

Manual:IP/DHCP Server

From MikroTik Wiki

< Manual:IP

Applies
to
RouterOS: v3, v4,
v5+

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Summary

Standards: RFC 2131, RFC 3315, RFC 3633

Package: dhcp

The DHCP (Dynamic Host Configuration Protocol) is used for the easy distribution of IP addresses in a network. The MikroTik RouterOS implementation includes both server and client parts and is compliant with RFC 2131.

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 for the DHCP server to work, IP pools must also be configured (do not include the DHCP server's own IP address into the pool range) and the DHCP networks.

It is also possible to hand out leases for DHCP clients using the RADIUS server; the supported parameters for a RADIUS server is as follows:

Access-Request:

- NAS-Identifier - router identity
- NAS-IP-Address - IP address of the router itself
- NAS-Port - unique session ID
- NAS-Port-Type - Ethernet
- Calling-Station-Id - client identifier (active-client-id)
- Framed-IP-Address - IP address of the client (active-address)
- Called-Station-Id - name of DHCP server
- User-Name - MAC address of the client (active-mac-address)
- Password - ""

Access-Accept:

- Framed-IP-Address - IP address that will be assigned to client
- Framed-Pool - ip pool from which to assign ip address to client
- Rate-Limit - Datarate limitation for DHCP clients. Format is: rx-rate[/tx-rate] [rx-burst-rate[/tx-burst-rate] [rx-burst-threshold[/tx-burst-threshold] [rx-burst-time[/tx-burst-time][priority] [rx-rate-min[/tx-rate-min]]]]. All rates should be numbers with optional 'k' (1,000s) or 'M' (1,000,000s). If tx-rate is not specified, rx-rate is as tx-rate too. Same goes for tx-burst-rate and tx-burst-threshold and tx-burst-time. If both rx-burst-threshold and tx-burst-threshold are not specified (but burst-rate is specified), rx-rate and tx-rate are used as burst thresholds. If both rx-burst-time and tx-burst-time are not specified, 1s is used as default. Priority takes values 1..8, where 1 implies the highest priority, but 8 - the lowest. If rx-rate-min and tx-rate-min are not specified rx-rate and tx-rate values are used. The rx-rate-min and tx-rate-min values can not exceed rx-rate and tx-rate values.
- Ascend-Data-Rate - tx/rx data rate limitation if multiple attributes are provided, first limits tx data rate, second - rx data rate. If used together with Ascend-Xmit-Rate, specifies rx rate. 0 if unlimited
- Ascend-Xmit-Rate - tx data rate limitation. It may be used to specify tx limit only instead of sending two sequential Ascend-Data-Rate attributes (in that case Ascend-Data-Rate will specify the receive rate). 0 if unlimited
- Session-Timeout - max lease time (lease-time)



Note: DHCP server requires a real interface to receive raw ethernet packets. If the interface is a Bridge interface, then the Bridge must have a real interface attached as a port to that bridge which will receive the raw ethernet packets. It cannot function correctly on a dummy (empty bridge) interface.

Quick Setup Guide

RouterOS has a built in command that lets you easily set up a DHCP server. Let's say we want to configure DHCP server on ether1 interface to lease 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.

From `/ip dhcp-server` menu run **setup** command and follow instructions:

```
[admin@MikroTik] ip dhcp-server> setup
Select interface to run DHCP server on

dhcp server interface: ether1
Select network for DHCP addresses

dhcp address space: 192.168.0.0/24
Select gateway for given network

gateway for dhcp network: 192.168.0.1
Select pool of ip addresses given out by DHCP server

addresses to give out: 192.168.0.2-192.168.0.254
Select DNS servers

dns servers: 192.168.0.1
Select lease time

lease time: 3d
[admin@MikroTik] ip dhcp-server>
```

The wizard has made the following configuration based on the answers above:

```
[admin@MikroTik] ip dhcp-server> print
Flags: X - disabled, I - invalid
#  NAME      INTERFACE RELAY      ADDRESS-POOL LEASE-TIME ADD-ARP
0  dhcp1      ether1    0.0.0.0      dhcp_pool1   3d         no

[admin@MikroTik] ip dhcp-server> network print
#  ADDRESS      GATEWAY      DNS-SERVER      WINS-SERVER      DOMAIN
0  192.168.0.0/24  192.168.0.1  192.168.0.1

[admin@MikroTik] ip dhcp-server> /ip pool print
#  NAME      RANGES
0  dhcp_pool1  192.168.0.2-192.168.0.254

[admin@MikroTik] ip dhcp-server>
```

IPv6

Starting from v5.8 RouterOS supports IPv6 prefix delegation according to RFC 3315 and RFC 3633.

Starting from v5.9, DHCPv6 server configuration was moved to /ipv6 sub-menu. Read-more >>

General

Sub-menu: /ip dhcp-server

| Property | Description |
|---|---|
| add-arp (yes / no; Default: no) | Whether to add dynamic ARP entry. If set to no either ARP mode should be enabled on that interface or static ARP entries should be administratively defined in /ip arp submenu. |
| address-pool (string / static-only; Default: static-only) | 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. |
| always-broadcast (yes / no; Default: no) | Always send replies as broadcasts even if destination IP is known. Will add additional load on L2 network. |
| authoritative (after-10sec-delay / after-2sec-delay / yes / no; Default: after-2sec-delay) | Option changes the way how server responds to DHCP requests: |

| | |
|--|--|
| | <ul style="list-style-type: none"> ▪ yes - replies to clients request for an address that is not available from this server, dhcp server will send negative acknowledgment (DHCPNAK) ▪ no - dhcp server ignores clients requests for addresses that are not available from this server ▪ after-10sec-delay - requests with "secs < 10" will be processed as in "no" setting case and requests with "secs >= 10" will be processed as in "yes" case. ▪ after-2sec-delay - requests with "secs < 2" will be processed as in "no" setting case and requests with "secs >= 2" will be processed as in "yes" case. <p>If all requests with "secs < x" should be ignored, then delay-threshold=x setting should be used.</p> |
| bootp-lease-time (<i>forever lease-time time</i> ; Default:) | <p>Accepts two predefined options or time value:</p> <ul style="list-style-type: none"> ▪ forever - lease never expires ▪ lease-time - use time from lease-time parameter |
| bootp-support (<i>none static dynamic</i> ; Default: static) | <p>Support for BOOTP clients:</p> <ul style="list-style-type: none"> ▪ none - do not respond to BOOTP requests ▪ static - offer only static leases to BOOTP clients ▪ dynamic - offer static and dynamic leases for BOOTP clients |
| conflict-detection (<i>yes no</i> ; Default:) | |
| delay-threshold (<i>time none</i> ; Default: none) | <p>If secs field in DHCP packet is smaller than delay-threshold, then this packet is ignored. If set to none - there is no threshold (all DHCP packets are processed)</p> |
| dhcp-option-set (<i>name none</i> ; Default:) | <p>Use custom set of DHCP</p> |

| | |
|--|--|
| | options defined in option sets menu. |
| insert-queue-before (<i>bottom first name</i> ; Default:) | |
| interface (<i>string</i> ; Default:) | Interface on which server will be running. |
| lease-script (<i>string</i> ; Default: "") | <p>Script that will be executed after lease is assigned or de-assigned. Internal "global" variables that can be used in the script:</p> <ul style="list-style-type: none"> ▪ leaseBound - set to "1" if bound, otherwise set to "0" ▪ leaseServerName - dhcp server name ▪ leaseActMAC - active mac address ▪ leaseActIP - active IP address |
| lease-time (<i>time</i> ; Default: 10m) | The time that a client may use the assigned address. The client will try to renew this address after a half of this time and will request a new address after time limit expires. |
| name (<i>string</i> ; Default:) | Reference name |
| relay (<i>IP</i> ; Default: 0.0.0.0) | <p>The IP address of the relay this DHCP server should process requests from:</p> <ul style="list-style-type: none"> ▪ 0.0.0.0 - the DHCP server will be used only for direct requests from clients (no DHCP relay allowed) ▪ 255.255.255.255 - the DHCP server should be used for any incoming request from a DHCP relay except for those, which are processed by another DHCP server that exists in the /ip dhcp-server submenu. |
| src-address (<i>IP</i> ; Default: 0.0.0.0) | |

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| | <p>The address which the DHCP client must send requests to in order to renew an IP address lease. If there is only one static address on the DHCP server interface and the source-address is left as 0.0.0.0, then the static address will be used. If there are multiple addresses on the interface, an address in the same subnet as the range of given addresses should be used.</p> |
| <code>use-framed-as-classless</code> (yes / no; Default:) | |
| <code>use-radius</code> (yes / no / accounting; Default: no) | <p>Whether to use RADIUS server:</p> <ul style="list-style-type: none"> ▪ <code>no</code> - do not use RADIUS; ▪ <code>yes</code> - use RADIUS for accounting and lease; ▪ <code>accounting</code> - use RADIUS for accounting only. |

Menu specific commands

| Property | Description |
|----------------------|---|
| <code>setup()</code> | Start DHCP server setup wizard, which guides you through the steps to easily create all necessary |

configuration. Read [more](#)>>

Lease Store Configuration

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

This sub-menu allows the configuration of how often the DHCP leases will be stored on disk. If they would be saved on disk on every lease change, a lot of disk writes would happen which is very bad for Compact Flash (especially, if lease times are very short). To minimize writes on disk, all changes are saved on disk every `store-leases-disk` seconds. Additionally leases are always stored on disk on graceful shutdown and reboot.



Note: Manual changes to leases - addition/removal of static lease, removal of dynamic lease will cause changes to be pushed for this lease to storage.

This sub-menu has only one configurable property:

| Property | Description |
|--|---|
| <code>store-leases-disk</code> (<i>time immediately never</i> ; Default: 5m) | How frequently lease changes should be stored on disk |

Networks

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

| Property | Description |
|--|---|
| <code>address</code> (<i>IP/netmask</i> ; Default:) | the network DHCP server(s) will lease addresses from |
| <code>boot-file-name</code> (<i>string</i> ; Default:) | Boot file name |
| <code>caps-manager</code> (<i>string</i> ; Default:) | Comma-separated list of IP addresses for one or more CAPsMan system |

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| | managers. DHCP Option 138 (capwap) will be used. |
| dhcp-option (<i>string</i> ; Default:) | Add additional DHCP options from option list. |
| dns-server (<i>string</i> ; Default:) | the DHCP client will use these as the default DNS servers. Two comma-separated DNS servers can be specified to be used by the DHCP client as primary and secondary DNS servers |
| domain (<i>string</i> ; Default:) | The DHCP client will use this as the 'DNS domain' setting for the network adapter. |
| gateway (<i>IP</i> ; Default: 0.0.0.0) | The default gateway to be used by DHCP Client. |
| netmask (<i>integer: 0..32</i> ; Default: 0) | The actual network mask to be used by DHCP client. If set to '0' - netmask from network address will be used. |
| next-server (<i>IP</i> ; Default:) | IP address of next server to use in bootstrap. |
| ntp-server (<i>IP</i> ; Default:) | |

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| | the DHCP client will use these as the default NTP servers. Two comma-separated NTP servers can be specified to be used by the DHCP client as primary and secondary NTP servers |
| <code>wins-server</code> (IP; Default:) | The Windows DHCP client will use these as the default WINS servers. Two comma-separated WINS servers can be specified to be used by the DHCP client as primary and secondary WINS servers |

Leases

Sub-menu: /ip dhcp-server lease

DHCP server lease submenu is used to monitor and manage server's leases. The issued leases are showed here as dynamic entries. You can also add static leases to issue a specific IP address to a particular client (identified by MAC address) .

Generally, the DHCP lease it allocated as follows:

- an unused lease is in waiting state
- if a client asks for an IP address, the server chooses one
- if the client receives a statically assigned address, the lease becomes

offered, and then bound with the respective lease time

- if the client receives a dynamic address (taken from an IP address pool), the router sends a ping packet and waits for answer for 0.5 seconds. During this time, the lease is marked testing
- in the case where the address does not respond, the lease becomes offered and then bound with the respective lease time
- in other case, the lease becomes busy for the lease time (there is a command to retest all busy addresses), and the client's request remains unanswered (the client will try again shortly)

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 reacquires the address.



Note: IP addresses assigned statically are not probed!

Properties

| Property | Description |
|--|--|
| address (<i>IP</i> ; Default:) | Specify IP address (or ip pool) for static lease. If set to 0.0.0.0 - pool from server will be used |
| address-list (<i>string</i> ; Default:) | Address list to which address will be added if lease is bound. |
| always-broadcast (<i>yes / no</i> ; Default:) | Send all replies as broadcasts |
| block-access (<i>yes / no</i> ; Default: no) | Block access for this client |
| client-id (<i>string</i> ; Default:) | If specified, must match |

| | |
|---|--|
| | DHCP 'client identifier' option of the request |
| lease-time (<i>time</i> ; Default: 0s) | Time that the client may use the address. If set to 0s lease will never expire. |
| mac-address (<i>MAC</i> ; Default: 00:00:00:00:00:00) | If specified, must match the MAC address of the client |
| src-mac-address (<i>MAC</i> ; Default:) | Source MAC address |
| use-src-mac (<i>MAC</i> ; Default:) | Use this source MAC address instead |

Read only properties

| Property | Description |
|---|---|
| active-address (<i>IP</i>) | Actual IP address for this lease |
| active-client-id (<i>string</i>) | Actual client-id of the client |
| active-mac-address (<i>MAC</i>) | Actual MAC address of the client |
| active-server (<i>list</i>) | Actual dhcp server, which serves this client |
| agent-circuit-id (<i>string</i>) | Circuit ID of DHCP relay agent. If each character should be valid ASCII text symbol or else this value is |

| | |
|--|---|
| | displayed as hex dump. |
| <code>agent-remote-id</code> (<i>string</i>) | Remote ID, set by DHCP relay agent |
| <code>blocked</code> (<i>flag</i>) | Whether the lease is blocked |
| <code>expires-after</code> (<i>time</i>) | Time until lease expires |
| <code>host-name</code> (<i>text</i>) | Shows host name option from last received DHCP request |
| <code>radius</code> (<i>yes / no</i>) | Shows if this dynamic lease is authenticated by RADIUS or not |
| <code>rate-limit</code> (<i>string</i>) | Sets rate limit for active lease. Format is: rx-rate[/tx-rate] [rx-burst-rate[/tx-burst-rate] [rx-burst-threshold[/tx-burst-threshold] [rx-burst-time[/tx-burst-time]]]]. All rates should be numbers with optional 'k' (1,000s) or 'M' (1,000,000s). If tx-rate is not specified, rx-rate is as tx-rate too. Same goes for tx-burst-rate and tx-burst- |

| | |
|--|---|
| | threshold and tx-burst-time. If both rx-burst-threshold and tx-burst-threshold are not specified (but burst-rate is specified), rx-rate and tx-rate is used as burst thresholds. If both rx-burst-time and tx-burst-time are not specified, 1s is used as default |
| server (string) | Server name which serves this client |
| status (waiting testing authorizing busy offered bound) | <p>Lease status:</p> <ul style="list-style-type: none"> ▪ waiting - un-used static lease ▪ testing - testing whether this address is used or not (only for dynamic leases) by pinging it with timeout of 0.5s ▪ authorizing - waiting for response from radius server ▪ busy - this address is assigned statically to a client or already exists in the network, so it can not be leased ▪ offered - server has offered this lease to a client, but did not receive confirmation from the client ▪ bound - server has received client's confirmation that it accepts offered address, it is using it now and will free the address no later than the lease time |

Menu specific commands

| Property | Description |
|--------------------------|-------------|
| check-status (id) | |

| | |
|-------------------------------|--|
| | Check status of a given busy dynamic lease, and free it in case of no response |
| <code>make-static (id)</code> | Convert a dynamic lease to a static one |

Alerts

Sub-menu: /ip dhcp-server alert

To find any rogue DHCP servers as soon as they appear in your network, DHCP Alert tool can be used. It will monitor the ethernet interface for all DHCP replies and check if this reply comes from a valid DHCP server. If a reply from an unknown DHCP server is detected, alert gets triggered:

```
[admin@MikroTik] ip dhcp-server alert>/log print
00:34:23 dhcp,critical,error,warning,info,debug dhcp alert on Public:
    discovered unknown dhcp server, mac 00:02:29:60:36:E7, ip 10.5.8.236
[admin@MikroTik] ip dhcp-server alert>
```

When the system alerts about a rogue DHCP server, it can execute a custom script.

As DHCP replies can be unicast, the 'rogue dhcp detector' may not receive any offer to other dhcp clients at all. To deal with this, the rogue dhcp detector acts as a dhcp client as well - it sends out dhcp discover requests once a minute

Properties

| Property | Description |
|--|--|
| <code>alert-timeout</code> (<i>none time</i> ; Default: none) | Time after which alert will be forgotten. If after that time the same server is detected, new alert will be generated. If set to none |

| | |
|---|---|
| | timeout will never expire. |
| interface (string; Default:) | Interface, on which to run rogue DHCP server finder. |
| on-alert (string; Default:) | Script to run, when an unknown DHCP server is detected. |
| valid-server (string; Default:) | List of MAC addresses of valid DHCP servers. |

Read only properties

| Property | Description |
|--------------------------------|--|
| unknown-server (string) | List of MAC addresses of detected unknown DHCP servers. Server is removed from this list after alert-timeout |

Menu specific commands

| Property | Description |
|-------------------------|----------------------------------|
| reset-alert (id) | Clear all alerts on an interface |

DHCP Options

Sub-menu: /ip dhcp-server option

With help of DHCP Option list, it is possible to define additional custom options for DHCP Server to advertise. Option precedence is as follows:

- radius,
- lease,
- server,
- network.

This is the order in which client option request will be filled in.

According to the DHCP protocol, a parameter is returned to the DHCP client only if it requests this parameter, specifying the respective code in DHCP request Parameter-List (code 55) attribute. If the code is not included in Parameter-List attribute, DHCP server will not send it to the DHCP client.

Properties

| Property | Description |
|---|---|
| code (integer:1..254; Default:) | dhcp option code. All codes are available at http://www.iana.org/assignments/bootp-dhcp-parameters |
| name (string; Default:) | Descriptive name of the option |
| value (string; Default:) | <p>Parameter's value.</p> <p>Starting from v6.8 available data types for options are:</p> <ul style="list-style-type: none">▪ 0xXXXX - hex string (works also in v5)▪ 'XXXXX' - string (works also in v5 but without ' ' around the text)▪ \$(XXXXX) - variable (currently there are no variables for server)▪ '10.10.10.10' - IP address▪ s'10.10.10.10' - IP address converted to string▪ '10' - decimal number▪ s'10' - decimal number converted to string <p>RouterOS has predefined variables that can be used:</p> <ul style="list-style-type: none">▪ HOSTNAME - client hostname▪ RADIUS_MT_STR1 - from radius MT attr nr. 24▪ RADIUS_MT_STR2 - from radius MT attr nr. 25▪ REMOTE_ID - agent remote id▪ NETWORK_GATEWAY - first gateway from '/ip dhcp-server network', note that this option won't work if used from lease |

Now it is also possible to combine data types into one, for example:
"0x01'vars'\$(HOSTNAME)"

For example if HOSTNAME is 'kvm', then raw value will be
0x0176617264736b766d.

raw-value
(HEX string)

Read only field which shows raw dhcp
option value (the format actually sent
out)

Example

Classless Route

A classless route adds specified route in clients routing table. In our example, it will add

- dst-address=160.0.0.0/24 gateway=10.1.101.1
- dst-address=0.0.0.0/0 gateway=10.1.101.1

According to RFC 3442: The first part is the netmask ("18" = netmask /24). Second part is significant part of destination network ("A00000" = 160.0.0). Third part is IP address of gateway ("0A016501" = 10.1.101.1). Then There are parts of the default route, destination netmask (0x00 = 0.0.0.0/0) followed by default route (0x0A016501 = 10.1.101.1)

```
/ip dhcp-server option
add code=121 name=classless value=0x18A000000A016501000A016501
/ip dhcp-server network
set 0 dhcp-option=classless
```

Result:

```
[admin@MikroTik] /ip route> print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r - rip, b - bgp, o - ospf,
m - mme, B - blackhole, U - unreachable, P - prohibit
# DST-ADDRESS      PREF-SRC  GATEWAY      DISTANCE
0 ADS  0.0.0.0/0      10.1.101.1    0
1 ADS  160.0.0.0/24   10.1.101.1    0
```

Much more robust way would be to use built in variables, previous example can be rewritten as:

```
/ip dhcp-server option
```

```
add name=classless code=121 value="0x18A00000\$(NETWORK_GATEWAY)0x00\$(NETWORK_GATEWAY)"
```

Auto Proxy Config

```
/ip dhcp-server option
add code=252 name=auto-proxy-config value="'http://autoconfig.something.lv/wpad.dat'"
```

DHCP Option Sets

Sub-menu: /ip dhcp-server option sets

This menu allows to combine multiple options in option sets, which later can be used to override default DHCP server option set.

| Property | Description |
|---|--|
| name (<i>string</i> ; Default:) | Name of the option set. |
| options (<i>list</i> ; Default:) | List of options defined in options menu. |

Configuration Examples

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