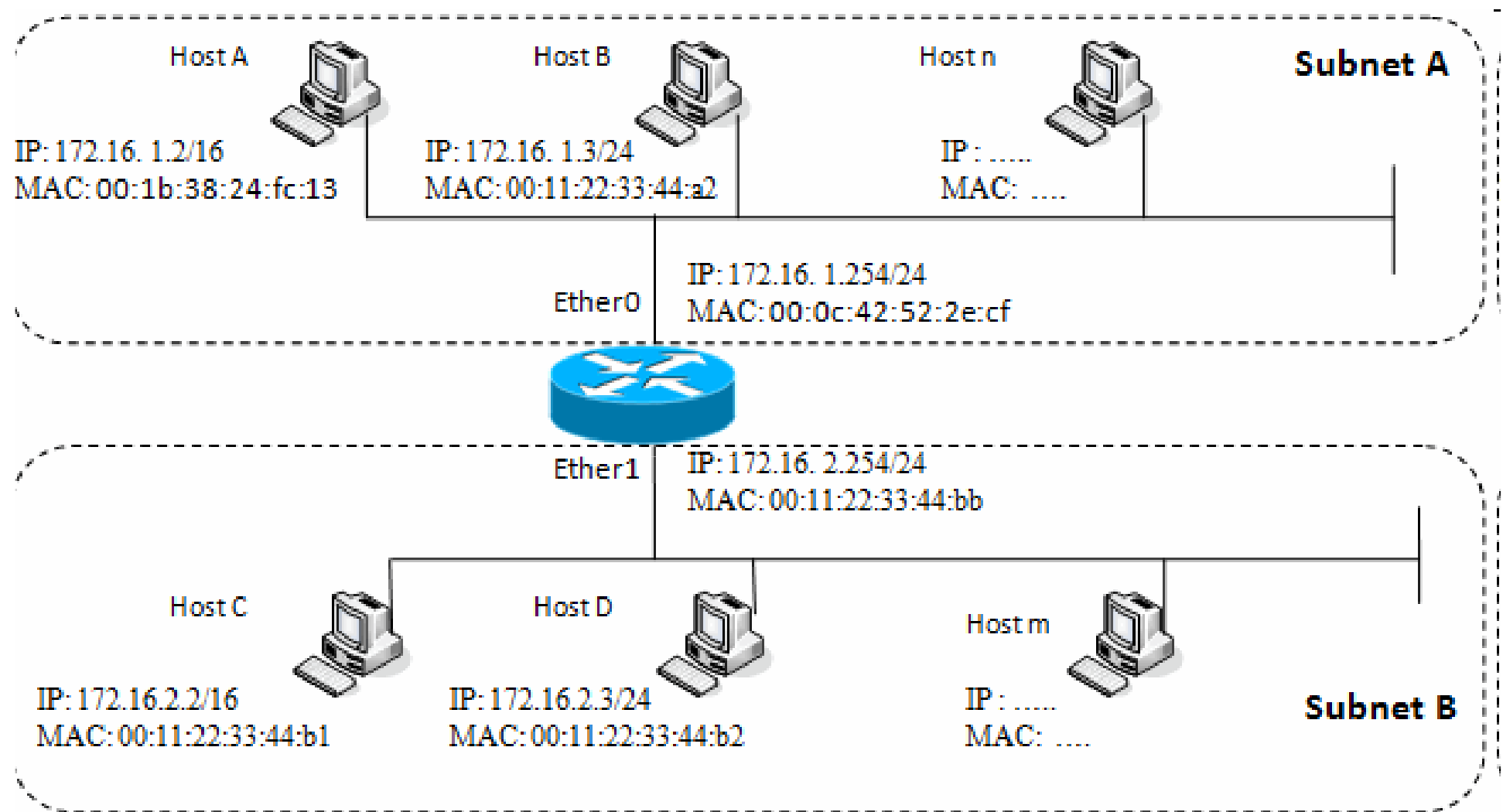


Figure 10.2. Network example for ARP proxy

- Host A (172.16.1.2) on Subnet A wants to send packets to Host D (172.16.2.3) on Subnet B. Host A has a /16 subnet mask *which means that Host A believes that it is directly connected to all 172.16.0.0/16 network (the same LAN).* Since the Host A believes that is directly connected, it sends an ARP request to the destination to clarify MAC address of Host D. Host A broadcasts an ARP request on Subnet A:

- Note: *(in case when Host A finds that destination IP address is not from the same subnet it send packet to default gateway.)*

- With this ARP request, Host A (172.16.1.2) is asking Host D (172.16.2.3) to send its MAC address. The ARP request packet is then encapsulated in an Ethernet frame with the MAC address of Host A as the source address and a broadcast (FF:FF:FF:FF:FF:FF) as the destination address. Layer 2 broadcast means that frame will be sent to all hosts in the same layer 2 broadcast domain which includes the ether0 interface of the router, but does not reach Host D, because router by default does not forward layer 2 broadcast .

- Since the router knows that the target address (172.16.2.3) is on another subnet but it can reach Host D, it replies with **its own MAC address** to Host A .

- This is the *Proxy ARP reply* that the router sends to Host A. *Router sends back unicast proxy ARP reply with its own MAC address as the source address and the MAC address of Host A as the destination address, by saying " send these packets to me, and I'll get it to where it needs to go "*.

- When Host A receives ARP response it updates its ARP table, as shown :

```
C:\Users\And>arp -a
```

```
Interface: 173.16.2.1 --- 0x8
```

Internet Address	Physical Address	Type
173.16.1.254	00-0c-42-52-2e-cf	dynamic
173.16.2.3	00-0c-42-52-2e-cf	dynamic
173.16.2.2	00-0c-42-52-2e-cf	dynamic

- After MAC table update, Host A forwards all the packets intended for Host D (172.16.2.3) directly to router interface ether0 (00:0c:42:52:2e:cf) and the router forwards packets to Host D. The ARP cache on the hosts in Subnet A is populated with the MAC address of the router for all the hosts on Subnet B. Hence, all packets destined to Subnet B are sent to the router. The router forwards those packets to the hosts in Subnet B .

- Multiple IP addresses by host are mapped to a single MAC address (the MAC address of this router) when proxy ARP is used .

Proxy ARP can be enabled on each interface individually with command

arp=proxy-arp:

4- Reply Only

- If arp property is set to *reply-only* on the interface, then router only replies to ARP requests. **Neighbour MAC addresses will be resolved using /ip arp statically**, but there will be no need to add the router's MAC address to other hosts' ARP tables like in case if arp is **disabled** .

DHCP

- The DHCP (Dynamic Host Configuration Protocol) is needed for easy distribution of IP addresses in a network. The MikroTik RouterOS implementation includes both server and client parts.

- The DHCP protocol gives and allocates IP addresses to IP clients. DHCP is basically insecure and should only be used on secure networks. DHCP server listens on UDP 67 port, DHCP client - on UDP 68 port .

- The router supports an individual server for each Ethernet-like interface. The MikroTik RouterOS DHCP server supports the basic functions of giving each requesting client an IP address/netmask lease, default gateway, domain name, DNS-server(s) and WINS-server(s) (for Windows clients) information (set up in the DHCP networks submenu)

- In order DHCP server to work, you must set up also IP pools (do not include the DHCP server's own IP address into the pool range) and DHCP networks.
- To setup DHCP server you should have IP address on the interface.

Quick Setup Guide

- RouterOS has built in command that lets you easily set up DHCP server.
- Lets say we want to configure DHCP server on ether1 interface to lend addresses from 192.168.0.2 to 192.168.0.254 which belong to the 192.168.0.0/24 network. The gateway and DNS server is 192.168.0.1.

Wireless

Bridge

PPP

Switch

Mesh

IP

MPLS

Routing

System

Queues

Files

ARP

Accounting

Addresses

DHCP Client

DHCP Relay

DHCP Server

DNS

Firewall

Hotspot

IPsec

Neighbors

Packing

DHCP Server

DHCP

Networks

Leases

Options

Alerts

+

-

✓

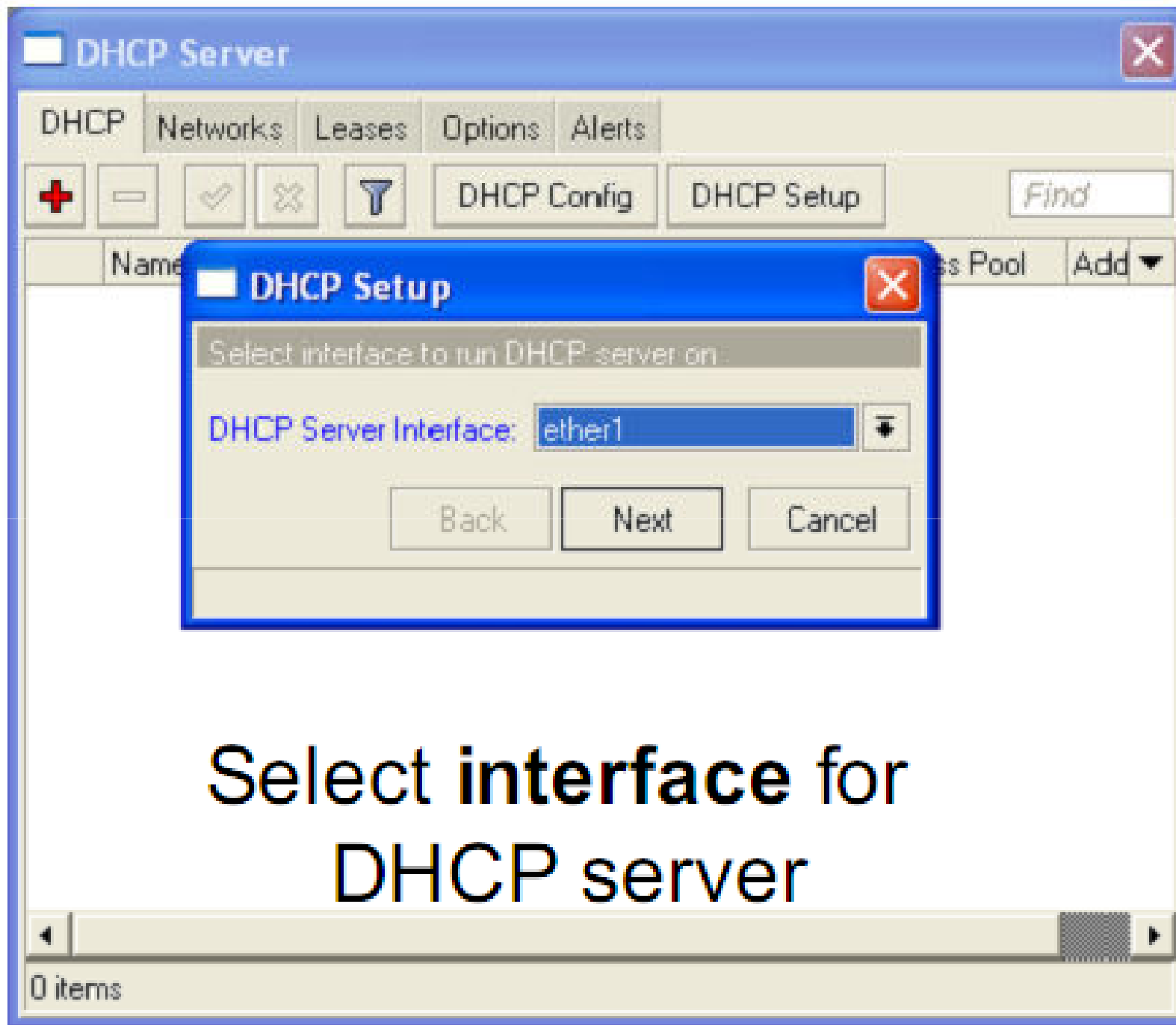
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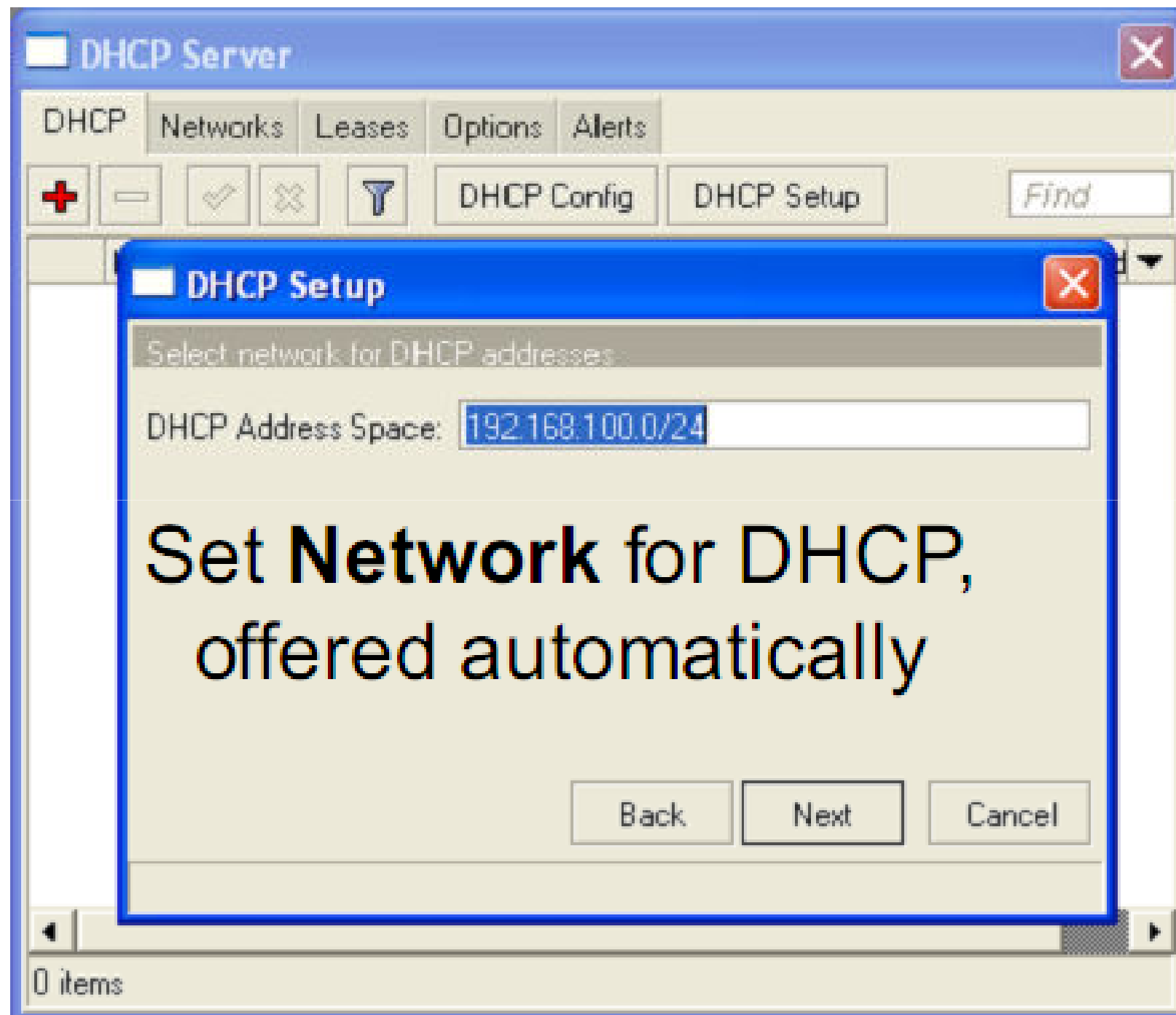
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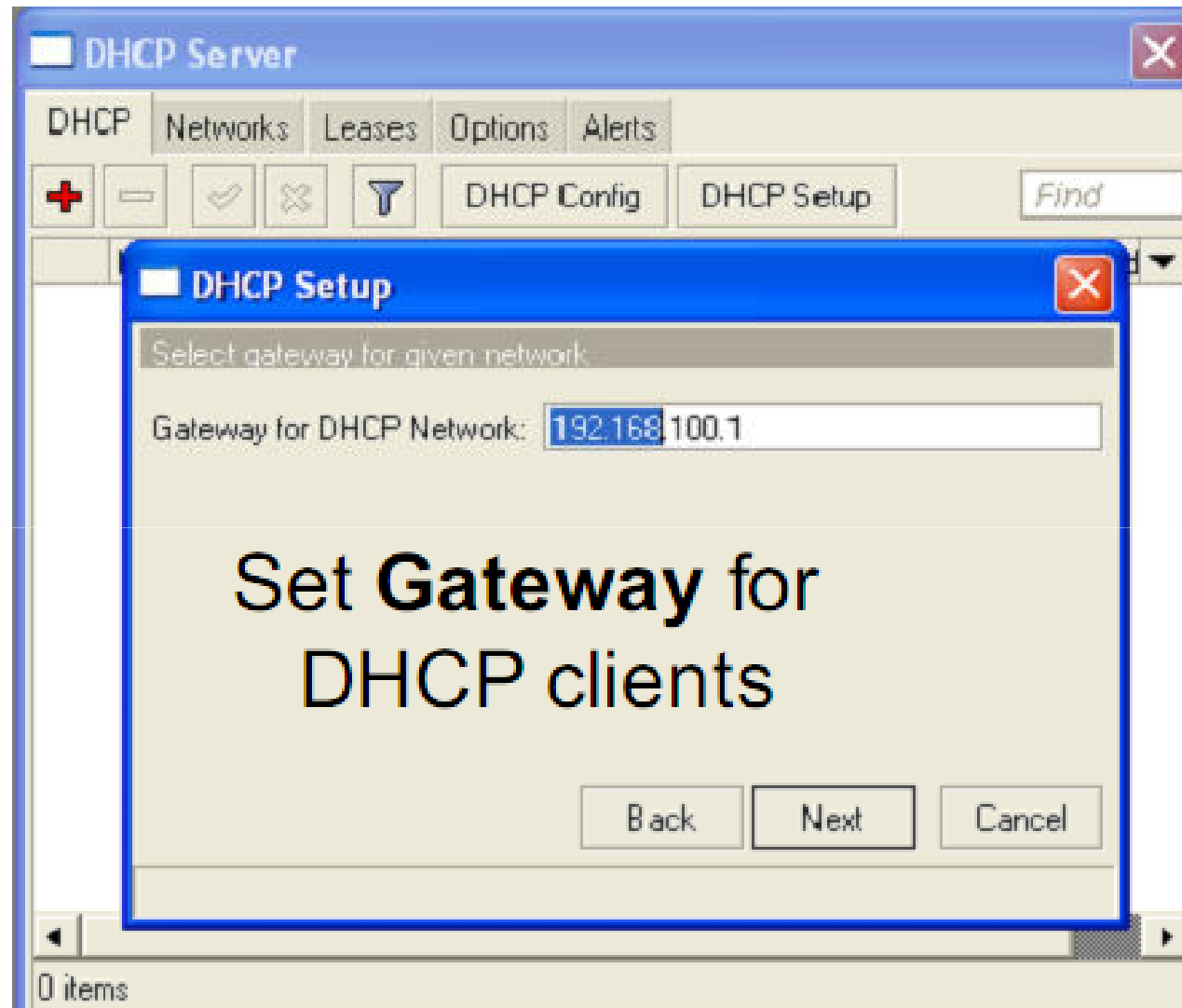
DHCP Config

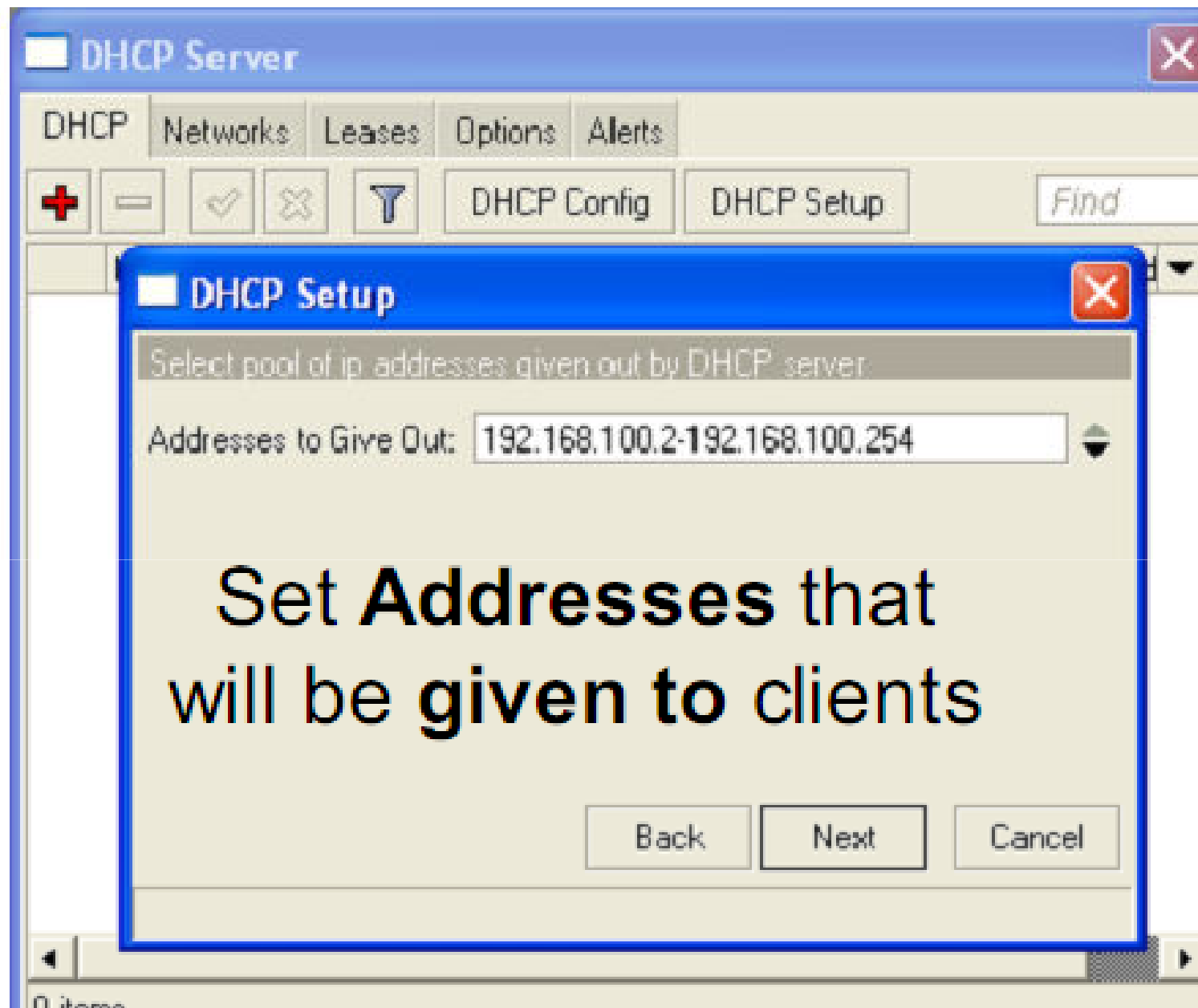
DHCP Setup

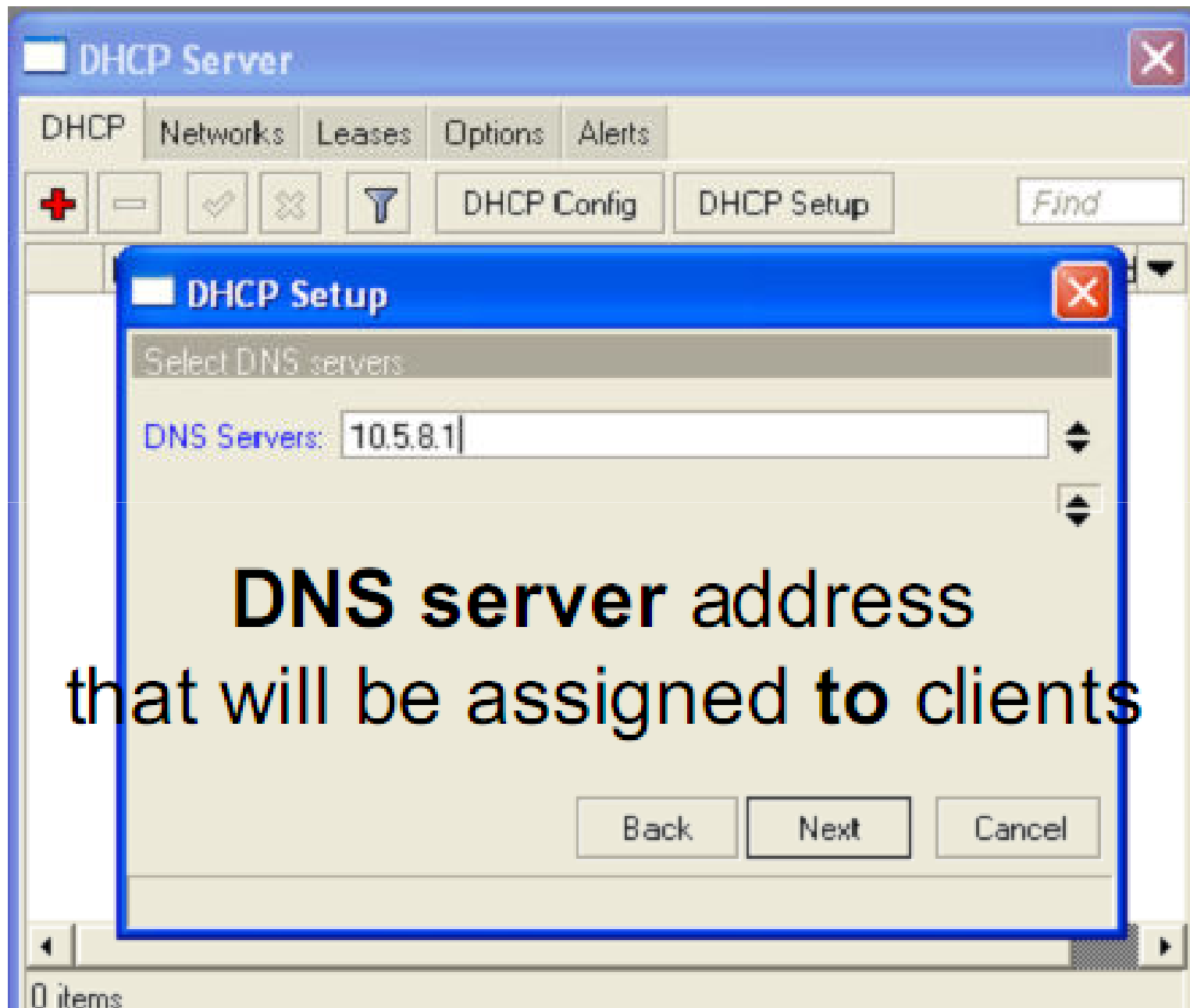
Name	Interface	Relay	Lease Time
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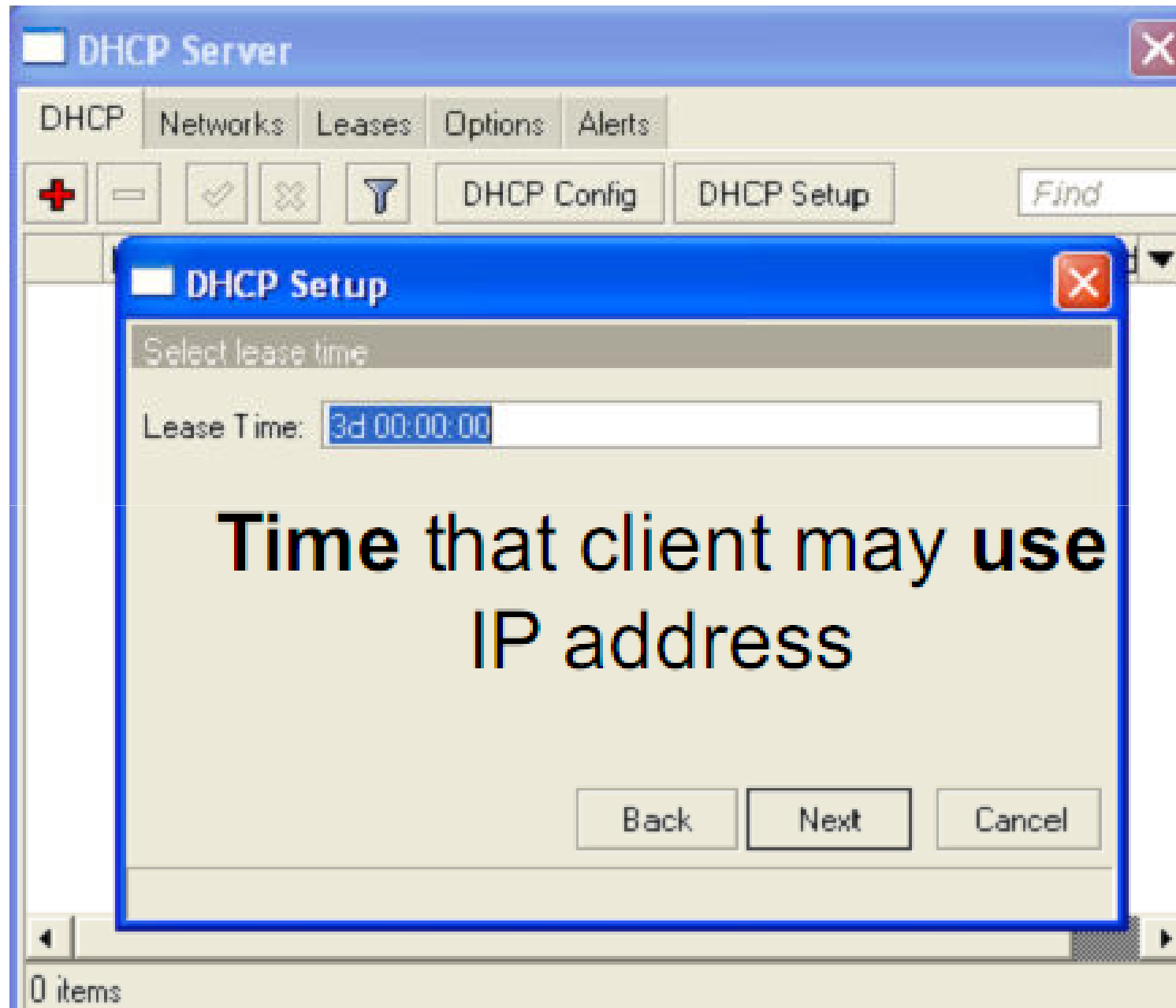


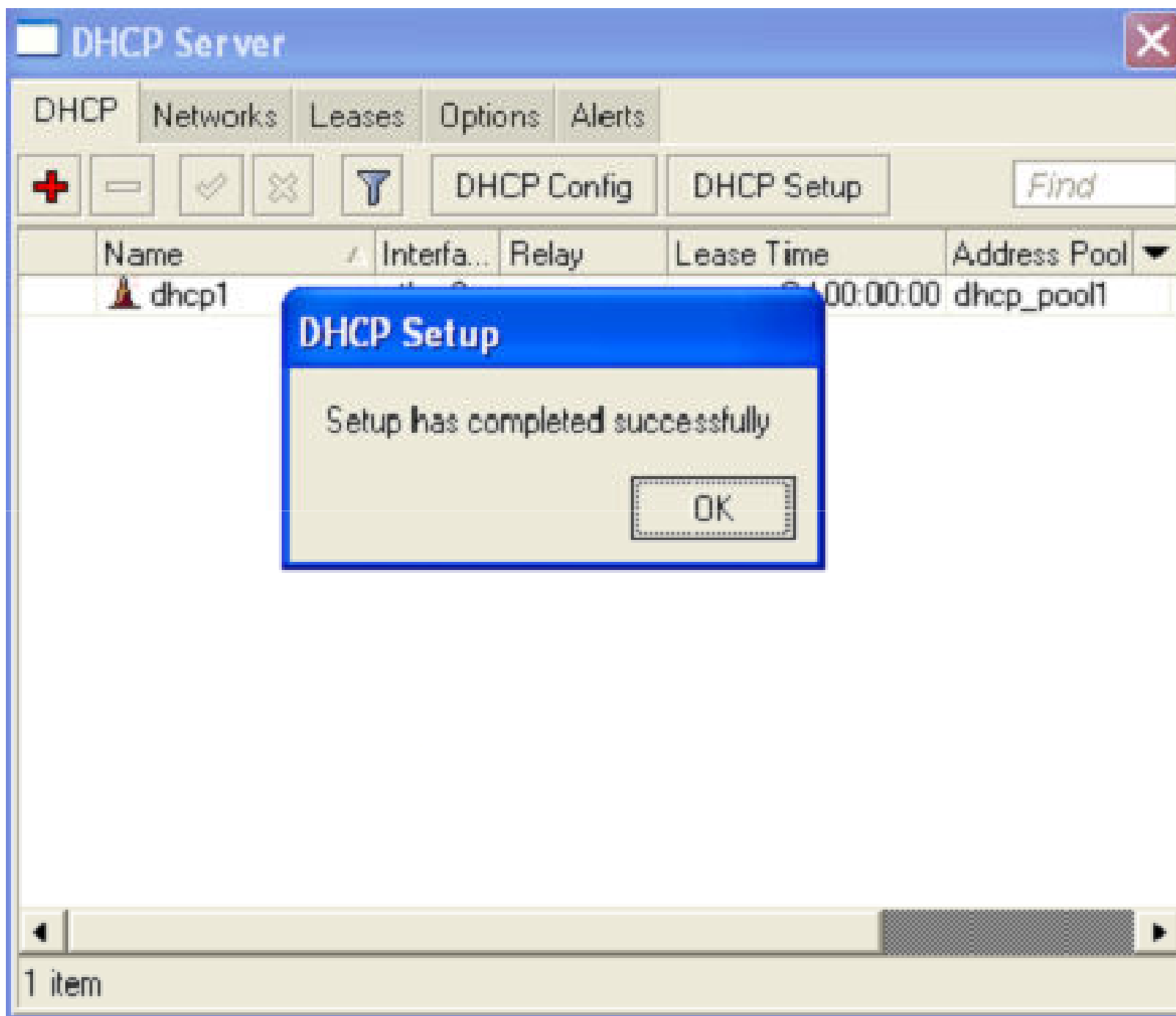












Note

- To configure DHCP server on bridge, set server on bridge interface.
- *DHCP server will be invalid, when it is configured on bridge port.*

Leases

- DHCP server lease submenu is used to monitor and manage server's leases. The issued leases are showed here as dynamic entries.
- A client may free the leased address. The dynamic lease is removed, and the allocated address is returned to the address pool. But the static lease becomes busy until the client will reacquire the address.
- IP addresses assigned statically are not probed .

DHCP Server



DHCP Networks Leases Options Alerts

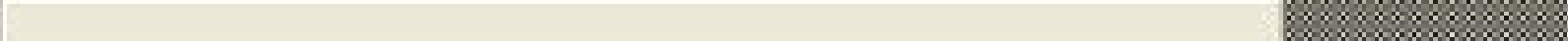


Make Static

Check Status

Find

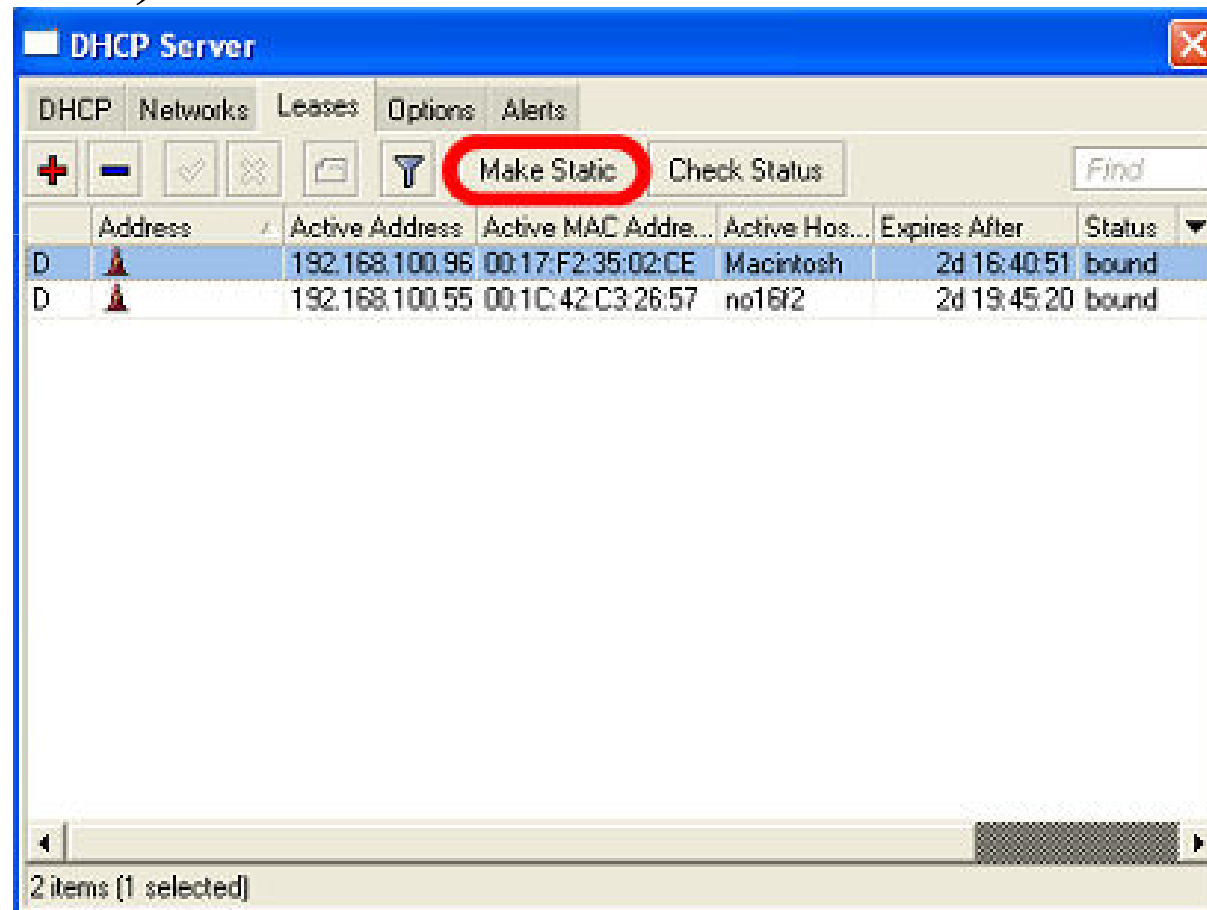
	Address	Active Address	Active MAC Address	Active Hos...	Expires After	Status	
D		192.168.100.96	00:17:F2:35:02:CE	Macintosh	2d 16:40:51	bound	
D		192.168.100.55	00:1C:42:C3:26:57	no16f2	2d 19:45:20	bound	



2 items (1 selected)

Static Lease

- You can also add static leases to issue a particular client (identified by MAC address) the desired IP address.



DHCP Server					
<div> <div>DHCP Networks Leases Options Alerts</div> <div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📄</div> <div>🔍</div> <div>Make Static</div> <div>Check Status</div> <div>Find</div> </div> </div>					
	Active Address	Active MAC Address	Active Host	Expires After	Status
D	192.168.100...	00:17:F2:35:02:CE	Macintosh-2	00:44:12	bound
	192.168.100...	00:1C:42:C3:26:57	no16f2	00:43:27	bound

DHCP Server		DHCP Server <dhcp1>	
DHCP	Networks	Name: <input type="text" value="dhcp1"/> <div>OK</div>	
+	-	Interface: <input type="text" value="bridge1"/>	Cancel
	✓	Relay: <input type="text"/>	Apply
	✗	Lease Time: <input type="text" value="01:00:00"/>	Disable
		Address Pool: <input type="text" value="static-only"/>	Copy
		Src. Address: <input type="text"/>	Remove
		Delay Threshold: <input type="text"/>	
		Authoritative: <input type="text" value="after 2s delay"/>	
		<input checked="" type="checkbox"/> Bootp Support <input type="checkbox"/> Add ARP For Leases <input type="checkbox"/> Always Broadcast <input type="checkbox"/> Use RADIUS	
1 item (1 selected)		disabled	

address-pool

- IP pools are used to define range of IP addresses that is used for DHCP server and Point-to-Point servers
- In DHCP servers, **IP pool** ,from which to take IP addresses for the clients.
- If set to **static-only** ,then only the clients that have a static lease (added in lease submenu) will be allowed .