DHCP Turbo Reference

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Introduction

DHCP Turbo is a carrier-grade provisioning DHCP server platform for high volume next-generation public access networks. With dual multi-threaded engines supporting both IPv4 and IPv6, it has been engineered from the ground up to provide extreme reliability, performance and scalability under all network conditions.

In addition to providing a single unified model for DHCP across IPv4 and IPv6 networks, DHCP Turbo is highly flexible, with more than 20 optional plugins that extend and enhance the basic DHCP services.

Standards Compliance

DHCP Turbo is compliant with more than 40 IETF standards, as well as standards from the Cablelabs® Consortium and various other entities. This list is not exhaustive, as new standards are added regularly.

IETF STANDARDS

- RFC 951, Bootstrap Protocol
- RFC 2131, Dynamic Host Configuration Protocol
- RFC 2132, DHCP Options and BOOTP Vendor Extensions
- RFC 2241, DHCP Optios for Novell Directory Services
- RFC 2242, Netware/IP Domain Name and Information
- RFC 2485, DHCP Option for the Open Group's User Authentication
- RFC 2563, DHCP Option to Disable Stateless Auto-Configuration in IPv4 Clients
- RFC 2610, DHCP Options for Service Location Protocol
- RFC 2865, Remote Authentication Dial-In User Service (RADIUS)*
- RFC 2937, The Name Service Search Option for DHCP
- RFC 3004, The User Class Option for DHCP
- RFC 3011, The IPv4 Subnet Selection Option for DHCP
- RFC 3046, DHCP Relay Agent Information Option
- RFC 3074, DHCP Load Balancing Algorithm
- RFC 3256, The DOCSIS® Device Class DHCP Relay Agent Information Sub-option
- RFC 3315, Dynamic Host Configuration Protocol for IPv6
- RFC 3361, DHCPv4 Option for SIP servers
- RFC 3397, DHCP Domain Search Option
- RFC 3442, The Classless Static Route Option for DHCPv4
- RFC 3495, DHCP Option for CableLabs Client Configuration

- RFC 3527, DHCPv4 Link Selection Suboption for the Relay Agent Information Option
- RFC 3736, Stateless DHCP Service for IPv6
- RFC 3825, DHCP Option for Coordinate-based Location Configuration Information
- RFC 3925, Vendor-Identifying Vendor Options for DHCPv4
- RFC 3993, Subscriber-ID Suboption for the DHCP Relay Agent Option
- RFC 4014, RADIUS Suboption for the DHCP Relay Agent Information Option
- RFC 4174, The IPv4 Option for Internet Storage Name Service
- RFC 4243, Vendor-Specific Information Suboption for the DHCP Relay Agent Option
- RFC 4280, DHCP Options for Broadcast and Multicast Control Servers
- RFC 4388, DHCPv4 Leasequery
- RFC 4578, DHCP Options for the Intel Preboot Execution Environment (PXE)
- RFC 4649, DHCPv6 Relay Agent Remote-ID Option
- RFC 4702, DHCPv4 Client Fully Qualified Domain Name Option
- RFC 4704, DHCPv6 Client Fully Qualified Domain Name Option
- RFC 4776, DHCPv4 and DHCPv6 Option for Civic Addresses Configuration Information
- RFC 4833, Timezone Options for DHCP
- RFC 5007, DHCPv6 Leasequery
- RFC 5010, The DHCPv4 Relay Agent Flags Suboption

Features

- Hardened engines withstand even the most sophisticated attacks from malicious devices
- Provisions IP addresses, networks and DHCP options using a simple yet highly flexible domain model
- Multi-platform architecture gives you the freedom to choose the system that best suits your needs
- ACID transactions provide guaranteed database consistency
- Advanced plugin architecture allows for future extensions
- First-time devices can be automatically classified and assigned to domains of your choosing
- Compliant with more international DHCP standards than any other server
- Full and seamless support for IPv6
- Runtime expression evaluation provides the ultimate in flexibility; DHCP option values can be automatically varied using almost any criteria
- Full-featured user interface manages any number of servers
- Flexible event publishing
- Multi-way Dynamic DNS synchronizes host names and addresses with your DNS server(s) using a flexible model
- Hundreds of system counters for analyzing the behavior of your network
- Complete packet collection provides a wealth of historical information
- Online re-configuration; no restarts required
- Easily integrates with third party software
- Flexible queries allow you to easily locate devices and associated leases

Supported Platforms

LINUX

- RHEL5 x86_64
- RHEL5 i686
- RHEL6 x86_64
- RHEL6 i686

SOLARIS

- Solaris 10 sparc

MICROSOFT WINDOWS

- Windows Server 2000/2003/2008
- Windows XP/Vista/7

System Requirements

MINIMAL

- CPU: 1GHz x86_64 or i686
- RAM: 1GB
- DISK: 2GB

Installing on Linux®

The software ships as a single tar.gz file containing RPMs for the daemon and various plugins. You may elect to install only the plugins you require for your particular deployment.

To install the packages, first untar the distribution file, then install the prerequisites, and afterwards install the services and plugins.

The daemon is registered automatically during installation, but the service is not automatically started.

Use the sysv script (`/etc/init.d/dhcptd`) to start the service.

Installing on Solaris®

Before installing this product you must ensure that the libgcc and firebird packages are installed. The libgcc package can be obtained from www.sunfreeware.com, and the firebird package is distributed with this software.

The software ships as a single tar.gz file containing Solaris package files for the daemon and various plugins. You may elect to install only the plugins you require for your particular deployment.

To install the packages, first untar the distribution file. Then install the prerequisites, and afterwards install the service and plugins using the `pkgadd` command.

You may want to create a startup script to launch the daemon (`dhcptd`) each time the machine is started.

Installing on Windows®

If you received a CD

Insert the CD into the drive. The installation should start automatically. Alternatively, run `SETUP.EXE` to begin installation.

If you received the software electronically

The DHCP Turbo software package is transmitted as a single file. Copy this file to a temporary directory on your hard drive, then double-click the file to start the installation process. Setup allows you to specify *Full* or *Custom* installations. If this is your first time installing the DHCP Turbo package you'll want to choose a Full install.

After selecting the installation directory and program group, the setup program copies the necessary files to your hard disk and registers the services. Once this is complete you should configure the software by clicking theDHCP Turbo icon on your desktop.

Uninstalling the software

Linux

Use the distribution specific add/remove software utility or open a super-user terminal window and use `rpm -e` to remove each of the packages.

Solaris

Open a *su terminal* and use `pkgrm` to remove each of the packages.

Windows

Click the uninstall icon in the DHCP Turbo program group, or, alternately, use the Control Panel's Add/Remove Programs applet.

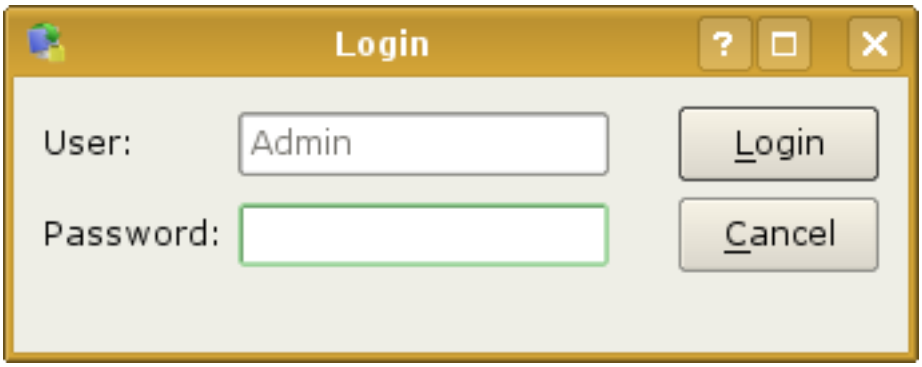
Registering your product

When you first start the user interface, DHCP Turbo will ask you to activate your product. If you are deploying the product yourself, mail your activation code to *activation@weird-solutions.com* to receive a product serial number, otherwise obtain the serial number from your local support representative.

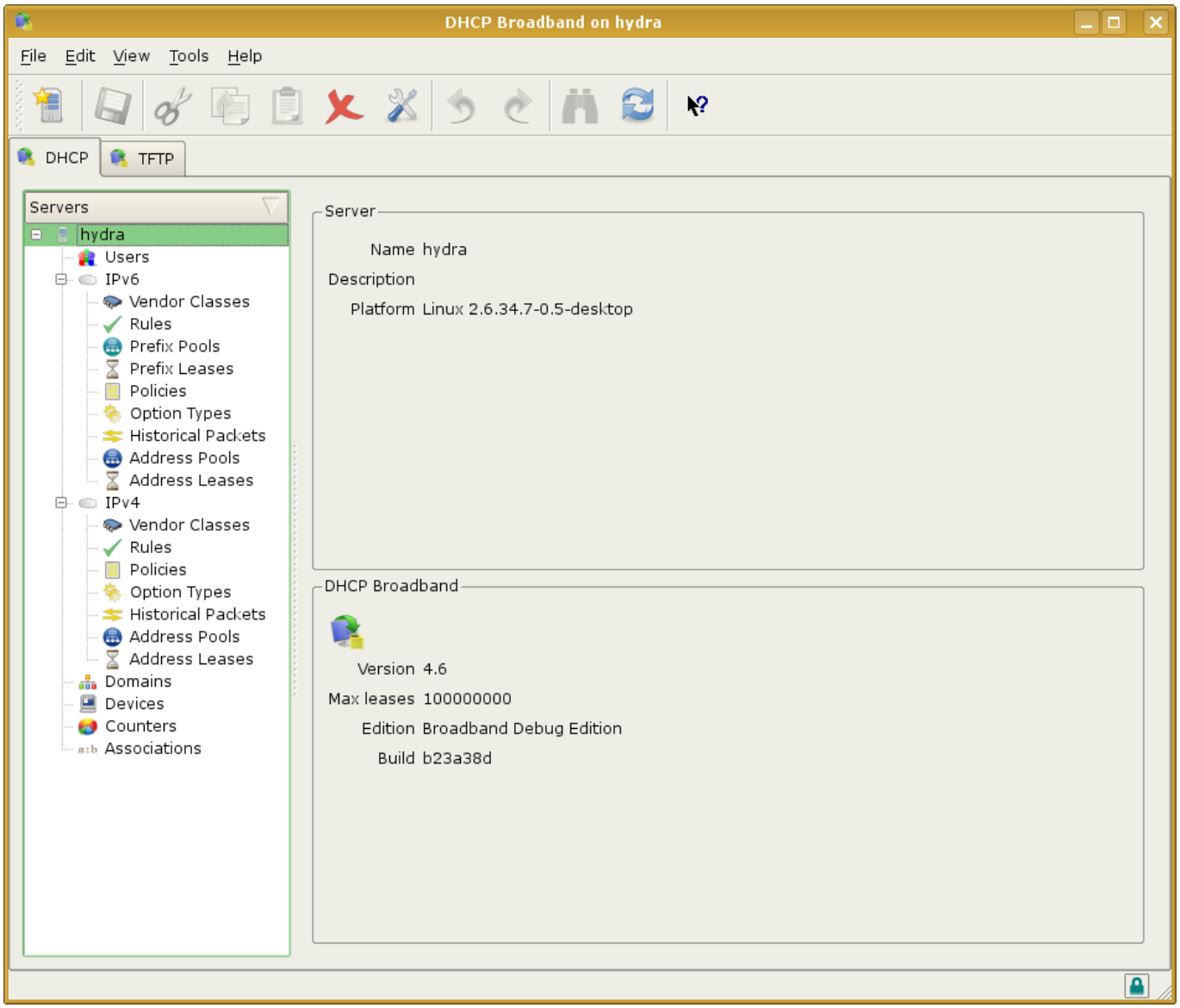
DHCP Reference

Login

To log into the system, open the user interface and double-click the "localhost" server in the upper left. If this is a first-time installation, the user name is *admin*, and the password is *admin*.



After login, you are presented with the main interface for managing your DHCP server. This interface can be used to add and remove address pools, device accounts, option policies, users, and much more.



When you first connect to the DHCP server you are asked to register the software. Registration creates a unique id for your installation and offers to register the software with Weird Solutions. Registration is completely optional and can be completed at any time prior to purchasing the software.

After registration is complete, you are presented with a one-time system configuration screen. This configuration screen will create some basic rules for your DHCP server, allowing it to classify all of the devices on your network as they receive IP addresses.

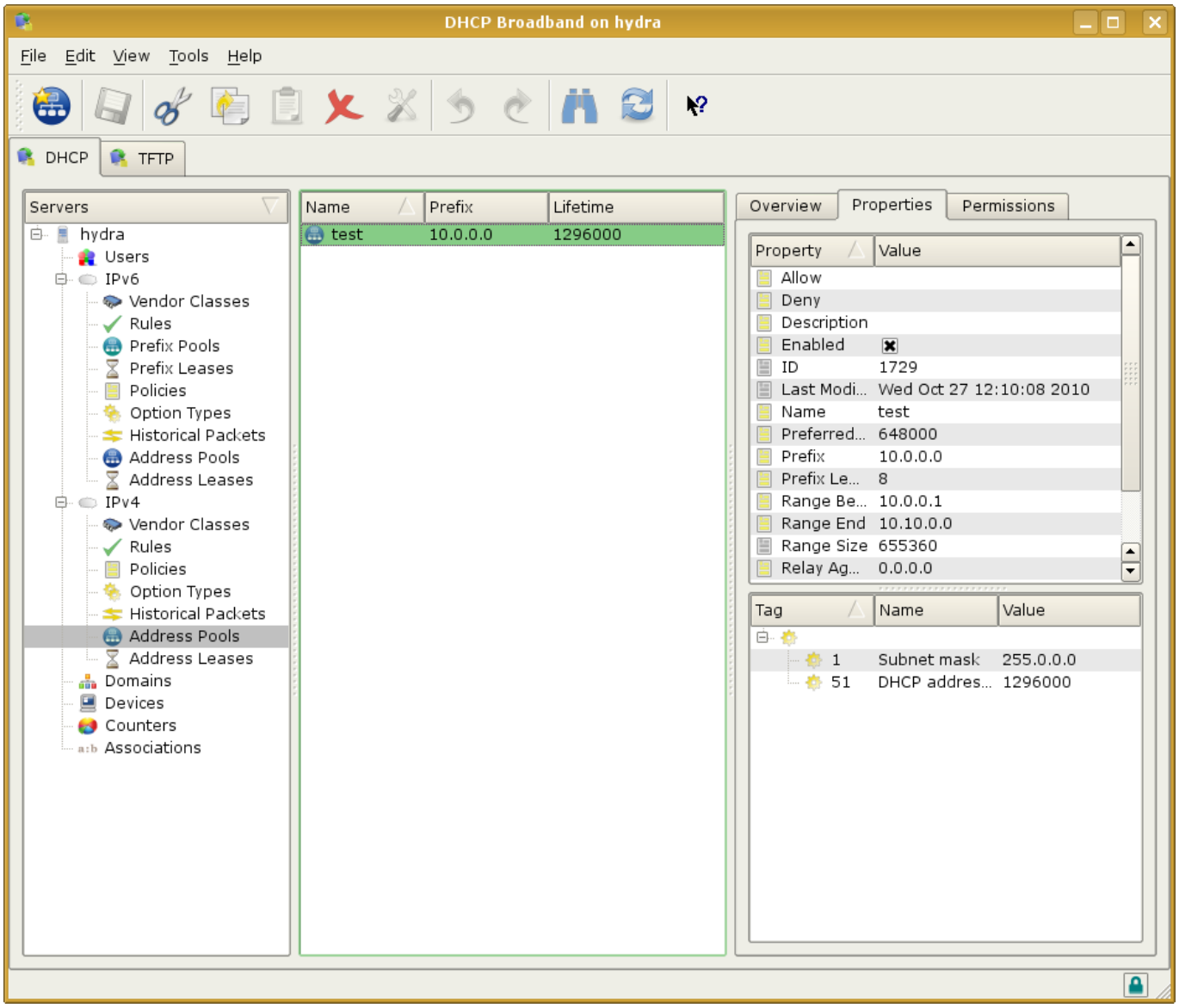
Basic Configuration

Basic configuration of your DHCP server is straightforward. You must define one or more address pools from which the DHCP server will assign IP address leases.

Address Pools

An address pool specifies a range of addresses that the server can lease to your devices. This is the primary means of automatically managing the IP addresses on your network.

To create an address pool, choose **File→New→Address Pool** in the user interface.



The fields for an address pool are:

Field	Description
Name	The name of this address pool. Must be unique for all address pools in this DHCP context.
Relay	If this pool is for DHCP clients on the same network segment as the DHCP server, enter a value of `0.0.0.0`. If this pool is for clients on a remote network segment, enter the IP address of the interface on the relay agent that's closest to the client. Specify multiple relay agent addresses by separating them with a comma.
Range start	The first IP address in the range of addresses to be leased.
Range stop	The last IP address in the range of addresses to be leased.
Prefix	The network number on which the IP address range resides, e.g. `192.168.1.0` is the network for address 192.168.1.1/24.
Prefix length	The number of significant bits in the prefix part of the network. 8, 16 and 24 are common prefix lengths.
Valid lifetime	The total amount of time, in seconds, that an address from this range can be leased. Leases that have been inactive for this amount of time are considered abandoned.
Preferred lifetime	The amount of time, in seconds, before an address leased from this pool must have the lease extended.
Weight	A DHCP client may be able to pick from multiple pools for a specific network segment. Setting the pool **weight** allows you to induce the server to prefer some pools over others. Use a higher number to give the pool preference over other available pools. The default weight is 0.
Exclusions	This field lists addresses within the pool range that should not be leased.
Policies	A comma-delimited list of policies to be used for every device that receives an address from this pool

For each pool there is also a pool-specific policy that can hold configuration information specific to the network on which this pool resides. The most common use of the pool-specific policy is to define the *Gateways* option (default gateway).

When a DHCP client on your network requests an address from the DHCP server, the server chooses a pool using a four stage process of reduction:

1. Find the relay agent address the client is booting through and search for all pools associated with that address.
2. Using the security access token assigned by the provisioner subsystem, discard pools the client doesn't have authorization for.
3. Check the **Allow** and **Deny** expressions for each pool. Discard pools that are disallowed by these expressions.
4. Of the remaining pools, choose the one with the highest weight that still has available addresses.

If a pool belongs to the **All devices** domain (the default), **step 2** will not discard the pool. By moving the pool from the **All devices** domain to a more restricted domain you can effectively allow or deny access to the pool based on the domains to which the DHCP client belongs.

Note
By default, new pools belong to the **All devices** domain. This ensures that, unless you specify otherwise, pools you create are available to all DHCP clients on your network.

Dynamic Address Bindings

Dynamic address bindings are automatically created by the DHCP server using the information provided from your address pools. A dynamic address binding is a DHCP lease that allots an IP address to a specific device for a certain amount of time.

A dynamic address binding contains these fields:

Field	Description
Client identifier	The unique device identifier
Fixed	This setting is false for dynamic bindings
IP address	The leased address
Commit time	The time at which this lease was last obtained or extended
Duration	The length of time this lease is valid
Relay	The relay agent the client booted through
Protocol	The specific protocol the client used to obtain this address lease
Pool	The name of the address pool used to create this lease
Trusted ID	An identifier for the device or circuit provided by the relay agent
Trusted ID type	The type of trusted identifier provided by the relay agent

The DHCP server automatically associates dynamic address bindings with one or more domains. If a device is able to obtain a lease from an address pool, it will be able to extend that lease as long as it still has access to the pool.

Tip
To "take away" a lease from a device, locate the lease, then under **Permissions** remove all domains from the lease. This ensures that the lease cannot be renewed, but the original contract time is still honored. Eventually the lease will expire and the IP address will be available for re-use.

Fixed Address Bindings

A *fixed address binding* is a specific kind of DHCP lease that guarantees that the recorded IP address will always be associated with the device named in the lease. Once a fixed address binding is made, the DHCP server will never use the binding's address with another client until you delete the binding or convert it to a dynamic binding.

You can create fixed address bindings manually or you can convert a dynamic binding to a fixed binding. To convert a dynamic binding to fixed, simply change the **Fixed** field in the binding to `true`.

When creating a fixed address binding you must specify the relay agent address to be associated with the binding. You can create different bindings for the same device on different network segments by specifying different relay addresses.

Note
A fixed address binding is not required to be associated with any address pool. It is a perfectly acceptable configuration to create fixed bindings without having any address pools.

When creating a fixed address binding from the command line interface, the following fields are not required:

- Commit time
- Protocol
- Pool
- Trusted ID
- Trusted ID type

Prefix Pools (Prefix Delegation)

From the standpoint of configuring DHCP, the IPv6 term *prefix* is essentially interchangeable with the IPv4 term *subnet*. (For a description of the difference, refer to RFC 5942.)

DHCP for IPv6 (DHCPv6) allows a DHCP client to request a lease for an **entire prefix**. When a DHCP server issues a lease for a prefix, this is called *Prefix Delegation*. The server is effectively delegating all address in the prefix to the DHCP client for however long the prefix lease is valid.

Residential gateways that support IPv6 will typically request one IPv6 address for their public-facing network interface and one IPv6 prefix for their private-facing network interface. This allows the gateway to issue its own leases to the devices that are connecting through the gateway.

When the lease for a delegated prefix expires, the prefix and all associated IP addresses within that prefix are returned to the DHCP server.

Prefix pools are functionally similar to Address Pools. The main difference with prefix pools is that once you've defined the number of bits in your prefix, you must then define the number of bits to use when splitting that prefix into smaller prefixes.

Once a prefix pool is defined, the server splits the prefix into sub-prefixes and proceeds to lease the sub-prefixes to the devices on your network that request a delegated prefix.

Dynamic Network Bindings

Dynamic network bindings are functionally similar to Dynamic Address Bindings.

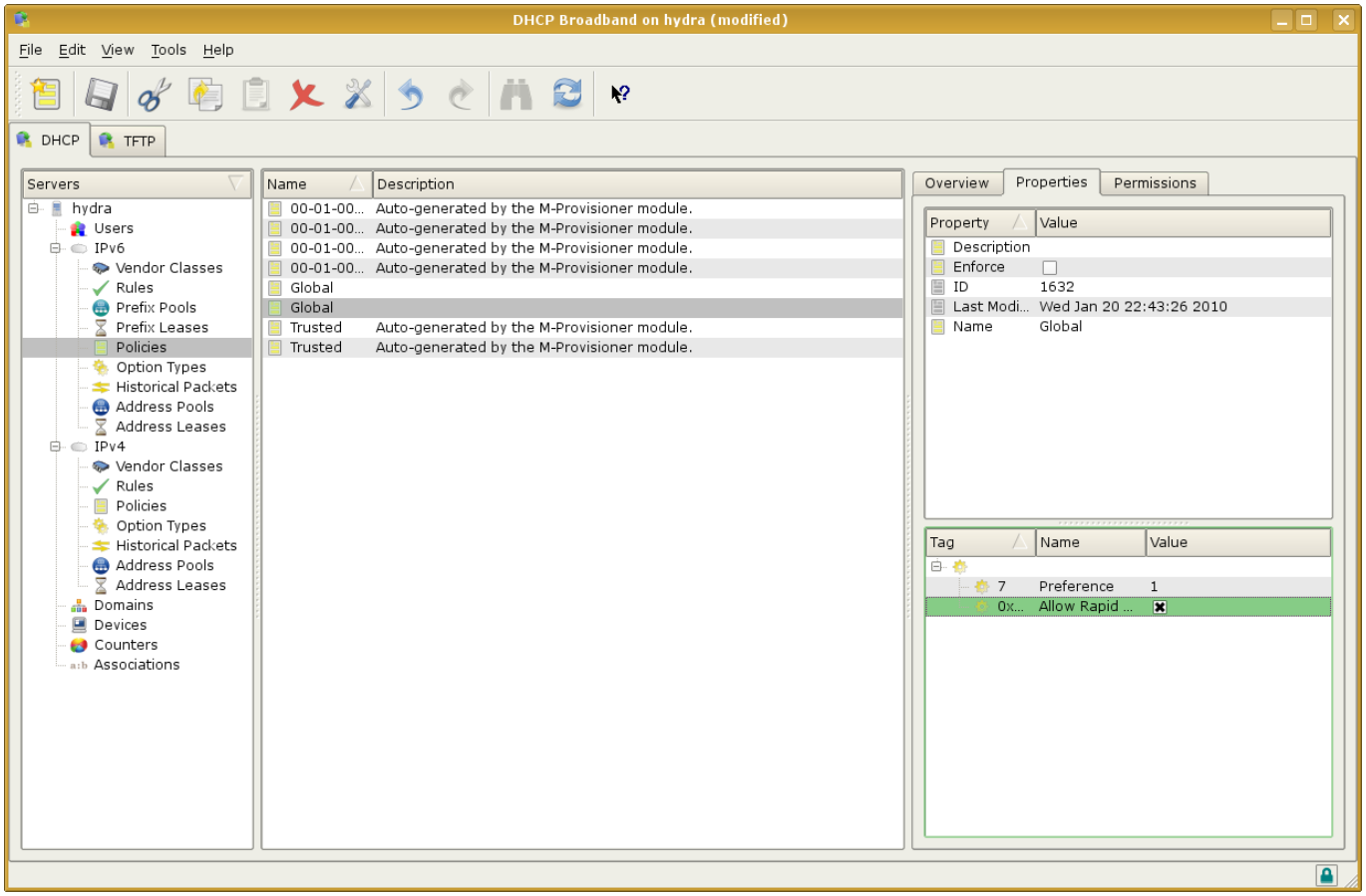
Fixed Network Bindings

Fixed network bindings are functionally similar to Fixed Address Bindings.

Policies

After defining your pools, you may want to define one or more policies to be associated with the different kinds of devices on your network.

A DHCP policy, which is simply a collection of DHCP options, is the primary means for giving a device extra configuration settings. A policy can hold any number of DHCP options, and any number of policies can be applied to a given device. There are two basic kinds of policies: **Enforced** and **Optional**.



When a DHCP client device contacts the server, the provisioner module determines the domains the device belongs to, and the DHCP engine uses this information to locate all policies for the device.

For every **enforced** policy applicable to the device, the DHCP server provides the device with *every option* in all enforced policies.

Devices are only provided with options from **optional** policies when the device explicitly requests values for those options.

Every domain you create with the web-based interface has one enforced policy and one optional policy. Having these two policies associated with the domain creates a set of common response options for devices using this domain, with certain options only provided when asked for.

For example, suppose you do the following:

- Create a domain named *Cablemodems*
- Insert option 4, *Time servers* into the domain's enforced policy and set an appropriate value
- Insert option 6, *Domain name servers* into the domain's optional policy and set an appropriate value

With this configuration, every will be given the *Time servers* option, but only cable modems that request the *Domain name servers* option will receive that information.

Since policies are associated with domains, it's straightforward to cause a device to receive one set of options or another by moving the device account between domains.

DHCP Options

DHCP options are operational settings that the DHCP server can distribute to devices on your network. The system is pre-configured with a wide array of IETF-standard DHCP options, as well as a set of *Control Options* that can alter the DHCP server's runtime behavior. In addition, the system allows you to define your own site-specific options.

DHCP options are defined in a policy, address pool or prefix pool.

Because policies belong to domains, it's easy to provision a set of DHCP options to a device: simply associate the device account with the domains that contain the policies the device should use.

> Suppose you have two geographical domains, *Charlotte* and *Atlanta*, and the policies belonging to these domains specify different DHCP option values. A device that belongs to the *Charlotte* domain would receive a different set of DHCP options than a device that belongs to the *Atlanta* domain.

Of course, a network device may belong to as many domains as you require, so you are free to mix and match domains to suit your provisioning model. Having Class-of-Service domains combined with geographical domains is one approach.

Assigning a device to a domain isn't the only way to provision DHCP options. Each option has an associated value, and that value can be a literal, such as *192.168.1.1* or it can be an expression that's dynamically calculated based on criteria you choose. For example, the "TFTP server" option could be calculated as:$RELAY.ADDRESS() + 1. This expression simply assumes that the address of a client's closest TFTP server is the next address in sequence after the relay agent's address.

Server Control Options

The DHCP server recognizes a set of *Control Options* that are not standard DHCP options. These options can be used to control various aspects of the DHCP server's behavior. Control Options are never transmitted to a device.

To define a Control Option in a policy or pool, select the *Server Control* class of options, then add the option you require.

Control Options can be defined in any resource that accepts standard DHCP options. If a device on your network uses a policy or pool that contains a Control Option, the DHCP server will alter its behavior for that device according to the option setting.

For Example

The Control Option *DDNS update server* can be used to specify that a dynamic DNS update be directed to a specific DNS server on your network. If this option is defined in a policy, devices that use the policy will have their DNS updates sent to the DNS server defined in this option. Devices not using this policy will have their DNS updates sent to the system default DNS server.

Vendor-specific options

Vendor-specific options are a special class of DHCP options that are specific to a particular kind of device, model or vendor. The system supports a range of vendor-specific options, and new options can be easily added.

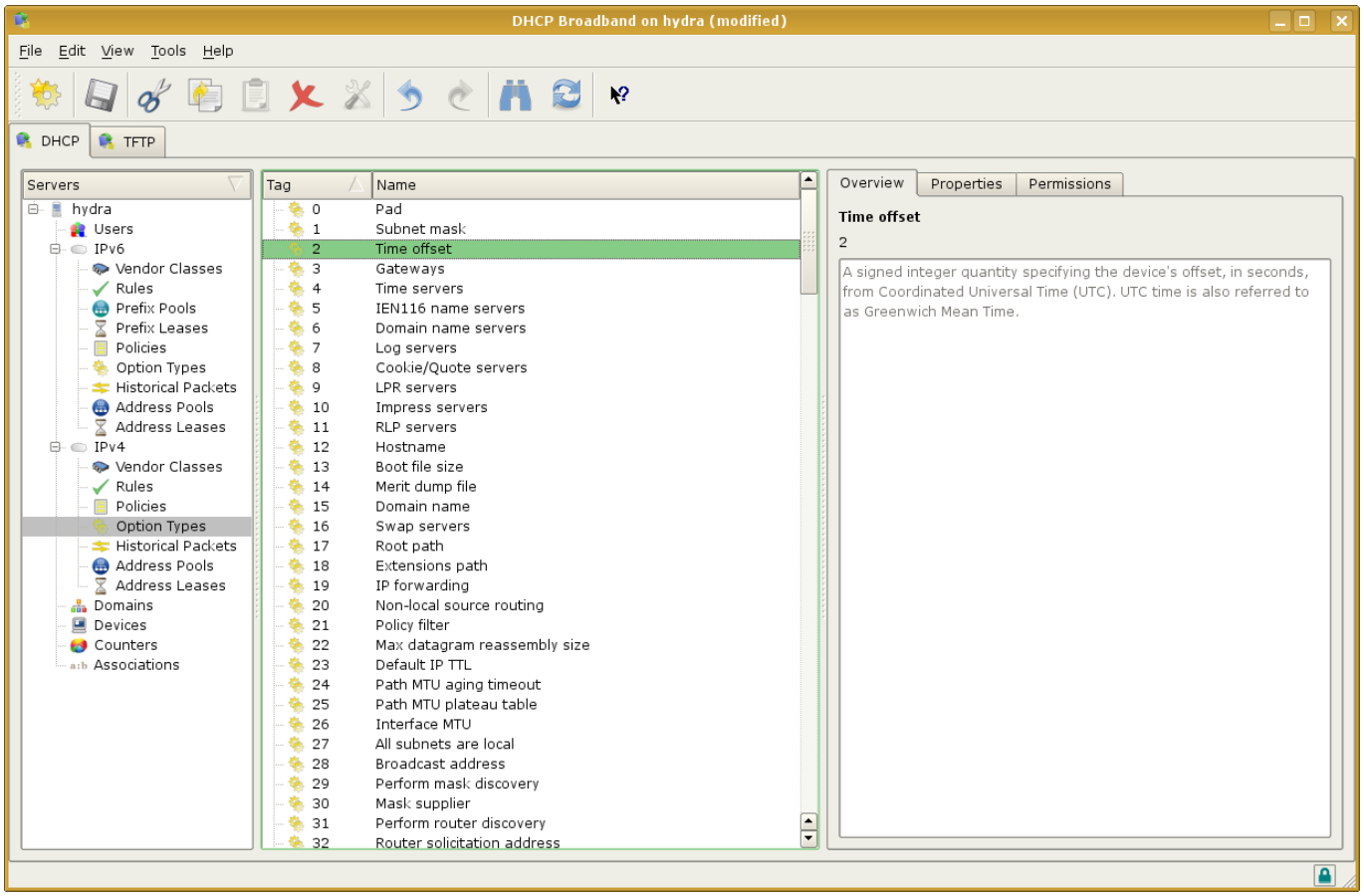
For DHCPv4, you can add a vendor-specific option to a policy by first adding the Class Identifier option and setting its value to anything that matches the vendor class. You can then add vendor-specific options to the policy.

When using vendor-specific options in DHCPv4, only one class of vendor-specific options can be added to any given policy. The system does not support adding vendor-specific options from different vendors to a single DHCPv4 policy.

For DHCPv6, you can add a vendor-specific option to any policy you deem appropriate. Multiple kinds of vendor-specific options can be added to a single policy, but a device will only receive the vendor-specific options that it is capable of understanding.

Option Types

Option types are *declarations* of DHCP options. They are not actual options, merely descriptions of options the server should be prepared to encounter. Option types specify a full range of details for DHCP options, including the tag number, data type, value limits, etc.



For every DHCP option the server receives there should be a corresponding Option Type that describes the option. If the DHCP server receives a packet that contains an unknown option, processing for that option is skipped.

Option types are quite complex because they describe in detail the complete characteristics of DHCP options. The fields of an option type are described below, with descriptions for each field.

Field	Description
tagpath	The option's unique tag. For many options this may simply be a number, but for options that must be encoded inside other options this will be a path of option tags such as `43/1`.
type	One of the predefined option type names. Type names are listed in the table below.
name	The official name of the option
class	An arbitrary name for grouping similar options
description	A human-readable description for this option
user_definable	Whether or not a user can set a value for this option. Can be `allowed`, `disallowed` or `required`.
max_instances	An integer specifying the maximum number of instances of this option that can be defined. 0 means unlimited. Default is 1.
default_value	A string representing the default value for this option, if there is one. The default value is used by the user interface when presenting the operator with a suggested value for this option.
arrayed	A boolean value indicating whether or not more than one element can exist in the option. The default is false.
unit	A string representing the unit of measurement for this option value. This text is displayed for operators when editing option values.
signed	A boolean value for numeric types that indicates whether or not the elements are signed. The default is false.
null_terminated	A boolean value for string types indicating whether or not to use a null terminator on binary output. The default is false.
min_value	An integer value for numeric types that specifies the minimum allowed value this option may hold.
max_value	An integer value for numeric types that specifies the maximum allowed value this option may hold.
input_type_encoding_value	An integer specifying whether this option has a type field. This **input** setting is used when reading the option from raw binary format. If this value is -1 (the default), this option does not have a type-encoding field. A value of 0 or greater indicates that this option a specific type encoding, and the specified value denotes the type. Type encodings are option-specific.
output_type_encoding_value	An integer specifying whether this option has a type field. This **output** setting is used when writing the option to raw binary format. If this value is -1 (the default), this option does not have a type-encoding field. A value of 0 or greater indicates that this option a specific type encoding, and the specified value denotes the type. Type encodings are option-specific.
fixed_offsets	This field is for fixed_offset type options only. It specifies a set of offsets where each contained tag should be found. The format is `tag/offset/width` (where `width` is in bytes), and multiple offsets are separated with a comma.
vendor_id	An integer representing the IANA-registered vendor ID. When non-zero, this number indicates to any subencoded options that their metadata is specific to this vendor. The default value is 0, which indicates that any subencoded options are not vendor-specific.
vendor_oro	A boolean value indicating whether this option defines a vendor-specific option-request-option (ORO). A vendor-specific ORO is used by a DHCP client to request a specific set of options from a DHCP server.
context_vendor_id	This option is used to indicate to the DHCP server that another option in the packet currently being processed holds information about the vendor identifier that should be used when reading suboptions of this option.

Field	Description
len_prefix_width	An integer that specifies whether each element in this option should be preceeded with a length field of this size (in bytes). The default value of 0 indicates that option elements are not length prefixed.
subtag_width	An integer value for options that hold options which specifies the width of the **tag** field for suboptions. The default value is the same as the DHCP protocol being used.
sublen_width	An integer value for options that hold options which specifies the width of the **len** field for suboptions. The default value is the same as the DHCP protocol being used.
subtype_width	An integer value for options that hold options which specifies the width of the **type** field for suboptions that are type-encoded. The default value is the same as the DHCP protocol being used.

An option may be declared as one of the following types:

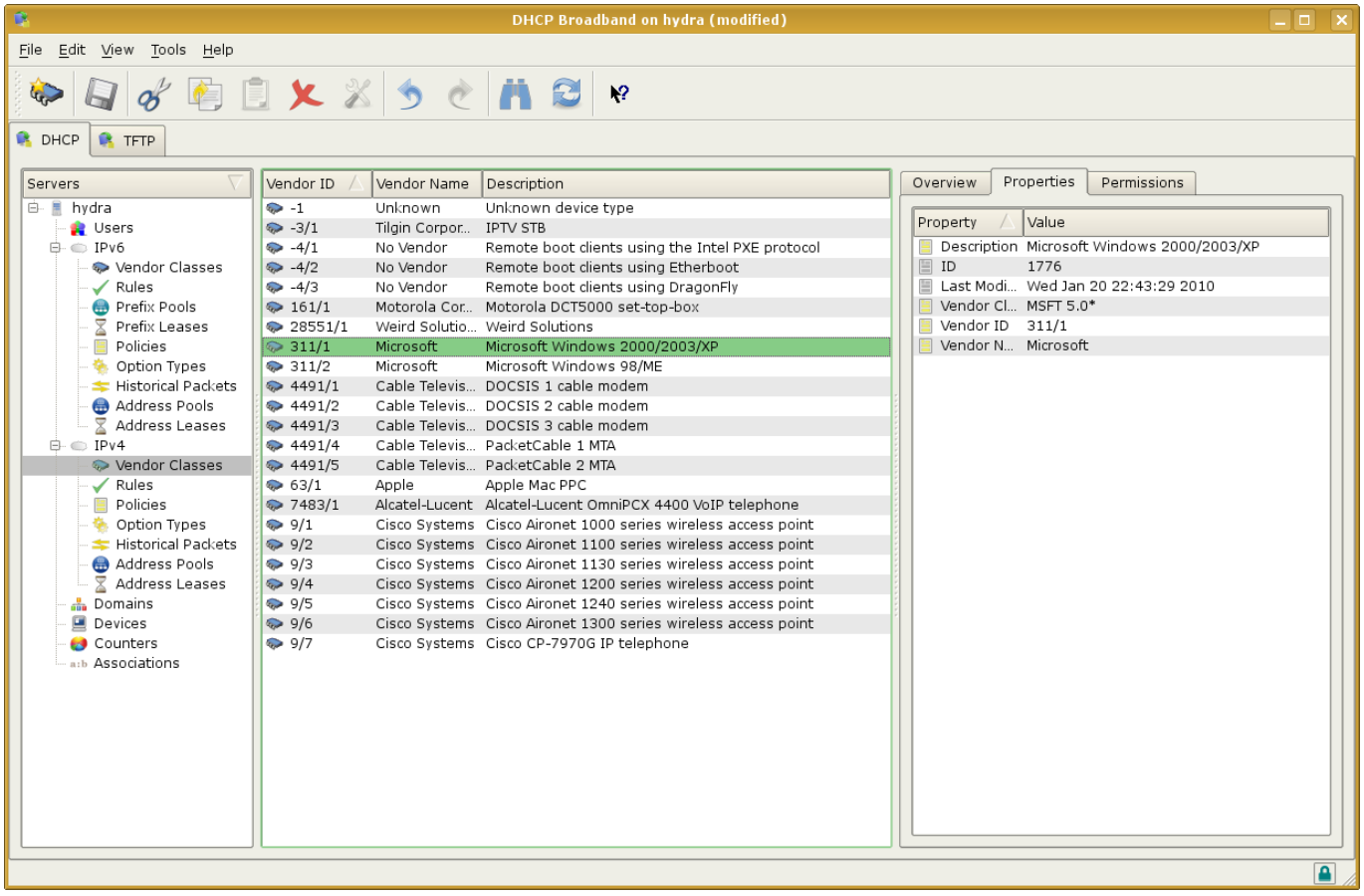
Name	Description
8bit	An 8 bit integer value
16bit	A 16 bit integer value
24bit	A 24 bit integer value
32bit	A 32 bit integer value
64bit	A 64 bit integer value
128bit	A 128 bit integer value
string	An ASCII string
ipaddress	An ip address
ip_endpoint	An ip endpoint (ip:port)
boolean	An 8 bit boolean value
time	A 32 bit time value
byte_sequence	A sequence of arbitrary bytes
subencoded	An option that can hold child options
topencoded	An option that can hold top-level options
dnsname	An RFC 1035 DNS name
expression	An expression that evaluates to a value at runtime
control	A DHCP protocol-control option
fixed_offset	An option that holds child options that are not tag/len/data encoded
varbind	An snmp variable binding. This may also be written as `snmp_oid`.

Vendor Classes

Vendor classes are a convenient way of organizing the different kinds of devices that may appear on your network.

DHCP packets typically contain information that describes the kind of device communicating with the server. Instead of writing an expression to fully analyze all possible combinations of a DHCP packet, you can call the $DEVICE.TYPEID() function. This function returns a number that indicates the exact type of device communicating with the server.

The $DEVICE.TYPEID() function uses vendor classes to determine the type of device that is requesting DHCP service.



The DHCP server package ships with vendor-specific definitions for a few common devices, but more vendor classes can be added at any time.

A vendor class object (and the corresponding definition file) contains these fields:

Field	Description
vendor_id	A *numeric path*, where the first element is the IANA-assigned enterprise identifier for this vendor, followed by one or more numbers (assigned by Weird Solutions) that represent this specific device model.
vendor_class	A string that is used to match the vendor class received from the client (DHCPv4 option 60 or DHCPv6 option 16/2). For example, if a client sends a vendor class with the text "kazoo", and there is a vendor class matching this text, the device is assumed to be manufactured by that vendor.
vendor_name	The full name of the vendor that manufactures this equipment. Used for display purposes when viewing network devices.
description	A description for this vendor. Used for display purposes.

Choosing a vendor_class value

The **vendor_class** field is the most important part of a DHCPv4 vendor class definition. This is because the text in this field determines how the server identifies the device, and consequently determines whether or not the server is capable of reading device-specific options (option 43 suboptions).

Wildcards can be used to match text in the vendor class field, but you should take care not to make the wildcards match too loosely. For example, if one kind of device sends a vendor class of "kazoo" and another kind of device sends "kazam", having a wildcard entry for kazoo with the text "ka*" would inadvertently match two kinds of devices to one vendor.

You can use the asterisk (*) and question mark (?) characters for wildcard matching. Asterisk matches multiple characters, whereas the question mark matches one character only.

IANA Enterprise Identifiers

IANA enterprise identifiers (EIDs) are unique numbers that are assigned to organizations worldwide by the Internet Assigned Numbers Authority. The IANA website is http://www.iana.org.

The DHCP protocol uses IANA enterprise identifiers to represent specific vendor options. The DHCP server adds further qualifiers to IANA enterprise numbers to denote specific kinds of devices from a single manufacturer. These qualifiers have the form *EID/subid*.

How vendor classes relate to options

Some subencoded options such as DHCPv4 option 43 and DHCPv6 option 17 can contain suboptions that are specific to a particular vendor. When the server receives a packet that contains option 43, for example, it must be able to figure out which vendor's options are encoded in the payload.

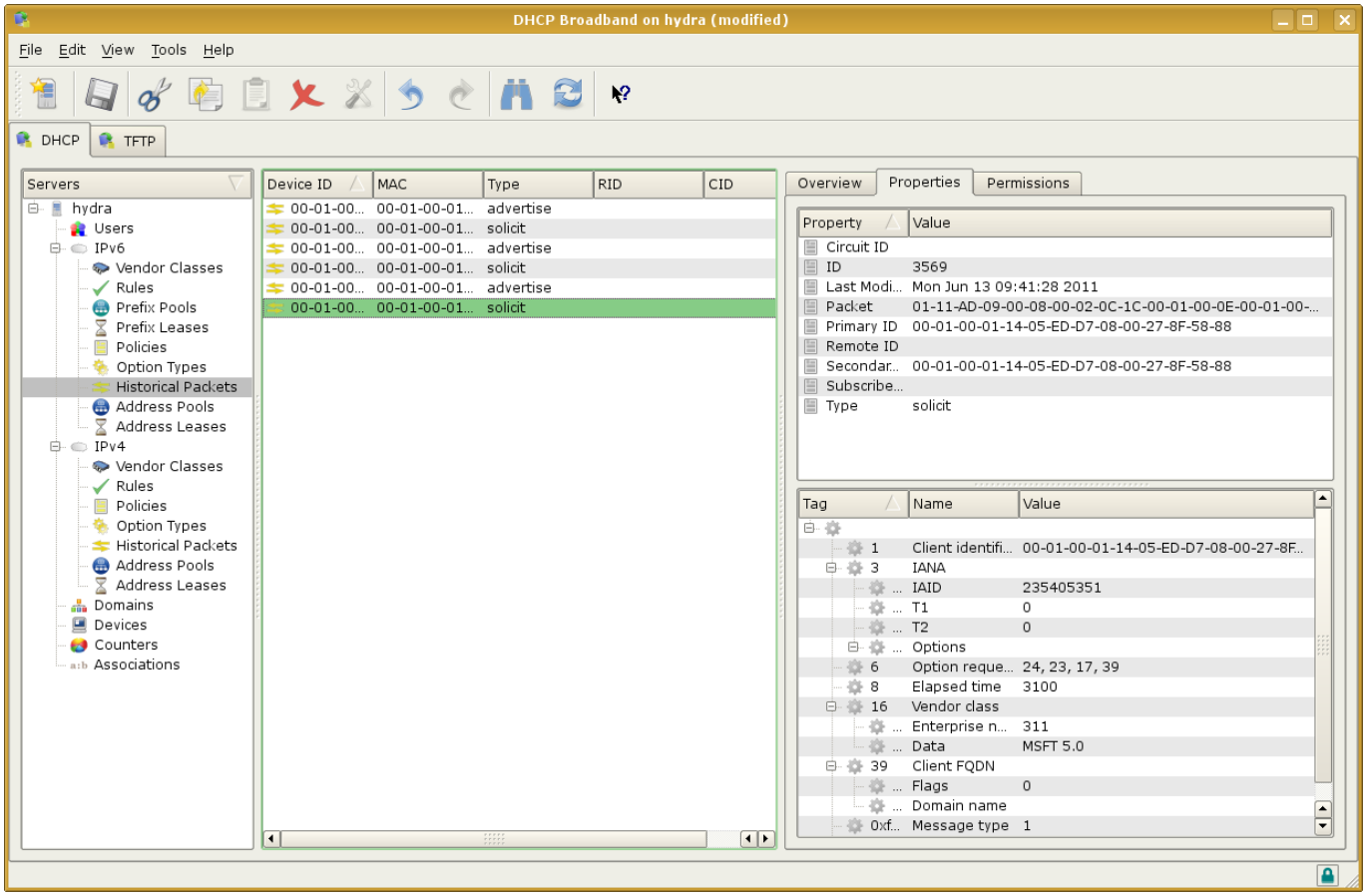
The server does this by simultaneously holding information about many vendor's options. Vendor's options are defined in the files found in the oinc4 and oinc6 directories.

When a vendor-specific option (VSO) such as DHCPv4 option 43 is encountered, the server decides what vendor class the device belongs to by matching the option 60 value against a vendor class record, and then looking for vendor-specific options having that vendor identifier. For DHCPv6, the vendor identifier is encoded directly in the VSO option, so the vendor can be immediately identified without an intermediate lookup.

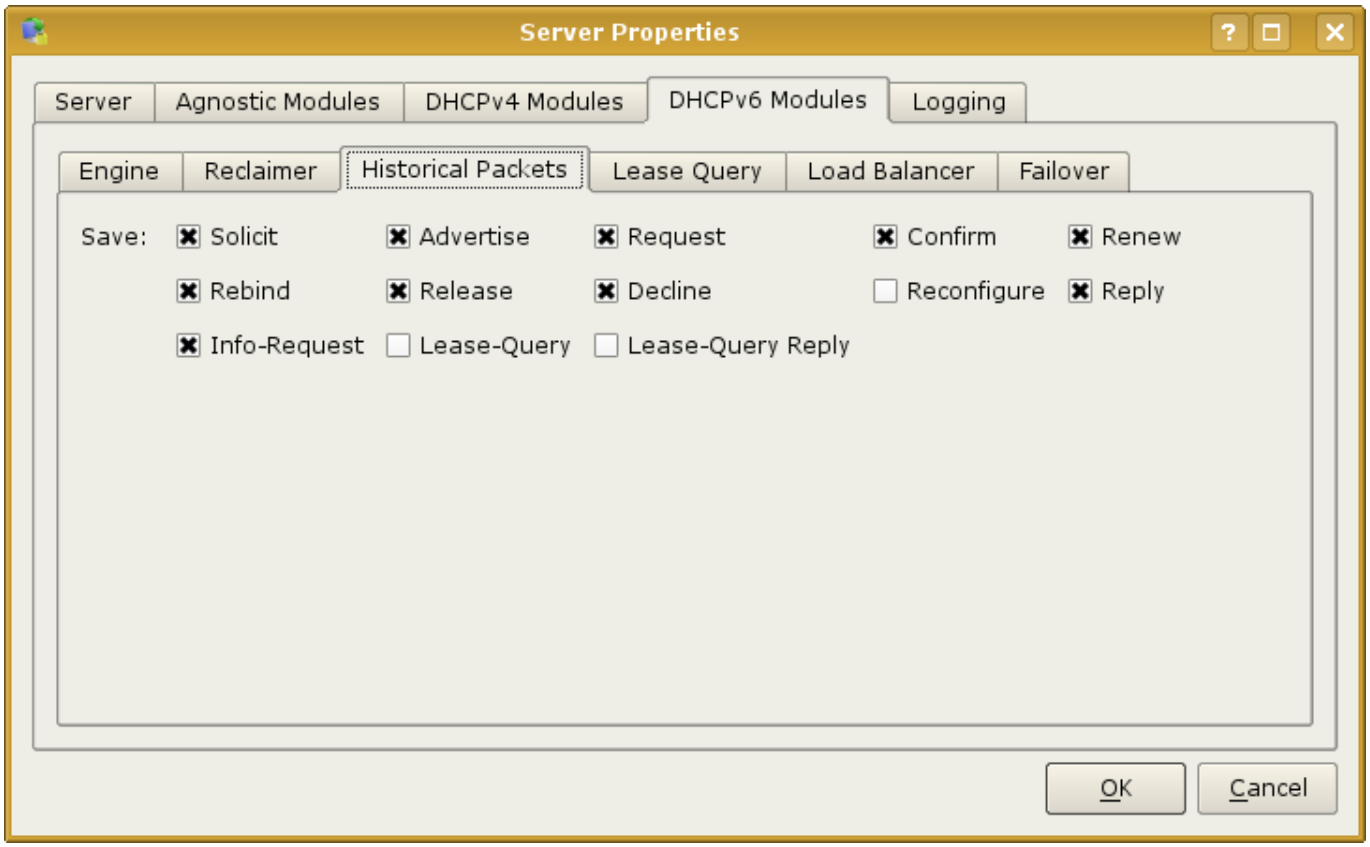
For example, it's entirely reasonable to declare **two** options having tagpath 43/1: one option having vendor id 28551, the other having vendor id 35/1. When parsing a received packet, the server will decide which option declaration is appropriate based on the vendor id it used to classify this device.

Historical packets

The DHCP server can be configured to store historical DHCP packets. The data contained in these stored packets can be used in response to lease queries, by the GUI (for displaying additional device information) or by an expression that computes a current value based on historical information.



Configure historical packet collecting in the System tab of the user interface, or by using the `ipv4.dhcpv4.pktstore.packet_types` (DHCPv4) or `ipv6.dhcpv6.pktstore.packet_types` (DHCPv6) settings in the DHCP configuration file. The server stores only the most recent packet of each type for each client. So for example, if the server is configured to store DHCP `discover` packets, the historical packet table will contain one `discover` packet for each client the DHCP server has serviced.



Some packet types can be used in more than one context with the DHCP protocols. The DHCP `ack` packet, for example, can be sent in response to a `request` or an `inform`. Because of this ambiguity, the server can be configured to store only those `ack` packets that are responses to `request` packets by specifying the packet type as `request/ack`. Any combination of packet types can be specified, but in practice (because of how the DHCP protocols work) only a few combinations will actually occur.

Packet types that can be collected for DHCPv4:

- discover
- offer
- request
- ack
- inform
- decline
- release
- nak
- force-renew
- lease-query
- lease-unassigned
- lease-unknown
- lease-active
- bootp-request

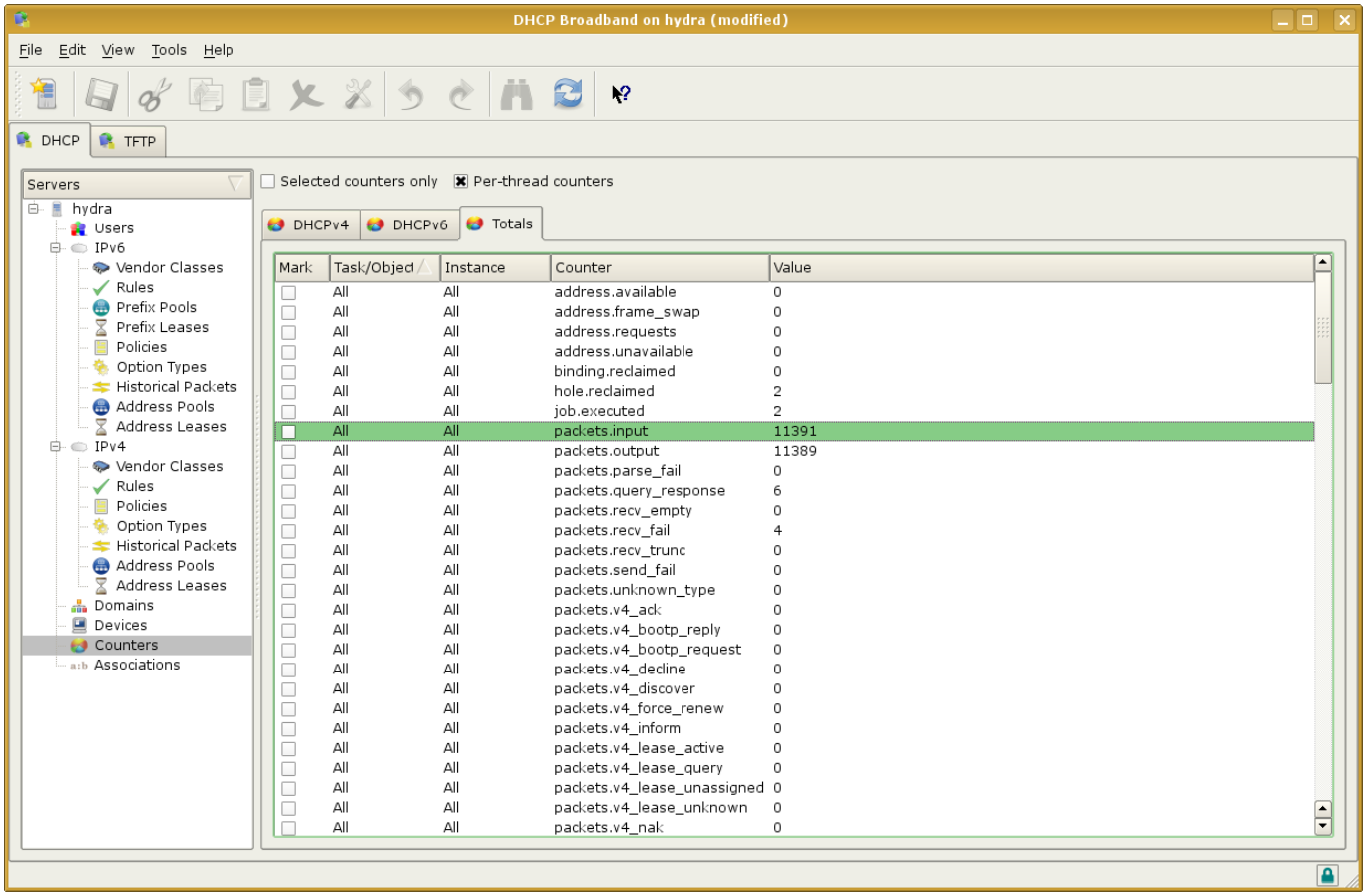
- bootp-reply

Packet types that can be collected for DHCPv6:

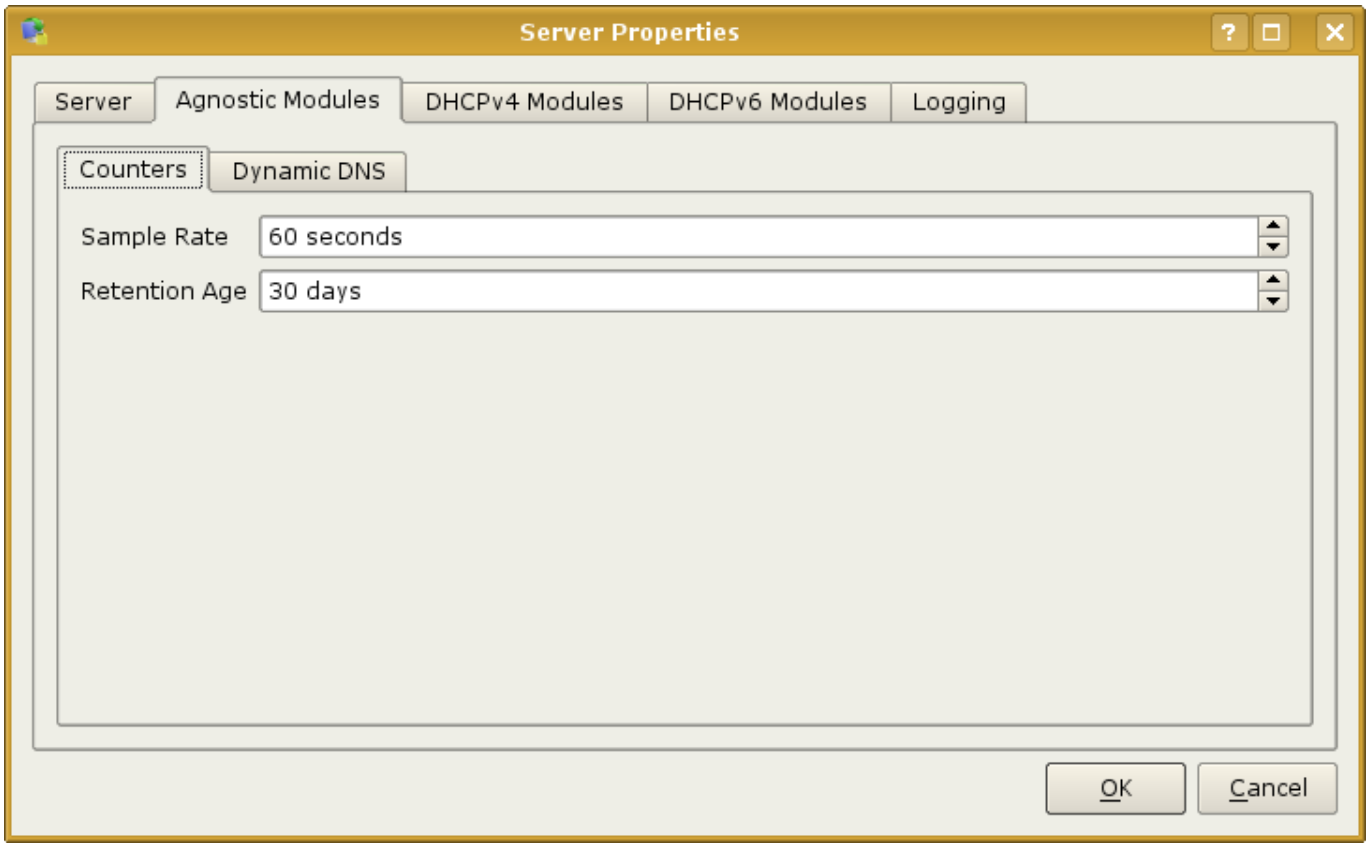
- solicit
- advertise
- request
- confirm
- renew
- rebind
- reply
- release
- decline
- reconfigure
- info-request
- relay-forward
- relay-reply
- lease-query
- lease-query-reply

Statistics and Counters

The DHCP server maintains hundreds of counters for its internal operations, and it periodically samples and stores these counters for historical analysis.



System counters are sampled every 60 seconds by default, but this value can be overriden on a per-protocol basis using the following configuration settings:




```
ipv4.dhcpv4.stats.sample_rate = 60

ipv6.dhcpv6.stats.sample_rate = 60
```

By default, system samples are stored for a maximum 30 days, but this value can be overriden on a per-protocol basis using the following configuration settings:

```
ipv4.dhcpv4.stats.retention_age = 30:::

ipv6.dhcpv6.stats.retention_age = 30:::
```

The retention age value is formatted as days:hours:minutes:seconds, so 30::: is 30 days, 0 hours, 0 minutes and 0 seconds.

See the documentation for the command line interface for information on how to select counter samples and calculate statistics.

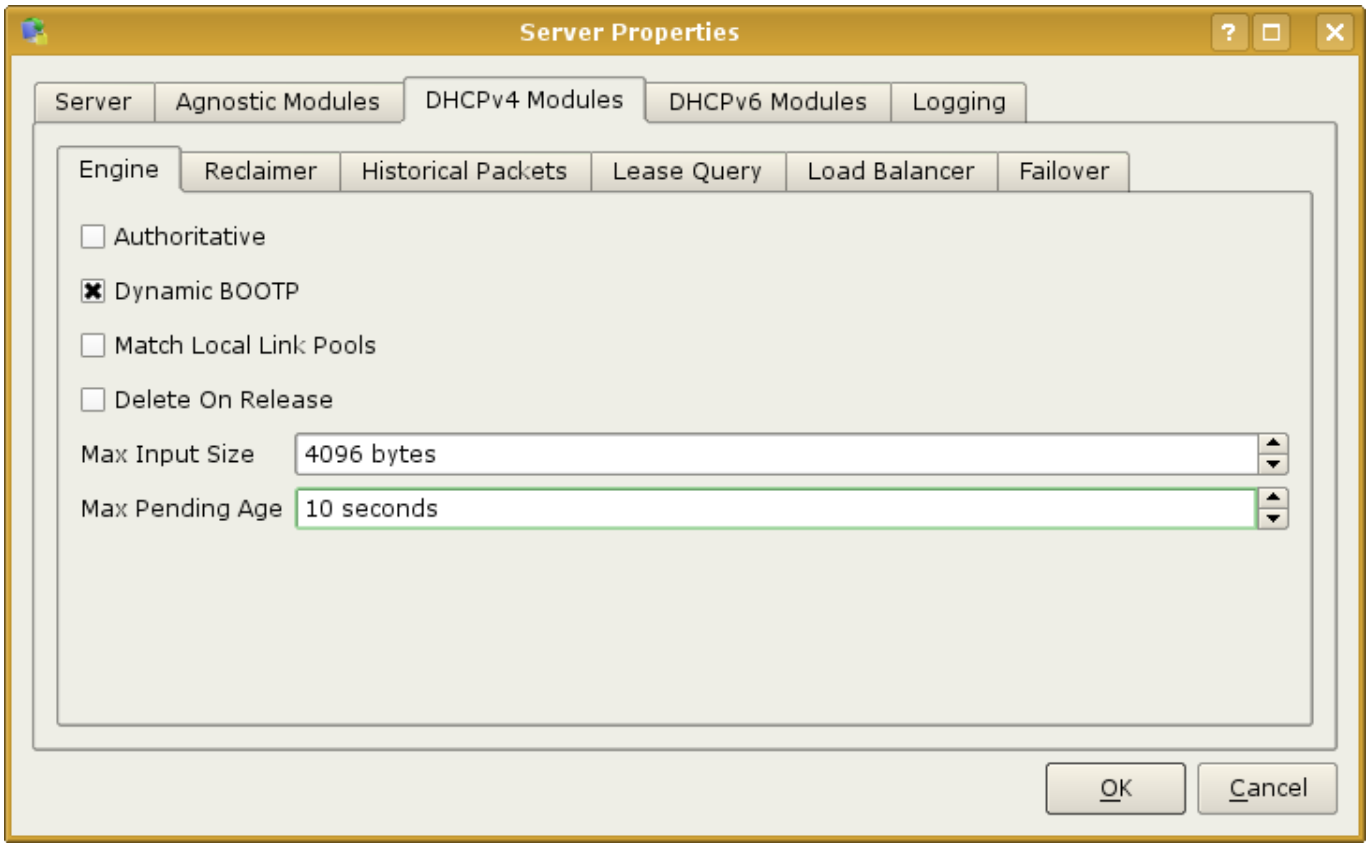
Pendings

A *pending* represents the transition stage from a free address to a valid binding. When a client requests a new address, the address is first stored as a pending and offered to the client.

If the client later accepts the address, a binding is created and the pending is deleted. If the client refuses the address, the pending is immediately deleted.

Pendings cannot be directly viewed through the user interface, but they can be viewed through the command line interface with the `select/insert/update/delete` commands.

Pendings have a valid lifetime of ten (10) seconds, but this can be changed with the configuration setting shown below:




```
ipv4.dhcpv4.engine.pendings.max_age = 5

ipv6.dhcpv6.engine.pendings.max_age = 5
```

The DHCP server periodically purges pendings that have expired due to lack of acknowledgement.

Event Notifications

The DHCP server can be configured to notify external services when internal events occur. This external notification operates over the UDP protocol and is handled by the **UDP Publisher** plugin.

On startup, the UDP publisher reads a list of event subscribers from a configuration file and starts publishing events to those subscribers. The subscribers file consists of a set of subscriptions, where each subscription includes a destination ip:port (on which the subscriber must be listening) as well as a set of event classes the subscriber is interested in.

The UDP publisher is configured through the main configuration file with the settings shown here:

udp_publisher.latency = 300 The publisher latency setting states how long the UDP publisher thread will collect events before publishing to the subscribers

udp_publisher.max_history = 500 The max history setting controls the total number of historical events that can be held. Events older than this are discarded.

udp_publisher.subscribers.file = udp_subscribers.txt The subscribers file is an ascii file that lists every subscriber.

The default subscribers file is `udp_subscribers.txt`, and it's located in the application's **var** dir. (/var/lib/dhcptd, /var/dhcptd or the Windows program folder)

A sample UDP subscriber file is:

```
# notifies of changes to configuration, domains and policies
endpoint=10.0.0.1:5400
classes=config,domain,policy

# notifies of all changes except configuration
endpoint=10.1.2.20:5500
classes=*,!config
```

If no classes are specified, or the wildcard symbol (*) is specified, the subscriber will be notified of all server events. Receiving all event notifications from a loaded server can be taxing on both the DHCP server and the subscriber. This configuration should be avoided if possible.

The following tables show the classes of events that can be published from the UDP publisher:

Class	Description
*	All events
subscription	Change to a udp subscriber's state
config	Changes to the application's configuration settings
address_lease	Changes to an address lease
network_lease	Changes to a network lease

Table 1: Event Classes

Class	Description
*	All classes
domain	Domains
account	Device accounts
access_control	Access Controls
keyvalue	Associations
address_pool	Address Pools
network_pool	Network Pools (Prefix Pools)
address_binding	Address Bindings
network_binding	Network Bindings (Prefix Bindings)
address_pending	Address Pendings
network_pending	Network Pendings (Prefix Pendings)
policy	Policies
option	Option Types
vendor_class	Vendor Classes
historical_packet	Historical Packets
sql_query	SQL Queries
sql_query_group	SQL Query Groups
capability	Capabilities

Table 2: Object Classes

This next table lists the verbs, or operations that may accompany an event:

Permanent Subscriptions

All subscribers listed in the udp_subscribers file are permanent subscribers. The server will continue to publish events to these subscribers even if the network indicates that the subscriber is not listening.

Type	Description
add	A new object has been added
del	An object has been deleted
modify	An existing object has been modified
obtain	A new lease has been obtained (alease/nlease class only)
renew	A client has renewed a lease (alease/nlease class only)
release	A client has released a lease (alease/nlease class only)
expire	A lease has expired (alease/nlease class only)
decline	An offer for a lease has been declined (alease/nlease class only)
purge	An existing lease has been purged from the system (alease/nlease class only)

Table 3: Verbs

Temporary Subscriptions

A temporary subscription can be made through the command line interface. Temporary subscriptions are valid as long as the subscriber is receiving the server's event messages.

Event notification format

A subscriber will receive event notifications from the server over the UDP protocol to the ip:port listed in the subscription. Each packet received corresponds to one event, and uses an ASCII-based *key*=*value* format. Multiple key/values are separated with a single newline character (`\n`).

A sample event from the DHCP server:

```
event_type=modify
event_class=domain
event_instance=My Domain
event_time=Mon Jul 28 14:45:26 CEST 2008
```

Some events may contain more key/value pairs, but the pairs listed above are guaranteed to always be present in any event notification. The order of key/value pairs is **not** guaranteed, and may change in the future.

Lease Event or Binding Event?

Whether or not you should subscribe to `lease` events or `binding` events depends on the kind of activity you wish to receive notifications for.

A *lease* event signifies that an exchange has occured between the DHCP server and a DHCP client, whereas a *binding* event signifies that a change has occured in the written record of a lease. Consider the case where an operator creates a fixed binding: the record for this lease has been added, but there has not necessarily been an exchange between the server and the client.

You might assume that a lease event would always be followed by a binding event, but that may not be the case. It could be possible for the lease to change state in such a way as to not need a corresponding change to the binding.

Normally a binding event is generated any time a binding is modified, but there's one major exception to this: the DHCP engines. The engines operate at extremely high rates, and simply have not been burdened with triggering both lease events and binding events.

If you wish to receive notification about lease activities that are occuring on your network, subscribe to lease events. These events are directly triggered by the DHCP queries received from clients.

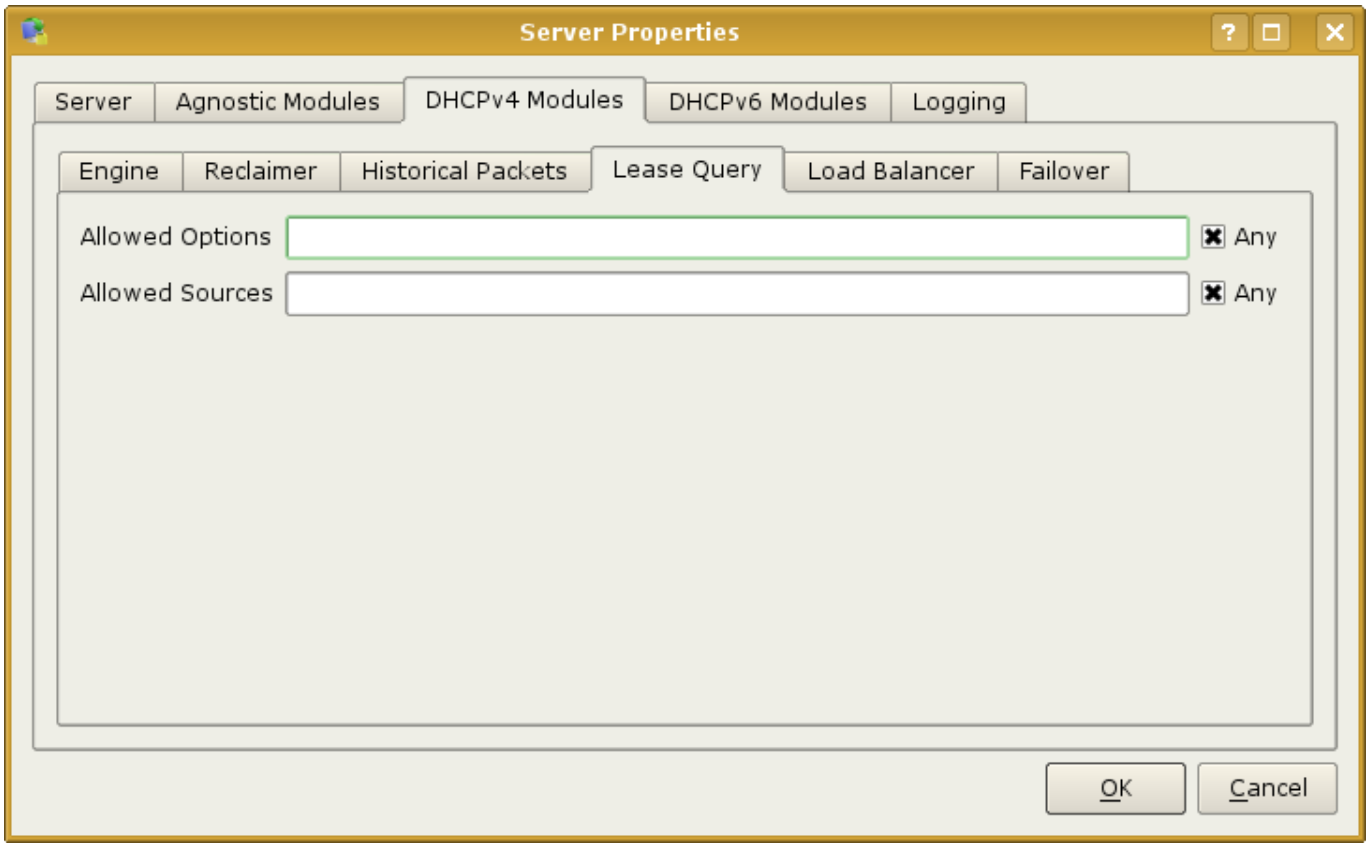
If, however, you wish to be notified of changes to bindings, you should consider subscribing to both lease events and binding events. The lease events will give you a good indication of whether a binding has been modified, but you'll also receive binding events that occur as a result of operator activity or address reclamation.

Lease Query

The system supports the DHCP Lease-query protocol for IPv4 and IPv6 networks. DHCP Lease-query is handled by the **Lease-Query** plugin, therefore this plugin must be loaded for lease-query to work.

The lease-query module reports information about the server's leases to any device that supports the DHCP lease-query standard. The most common use for lease-query is for DSLAMs and CMTS:es to repopulate route and circuit information after the unit has rebooted.

You can use the following configuration settings to configure the DHCP server to only allow lease-queries from certain IP addresses. You can also state which options are allowed in a lease query.



Dynamic DNS

The DHCP server can be configured to perform dynamic DNS (DDNS) updates to your DNS server when a lease changes state. Dynamic DNS is handled by the **DHCP-DDNS** plugin, therefore this plugin must be loaded for dynamic DNS to function.

DDNS is supported by interpreting a set of control options. Since DDNS is configured with options, you can effectively provision DDNS updates using the domain provisioning model by placing different DDNS options in different policies. DDNS option values can also be expressions, so this form of provisioning is also avaliable.

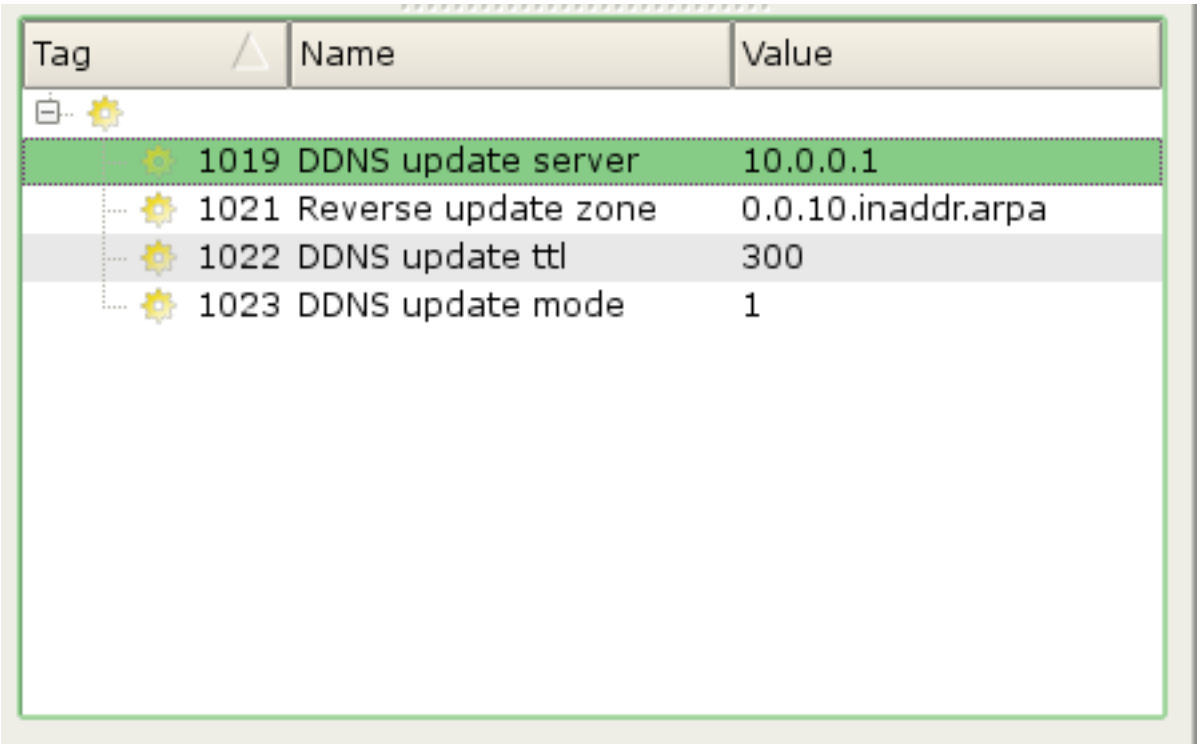
Before configuring DDNS as described below, choose the policy you want to use for enabling DDNS. The global policy will enable DDNS for every address leased, whereas other policies can limit the scope of when DDNS updates are made.

Configuring DDNS for trusted clients

If you trust the DHCP client(s) to supply a valid fully-qualified domain name and want the client-supplied domain name to be used when performing dynamic DNS, define these options in an applicable policy:

- option DDNS update server = `10.0.0.1`

- option DDNS update mode = `1`
- option DDNS update ttl = `300`
- option Reverse update zone = `"1.168.192.inaddr.arpa"`



THE EXAMPLE ABOVE:

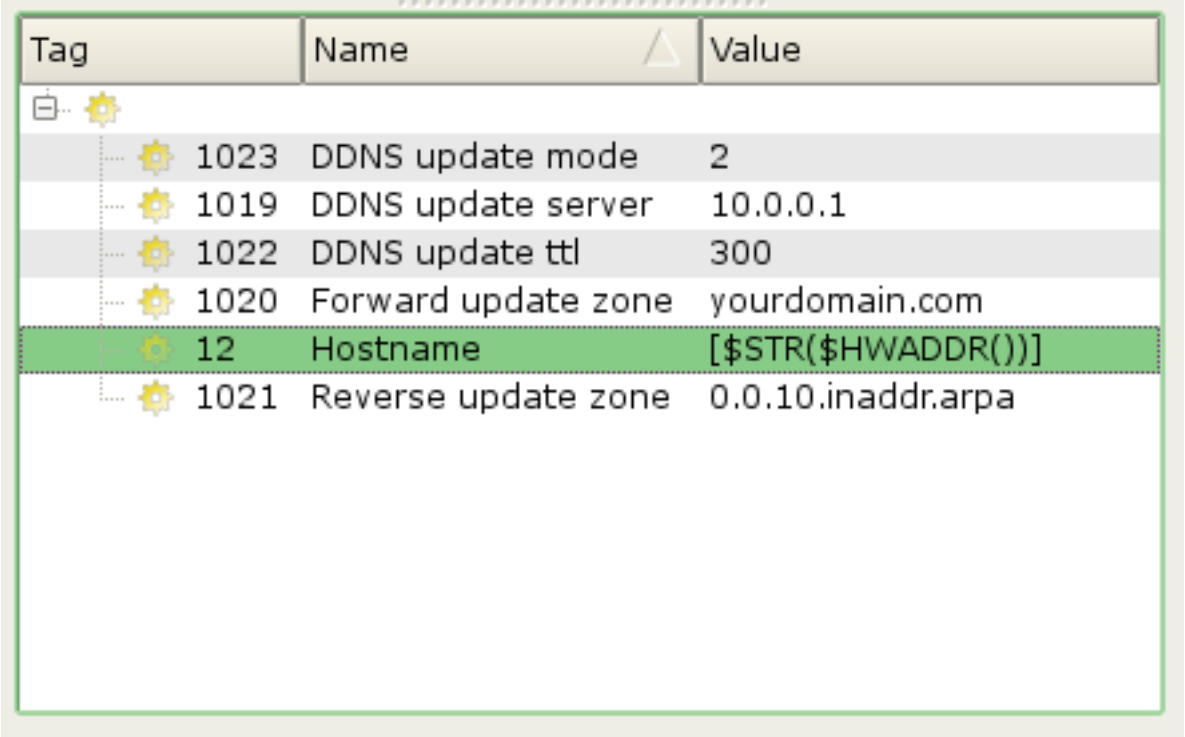
- Updates the DNS server on address 10.0.0.1
- Uses a DNS TTL of 300 seconds
- Updates the foward lookup zone based on the domain name supplied by the DHCP client(s)
- Updates the reverse lookup zone for the 192.168.1.0 network
- Uses the host name supplied by the client

Configuring DDNS for untrusted clients

If you *do not* trust the DHCP client(s) to supply a valid fully-qualified domain name, define these options in the policy:

- option DDNS update server = `10.0.0.1`
- option DDNS update mode = `2`
- option DDNS update ttl = `300`
- option Reverse update zone = `"1.168.192.inaddr.arpa"`
- option Forward update zone = `"yourdomain.com"`
- option Hostname = `[ $STR ($HWADDR()) ]`

for IPv6/DHCPv6, instead of `option Hostname`*, use* `option DDNS hostname`



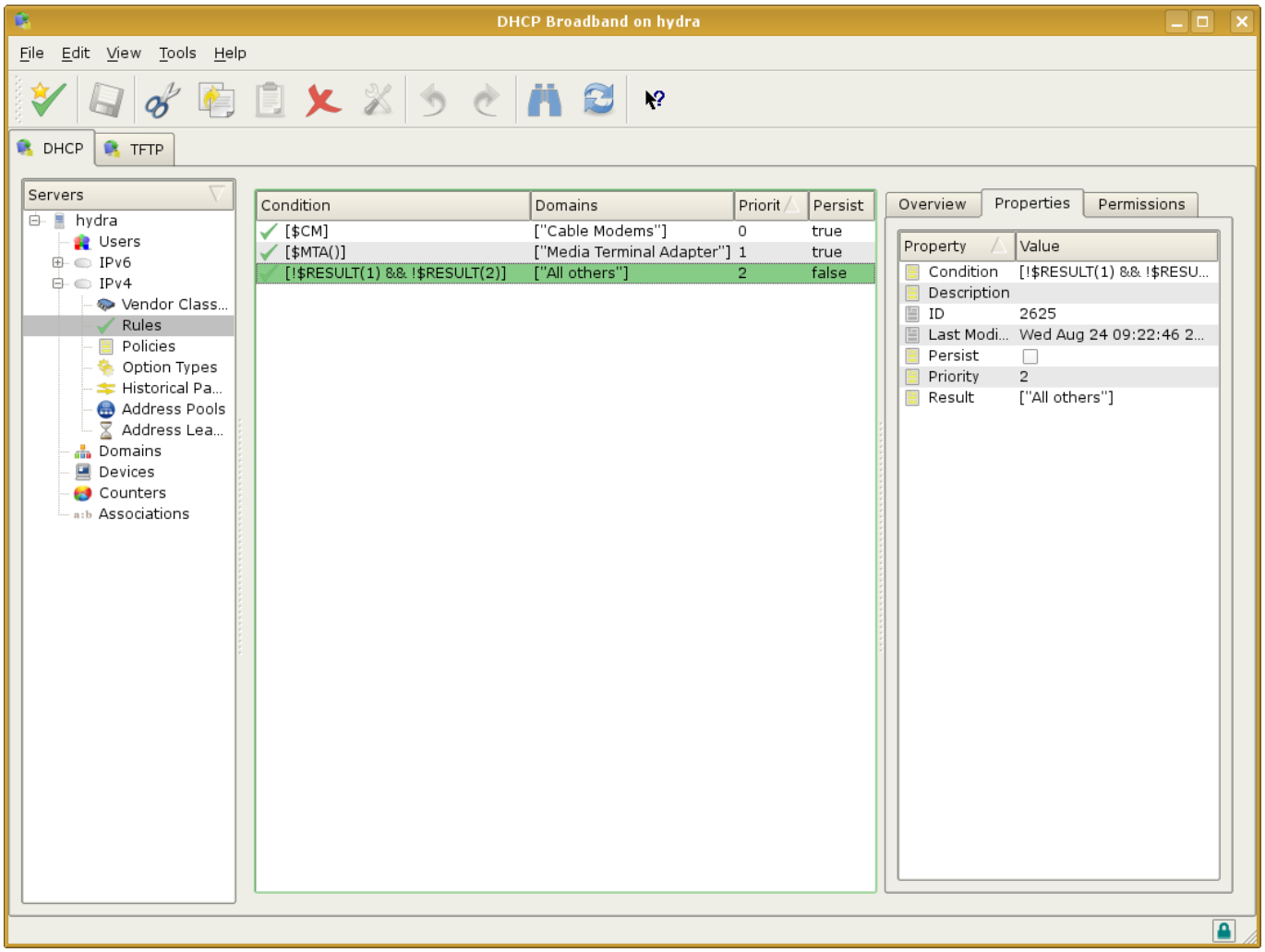
THE EXAMPLE ABOVE:

- Updates the DNS server on address 10.0.0.1
- Uses a DNS TTL of 300 seconds
- Updates the foward lookup zone "yourdomain.com"
- Updates the reverse lookup zone for the 192.168.1.0 network
- Generates a host name from the DHCP client's link-layer (MAC) address

Host names can be generated or looked up in a variety of ways using the DHCP server's expression syntax.

Device Classification Rules

The DHCP server can be configured to automatically execute a set of rules in order to classify the devices on your network. These rules can be executed every time a device contacts the server, or only the first time the device contacts the server.



When the DHCP server receives a request from a device on your network, it searches the **Devices** database to see if this device has an account in the DHCP server. If an account exists, the device is classified according to the settings in the account. If an account does not exist, the DHCP server executes all rules in priority order.

A rule contains a **condition** expression and a **result** expression. When executing a rule, the DHCP server first evaluates the condition. If the condition evaluates to *true*, the **result** expression is then evaluated. The result expression returns a list of domain names to associate with this device.

If any matching rule has the **Persist** flag set, a new account is created for this device, and the domains from every matching rule are saved with the account. If no matching rules have the **Persist** flag set, the device is classified into the the domains, but no device account is created. In this case, the device will execute the rules again the next time it contacts the server.

Although you can create rule expressions based on any criteria you want, a good general-purpose approach is to simply associate a new device with a domain explicitly reserved for devices of that type.

In other words, if you have one domain for fiber modems (**FM**) and one for cable modems (**CM**), you can create rules that associate fiber modems with the **FM** domain and cable modems with the **CM** domain.

The $DEVICE.TYPEID() function is particularly useful when creating rules that differentiate different kinds of devices. The system is pre-configured to recognize many different device types through **Vendor Classes**, and new device types can be easily added.

Permissions

The DHCP server uses a domain system for classifying the devices on your network. A domain is simply a logical grouping to which resources and accounts are assigned. An easy way to understand how domains work is to view a domain as a partition

in the DHCP server's configuration. Two different devices having identical properties, but belonging to different domains, may "see" the DHCP server as having two completely separate configurations. In other words, domains can selectively enable the resources to which a device has access.

There are three standard domains available:

- **Admin**
- **All users**
- **All devices**

The **Admin** and **All users** domains are operator domains, used to grant system operators access to resources. The **All devices** domain is a device classification that refers to every device on your network.

Resources always belong to the **Admin** domain, and membership in this domain cannot be revoked. This membership gives administrators complete access to the resources managed by the system.

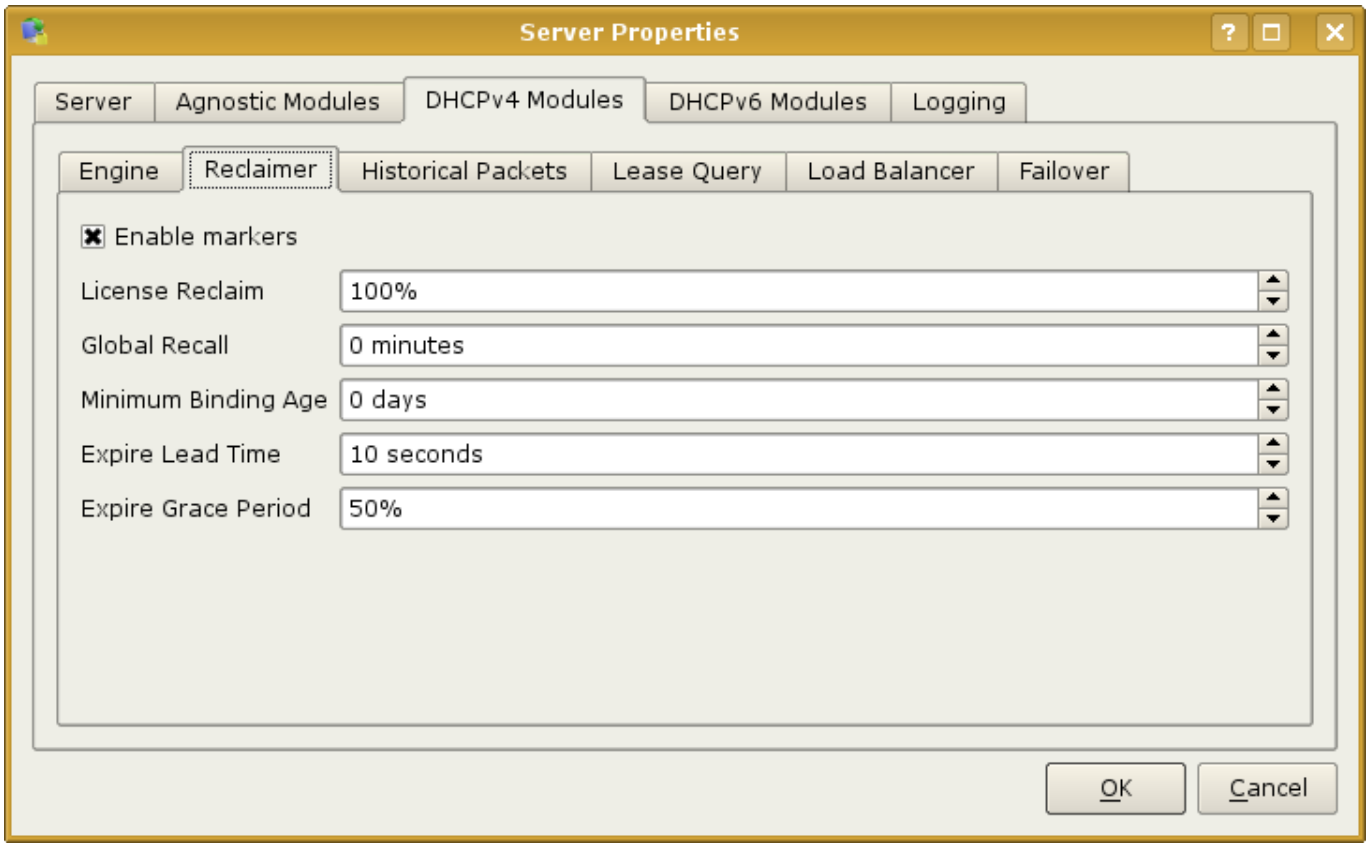
New resources belong to the **All devices** domain by default, but this membership can (and should) be revoked if the resource should not be available to every device on the network.

Address Manager

The DHCP server uses an address manager to cache free ip addresses and deliver them to the engines when needed. The address manager holds a high-speed cache for each pool you've defined, and maintains background threads that refill these caches as they're depleted.

Reclaimer

The **reclaimer** is the background subsystem in the DHCP server's address manager responsible for finding free IP addresses and delivering them to the address manager's cache. When a cache hits a 50% low-water mark, the reclaimer is signaled to start the process of finding free addresses with which to replenish the cache.



The reclaimer is multithreaded, which allows it to process multiple caches simultaneously.

In addition to processing cache requests on demand, the reclaimer can also be configured to purge expired bindings in order to "clean out" your database. This feature is known as a **Global recall**, and can be useful on transient networks where devices that leave the network are unlikely to reappear within a reasonable timeframe.

The `reclaimer.interval` setting controls how often (in minutes) a *global recall* is executed. The default setting is 0, which disables global recall.

Important
Global recall is not required or desired on stable networks where devices are unlikely to permanently disappear from your network.

The `reclaimer.min_inactive_days` setting is an overriding value that specifies the minimum lease retention age. The address from an expired lease will not be recovered under any circumstances until the lease has been expired for this amount of time. A value of 0 means there is no minimum lease retention age.

The `reclaimer.lead_time` dictates the minimum amount of time (in seconds) that must pass before a lease is considered expired. The address from a lease cannot be recovered before this time has passed.

The `reclaimer.lease_tolerance` setting is a hint for how long the lease should be kept after expiration. It is expressed as a percentage of the original lease length. This value can be overriden by the reclaimer if there is an emergency shortage of available ip addresses.

The `reclaimer.markers.enable` setting is a boolean value that instructs the reclaimer to remember, across application restarts, where in an address range it last searched for free addresses. Setting this value to true greatly reduces the amount of time needed initialize a pool cache when the DHCP server process is first starting, but may result in harmless gaps in leased addresses when the DHCP server process is restarted.

Destabilizing Dynamic Addresses

Some environments may want to ensure that a certain portion of the network's dynamically leased addresses be periodically relinquished regardless of the state of the DHCP client. This is referred to as *destabilizing* addresses, and it's a common practice for providers that want to charge a customer for the privilege of obtaining a stable ip address.

Because the DHCP server is built on a security access model, destabilizing addresses is very straightforward. The approach is to simply issue an update command that updates a set of the dynamic bindings in the DHCP server, moving them all into a domain that is inaccessible to the clients.

For example, suppose we create a domain called **No Access** which has 0 members. We could destabilize the entire network by issuing this command through the command interface:

```
update_address_binding
where=T.pk>0 AND T.fixed = 0
domains=No Access
```

In effect, this command denies all DHCP clients with dynamic addresses from renewing their existing leases. The server remembers the leases, and will not recycle the ip addresses until the lease has expired (or been released, if `ipvN.dhcpvN.engine.delete_on_release` is in effect), but the leases will not be available for renewal. If the server is configured to be authoritative it will NAK the client when it tries to renew the lease, and the client will proceed to attempt to acquire a new address.

In practice you probably don't want to destabilize your entire network at once. Instead, your `update_address_binding` command should use a `where` clause that limits the update to a subset of dynamic bindings.

Multi-Server Synchronization

The DHCP server can be configured to synchronize data between multiple independent servers using the **DHCP Sync** plugin. Any number of servers can cooperate in a synchronized cluster, and changes to any server are automatically distributed to all other servers. In addition, where required, the servers can be configured to only synchronize specific types of changes.

The synchronization plugin is multi-threaded and asynchronous, which allows it to achieve very high throughput without affecting the performance of the rest of the system. Realtime changes to the server are gathered into versioned changesets, staged for later processing, and finally processed by background threads. Changesets are kept in standard text files, which allows a system administrator to easily review the activity occuring on a busy cluster.

The basic settings for DHCP synchronization are in the main configuration file, while the specific settings for each synchronization target are stored in a separate configuration file.

The basic settings for the main configuration file are:

ipvN.dhcpvN.sync.interval = 3 How often, in seconds, the publisher threads should check for new changesets

ipvN.dhcpvN.sync.targets = dhcp_sync_targets.txt The name of the configuration file that specifies servers in the cluster

The default synchronization configuration file is `dhcp_sync_targets.txt`, and it's located in the application's **var** dir. (/var/lib/dhcptd, /var/dhcptd or the Windows program folder)

Note
Synchronization uses the remote console interface, which in turn requires that your remote console interface be available to all servers in the cluster.

A sample `dhcp_sync_targets.txt` file is:

```
target=offset.weird.se
classes=*

target=brutus.weird.se
classes=*
```

If no classes are specified, or the wildcard symbol (*) is specified, the target will be synchronized with all changes from the local server. To specify a subset of changes, list the classes of interest separated by a comma. System event classes are listed in the Object Classes table.

The most straightforward configuration for a set of servers is to list every server except the local one in the `dhcp_sync_targets.txt` file of every server. This is a full multi-way relationship that ensures maximum reliability, but it can generate more synchronization traffic than is required for most circumstances.

Another approach is to designate a few servers as **Master** servers, and have all other servers synchronize only with Master servers.

If a target server goes offline at any time, changesets are stored on the local server until the target comes back online. After the target is back online, all outstanding changesets are published to the target to bring it up to date.

High Availability - Active/Passive

The DHCP heartbeat plugin can be used in conjunction with the DHCP Sync plugin to configure an active/passive high availability solution between any number of cooperating servers. The heartbeat plugin uses the same configuration file as the DHCP sync plugin, and maintains the current operating mode for every server in the cluster.

The heartbeat module uses the following configuration values in the master configuration file:

ipvN.dhcpvN.heartbeat.interval = 5 How often to query all target servers for their current mode

system.index = 0 Each system in the cluster should have a unique index

When the DHCP server process starts with the heartbeat module loaded, the DHCP server is placed in `init` mode. The heartbeat module then queries all servers in the cluster for their current mode, and eventually adjusts the local system mode to either `servicing` or `standby` depending on the mode of the other servers and the local system index.

When a server is in standby mode, if the currently active server goes offline, the heartbeat module will pick the first available server that has the lowest system index and promote it to `servicing` mode.

By assigning a unique index to each server and having all servers track all other servers, the heartbeat module can guarantee that only one server is operating at any given moment, and any number of backup servers can assume responsibility for the network in the event the active server fails.

System Modes

The DHCP server has five modes of operation: `init`, `paused`, `standby`, `servicing` and `learning`.

INIT mode

This is the default mode when the server is starting if this server is configured to maintain the heartbeat status of multiple servers in a cluster. If the server is not configured to maintain heartbeat status for other servers, this mode is bypassed, and the server directly enters `servicing` mode during startup.

The `init` mode only applies to the startup of the system. For this reason, a server cannot be administratively placed in this mode.

PAUSED mode

When placed in this mode, the server keeps all of its subsystems operational, but it will not respond to service requests from devices on your network. This mode is useful when you want to temporarily pause the operation of the engines.

Pause differs from standby mode in that the system will never automatically switch out of pause mode, whereas the system may switch out of standby mode if it deems necessary to begin servicing clients.

When in `paused` mode, the command line interface is still fully operational.

STANDBY mode

When placed in this mode, the server will shut down some of its running subsystems, and it will not respond to requests from devices on your network. This is the default mode for all passive servers in an active/passive redundancy configuration.

When multiple servers are configured for active/passive redundancy, the heartbeat module causes the system to automatically switch between `servicing` and `standby` modes as required. This mode may be administratively set, but it is not recommended.

When in `standby` mode, the command line interface is still fully operational.

SERVICING mode

This is the default mode for a fully functioning server. When placed in this mode, the server will start any needed subsystems and actively service requests from devices on your network.

When multiple servers are configured for active/passive redundancy, the heartbeat module causes the system to automatically switch between `servicing` and `standby` modes as required. This mode may be administratively set, but it is not recommended.

All subsystems are fully operational in `servicing` mode.

LEARNING mode

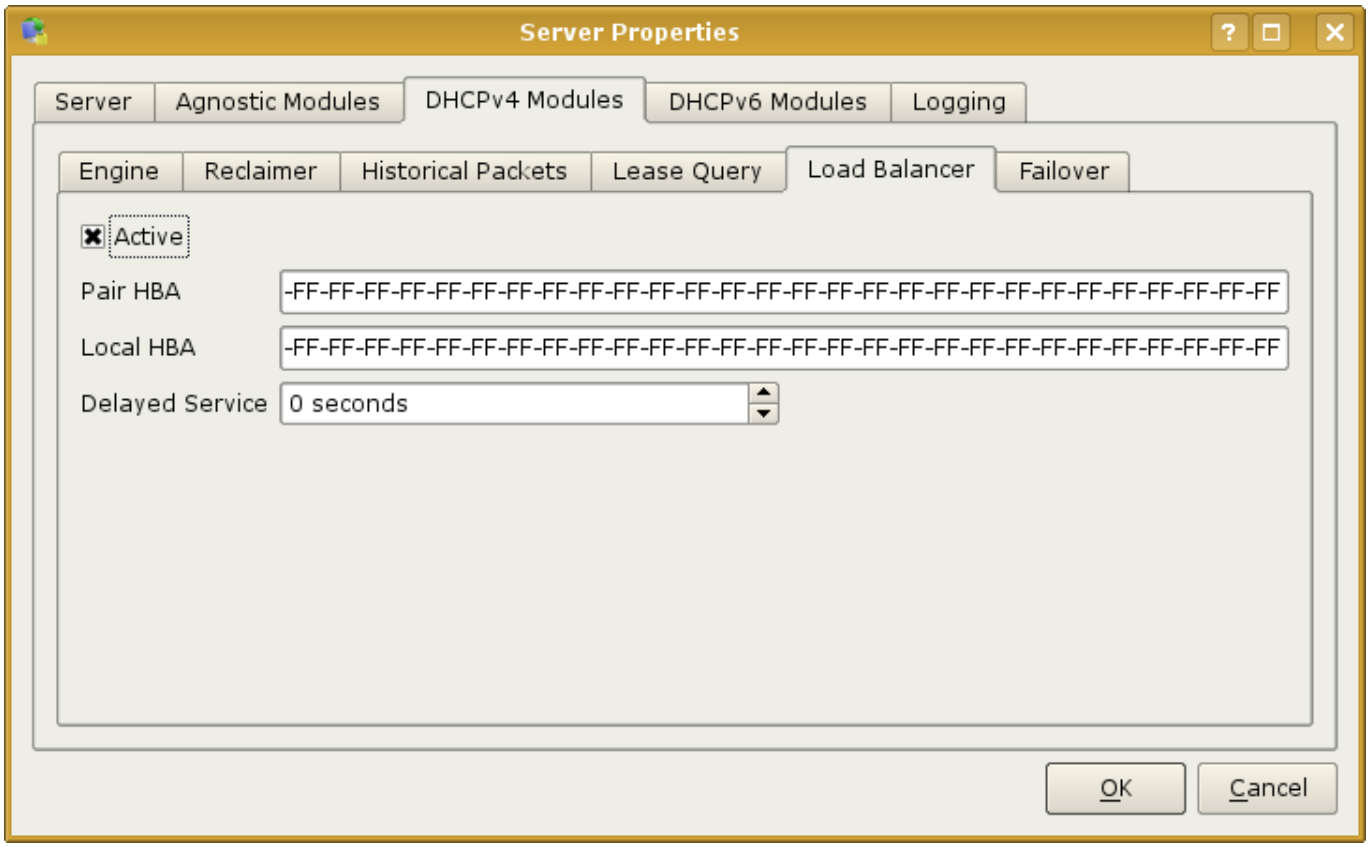
This mode is useful for migrating from another vendor's DHCP server. When in this mode, the DHCP server will assume that all requests to extend IP address leases are valid, and it will create any leases that are requested for extension.

Before switching to this mode, you should fully configure your system, including pools, auto-provisioning and permissions. Once you switch to this mode, you should leave the server in `learning` mode long enough to ensure that any leases granted by the other vendor's server will have been requested from this server or expired. After this time period is past, you can switch the server to `servicing` mode.

Most all subsystems are operational in `learning` mode, but some may run with limited functionality.

Load Balancing

Load Balancing is handled by two separate plugins: the **L-Balancer** and the **E-Balancer**. The L-Balancer plugin handles load balancing for the DHCP service itself (as well as for HA DHCP server pairs), and the E-Balancer handles balancing for all other services that can be discovered through DHCP.



You may install both of the balancer plugins, or either plugin independently. Both plugins seamlessly support IPv4 and IPv6.

Configuring the L-Balancer

The L-Balancer plugin conforms to RFC 3074, the DHCPv4 load balancing protocol. The L-Balancer also supports load balancing for DHCPv6, but as of this writing there is no standard for DHCPv6 load balancing. The DHCPv6 balancing implementation is similar to the protocol described in RFC 3074, but uses DHCPv6 client identifiers.

Each DHCP engine has three (3) basic settings for load balancing: `pair hba`, `local hba` and the `local ds`. The `hba` settings are 32-byte hash bucket assignments for hashing client identifiers. Refer to RFC 3074 for a description of these hash bucket assignments.

- The `pair hba` is a hash bucket assignment that limits the set of devices a DHCP server pair can service
- The `local hba` is a hash bucket assignment that limits the set of devices a single DHCP server in a pair can service
- The `local ds` setting allows a time-based override of the `local hba`

When configuring a pair of DHCP servers to operate in high-availability mode, the `local hba` on the primary server should be set so as to cause the primary to only service a subset of the devices. The secondary server should be configured with the *exact same* `local hba`, but will use the inverse of that hba on startup. This ensures that both servers split the DHCP load between themselves. In the event one server goes offline, the other will use its own hba and the other's hba, effectively allowing it to service all clients for the pair.

In order to further increase throughput of DHCP traffic, you can split the load across multiple DHCP server pairs. To accomplish this you must configure the `pair hba` on each server pair to service a subset of clients on your network.

The `pair hba` ensures that two servers in a pair will only service the subset of devices assigned to them, while the `local hba` allows the two servers to further split that load between themselves, and to assume the other's responsibilities in the event one server fails.

The `local ds` setting is for enabling delayed service. A positive integer indicates that the DHCP server should service any client that has been attempting to extend a lease for this number of seconds, regardless of the `local hba` configuration. A delayed-service setting of 0 indicates that delayed service should not be used. This setting has no effect for the `pair hba`.

The configuration settings for `hba` and `ds` are:

```
ipvN.dhcpvN.lbalancer.pair.hba = FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF- ↩
    FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF

ipvN.dhcpvN.lbalancer.local.hba = FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF- ↩
    FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF-FF

ipvN.dhcpvN.lbalancer.local.ds = 0
```

Configuring the E-Balancer

<incomplete>

Trusted ID Resource Limits

The DHCP server can enforce resource limitations by limiting the number of active clients on a specific part of your network. Resource limits are useful for limiting broadband subscribers to a maximum number of leases as well as for mitigating Denial-of-Service attacks that attempt to deplete your server of free IP addresses.

The DHCP server enforces resource limits by keeping track of the number of leases for any given Circuit ID, Remote ID or Subscriber ID (aka *Trusted Identifier* or *TID*).

By default, the DHCP server keeps track of the Remote ID for each active lease. This allows you to set resource limits by Remote ID only. To set resource limits for a different trusted identifier, use the *Binding TID type* option to specify the type of trusted ID to be stored with a lease.

Since the *Binding TID type* is a control option, you can define it in different policies to effectively limit different devices with different trusted identifiers.

Address Limits

By default the server stores the Remote Identifier with each lease.

Remote ID Address Limits

To set a limit on the maximum number of leases available to any Remote Identifier, add the *Remote ID address limit* option to a policy and set its value to the total number of allowed leases.

Circuit ID Address Limits

To limit the maximum number of leases for a Circuit Identifier, add the *Binding TID type* option to a policy and set its value to **2** (Circuit ID). Then add the *Circuit ID address limit* to a policy and set its value to the maximum number of leases allowed.

Subscriber ID Address Limits

To limit the maximum number of leases for a Subscriber Identifier, add the *Binding TID type* option to a policy and set its value to **3** (Subscriber ID). Then add the *Subscriber ID address limit* to a policy and set its value to the maximum number of leases allowed.

Note
Changing the Binding TID type option does not affect existing leases until those leases are next updated. If you want to change the TID type for existing bindings, issue an `update` command through the remote console for the applicable bindings.

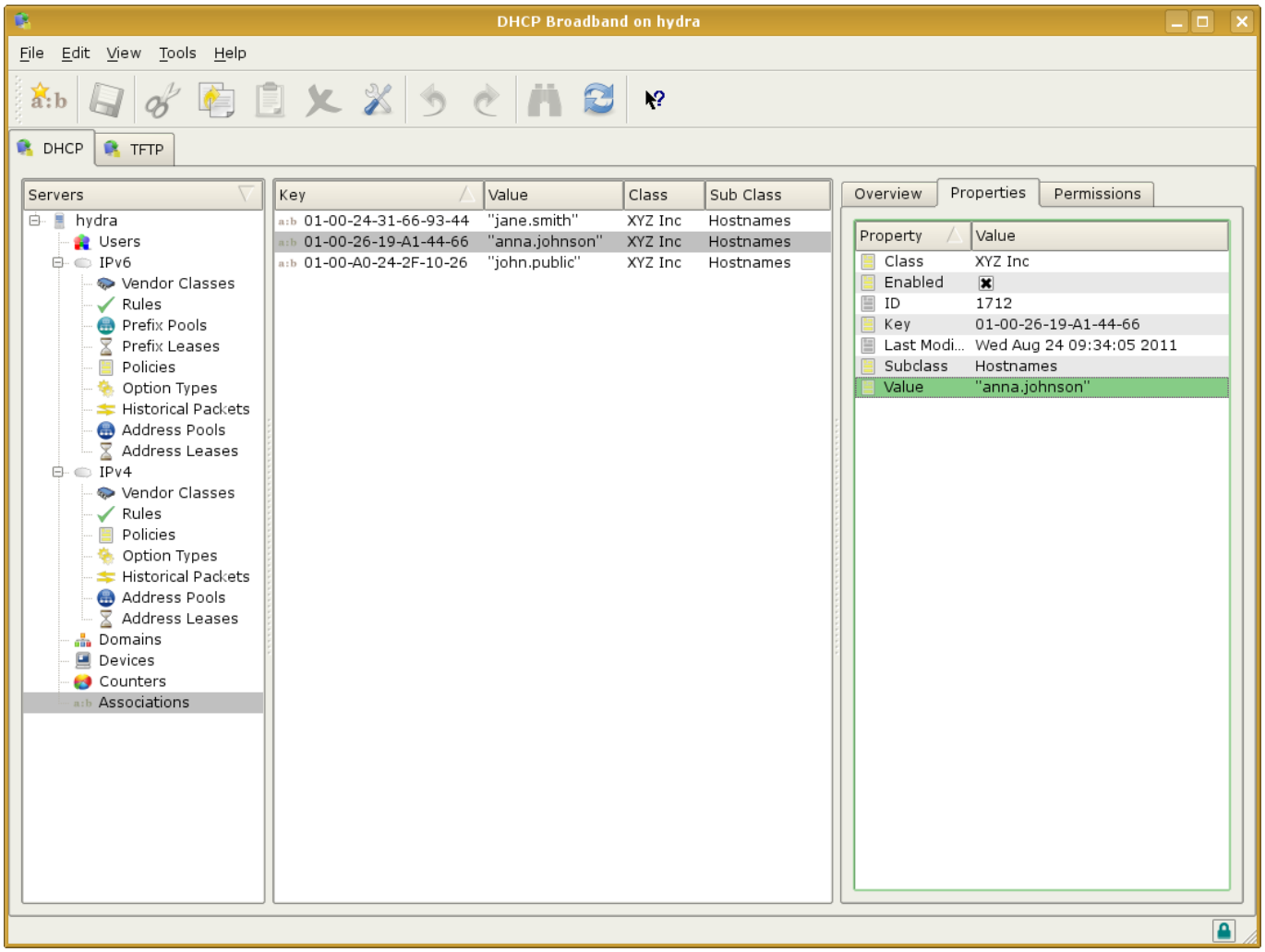
Network limits

Network limits are functionally identical to Address limits. See the Address Limits section.

Associations

The DHCP server allows you to create arbitrary associations (key/value pairs) that can then be used by your expressions. An expression may look up a specific association and use the result as an option value, for example.

Associations are flexible because they allow you to make arbitrary relations that cannot be automatically calculated. For example, you might list relay agent addresses as a set of keys, and have geographical information associated with each key. Clients could then be given a geographical location based on the relay through which they're connecting.



Creating associations

To create a new association, select the **New Association** menu option. An association has the following fields:

Setting	Description
class	Use this field to associate multiple associations with a major group name. This field can be any text value.
subclass	Use this field to associate multiple associations with a minor group name. This field can be any text value.
active	When set to false, this associations will not be located by a search using the `DB.KEYVALUE` function.
key	The key to use for lookup. Can be any arbitrary text, but is usually something that corresponds to an option value in an input packet.
value	The value to be associated with the key. Can be any arbitrary value.

One example of using associations is for relating arbitrary host names with client identifiers. You can configure associations for each client identifier on your network, then define the *Hostname* option to look up the host name using the client identifier supplied by the DHCP client. The example below maps client identifiers to host names (in this case, a customer ID):

Class XYZ Broadband

Subclass HOSTNAMES

Active **true**

Key **01-00-A0-24-2F-10-26**

Value **"john.public"**

Finding a value at runtime

To locate a value for a given key, use the `DB.KEYVALUE` function in an expression. The following example looks up a host name value from a client identifier:

```
[ $DB.KEYVALUE ("XYZ Broadband","HOSTNAMES",$CLIENTID()) ]
```

Note
When using this function to look up a value, make sure string values are enclosed in double quotes.

Device Masquerading

The DHCP server can be configured to masquerade multiple devices as one. Although this type of configuration is not common, it can be an elegant way to meet the requirements of certain kinds of networks.

Warning
This option can have unintended side-effects. Carefully consider the use cases before assigning a single address to multiple DHCP clients.

To masquerade multiple devices as one device, define the *Override Client ID* option in a policy. The client-id value you supply is used for tracking leases in the server, so if two devices have the same *Override Client ID* value they will appear as the same device to the DHCP engine.

The *Override Client ID* option cannot be defined in a pool. You should be very careful to limit the scope of this option in order to minimize inadvertent side-effects. Device-specific policies are the best place to define it, whereas the Global policy is the worst place to define it. Defining this option in the Global policy will effectively assign the **same IP address** to **every device on your network**.

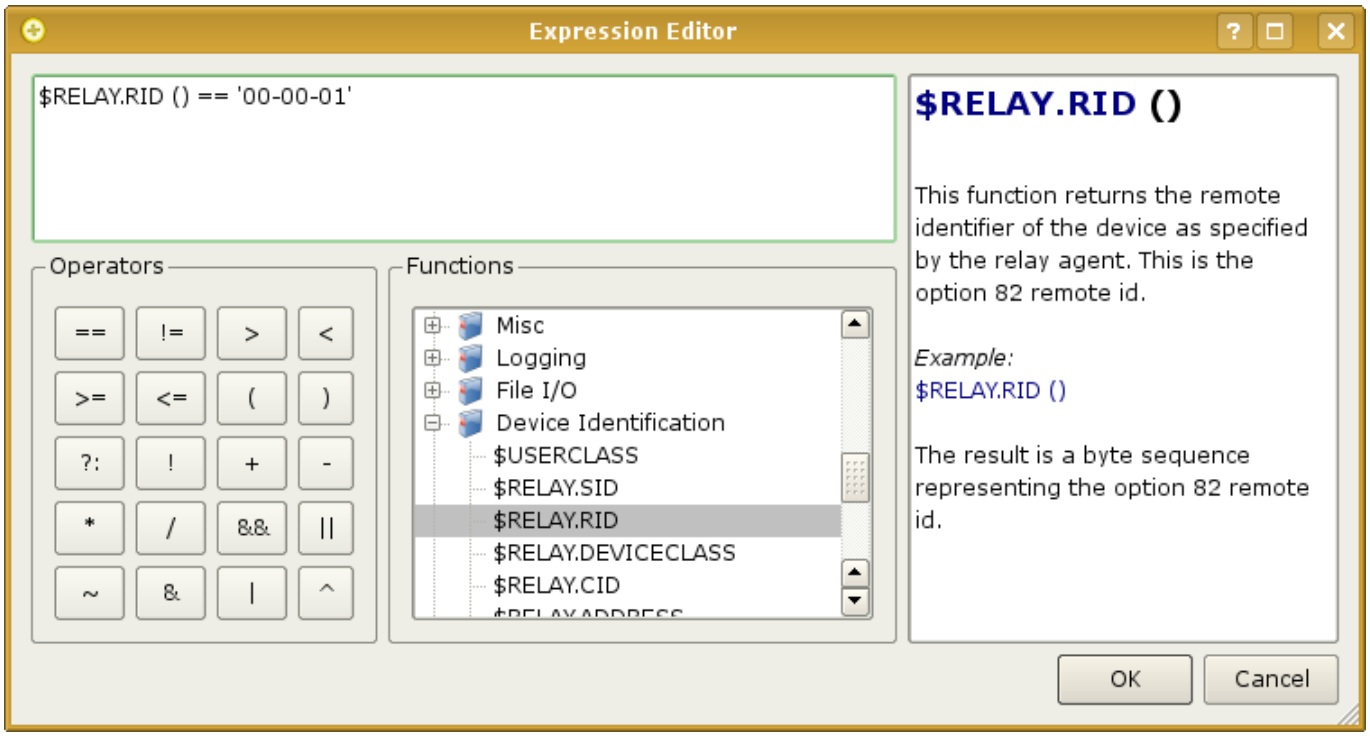
The *Override Client ID* option can be a literal value or an expression that is calculated at runtime.

Note
Be aware that the calculated value should not interfere with regular DHCP client identifiers. You may consider prepending a specific sequence of bytes to the calculated identifier to reduce the likelihood of a clash with DHCP client identifiers.

Expressions

The expression evaluator module is used to parse expressions and execute them at runtime. Expressions can be used to implement business-specific logic that allows the server to vary its response or to make specific runtime decisions at key processing points.

An expression can be used at any place where the **Build** button  is presented. Clicking this button opens the expression editor:



To denote that a value should be an expression instead of a literal, enclose the value in block characters `[ ]`.

Data Types

The expression evaluator recognizes the following data types:

Type	Description
string	Strings are always enclosed in double quotes. `"My name is"` is an example of a string.
time	The time type is an ISO-standard string representation of a date specified in a rigid month/day/year format. `Oct 1 1992` is an example of a date.
ip address	An ip address is specified in dotted-decimal notation. `192.168.1.1` is an example of an ip address.
integer	An integer is signed number specified in decimal form. `-1000` is an example of an integer.
boolean	A boolean represents true or false. Booleans are specified using true or false.
byte sequence	A byte sequence is a sequence of 8-bit values that together represent a single unit. `00-A0-24-2F-10-26` is an example of a byte sequence.
endpoint	An endpoint is a string representation of an ip:port pair. `"192.168.1.1:80"` is an example of an endpoint.

Operator Reference

The following operators can be used in your expressions:

Operator	Description
( )	Used to change the natural order of precedence among the operators
[ ]	Opening and closing tags for an expression
’	Enclosing literal operands forces interpretation as a native data type
+	addition
-	subtraction

Operator	Description
/	division
*	multiplication
<	less than
>	greater than
⇐	less than or equal
>=	greater than or equal
==	is equal
!=	is not equal
? :	conditional if. . . else
&&	logical AND
||	logical OR
!	logical NOT
&	bitwise AND
bitwise OR	+
bitwise XOR	^
bitwise inverse	-

Function Reference

The expression evaluator supports a wide range of functions that you can use in your expressions.

Date and Time

$DATE ([format])

Arguments Optional ISO-standard `strftime` arguments

Returns Current date as a string

Description This function returns the current date. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$DATE ()*

   Returns a string of the form `"2002-01-25"`.

2. *$DATE ("%c")*

   Returns a string with date and time in the current locale format, e.g. `"Thu Jul 25 16:56:18 CEST 2007"`.

$YEAR ([format])

Arguments Optional ISO-standard `strftime` arguments

Returns Current year as a string

Description This function returns the current year. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$YEAR ()*

   Returns a string of the form `"2007"`.

2. *$YEAR ("%y")*

   Returns a string containing the year without century, e.g. `"07"`.

$MONTH ([format])

Arguments Optional ISO-standard `strftime` arguments

Returns Current month as a string

Description This function returns the current month. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$MONTH ()*

   Returns a string of the form `"January"`.

2. *$MONTH ("%b")*

   Returns a string containing the abbreviated month name, e.g. `"Jan"`.

$DAY ([format])

Arguments Optional ISO-standard `strftime` arguments

Returns Current month as a string

Description This function returns the current day of the week. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$DAY ()*

   Returns a string of the form `"Thursday"`.

2. *$DAY ("%j")*

   Returns a string containing the julian day, e.g. `"206"`.

$TIME.UTC ()

Arguments None

Returns Current UTC time as an integer

Description This function returns the current UTC (GMT) time as an integer.

Examples

1. *$TIME.UTC()*

   Returns an integer representing the current UTC time.

$TIME.FORMAT.UTC (`integer`, `[format]`)

Arguments Current UTC time as an integer

Returns Current UTC time as a string

Description This function returns the current UTC time as a string. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$TIME.FORMAT.UTC($TIME.UTC())*

   Returns a string of the form `"04:58:26 PM"`.

$TIME.FORMAT.LOCAL (`integer`, `[format]`)

Arguments Current UTC time as an integer

Returns Current local time as a string

Description This function returns the current local time as a string. The optional `format` argument allows you to specify an ISO-C strftime format for the returned value. Information about `strftime` can be found at various sites on the Internet.

Examples

1. *$TIME.FORMAT.LOCAL($TIME.UTC())*

   Returns a string of the form `"04:58:26 PM"`.

File IO

$FILE.EXISTS (`file`)

Arguments File name as a string

Returns `true` if the file exists, `false` otherwise

Description This function checks for the existence of a file on the local file system.

$VALUE (`file`,`key`)

Arguments File name as a string, key to search on as a string

Returns The value associated with the key

Description This function retrieves a single value from a file, using the key argument as an index. The format of the file is:

```
<default>=some value
key1=some other value
key2=yet another value
...
```

The key and value can be any data type. The special <default> key can also be listed in this file. If it exists, all non-matching lookups return this value.

Examples

1. *$VALUE ("valid_macs.txt",$HWADDR ())*
   This expression implies that your file uses hardware addresses as the key.

Conditional

$IF (`value`,`result1`,`result2`)

Arguments Any values

Returns `result1` or `result2` depending on whether `value` evaluates to `true` or `false`

Description This function is the equivalent of an *if... then... else* construct.

Examples

1. *$IF (*true*,"yes","no")*
   Returns the string "yes".

$COND (`expression`,`expression`,`...`)

Arguments Any number of sub-expressions

Returns The first true sub-expression, or the last false if all sub-expressions are false.

Description This function is somewhat similar to the LISP COND function. The first sub-expression that returns any valid value except `false` will be the return value of this function. The *invalid* data type always evaluates to `false`, so a function that returns *invalid* does not stop the processing of sub-expressions.

```
Generally the last subexpression listed should be the default value in case
   all other subexpressions are false.
```

Examples

1. *$COND ($STARTSWITH ("haystack","hello"),STARTSWITH("haystack","hay")*
   Returns the string "hay".

Type Conversion

$BOOL (`value`)

Arguments Any value

Returns `true` or `false`

Description This function converts any type to a boolean result.

Examples

1. *$BOOL ("true")*
   This returns a boolean value of `true`.

$INT (`value`)

Arguments Any value

Returns integer

Description This function attempts to convert `value` to an integer. `value` can be any data type, but the conversion is not guaranteed to succeed because the type or format of `value` may not facilitate conversion.

Examples

1. *$INT ("206")*
   Returns an integer whose value is 206.

$IP (`value`)

Arguments Any value

Returns ip address

Description This function attempts to convert `value` to an ip address. `value` can be any data type, but the conversion is not guaranteed to succeed because the type or format of `value` may not facilitate conversion.

Examples

1. *$IP ("192.168.1.1")*
   Returns an IP address having the value 192.168.1.1.

$BYTES (`value`)

Arguments Any value

Returns byte sequence

Description This function attempts to convert `value` to a byte sequence. `value` can be any data type, but the conversion is not guaranteed to succeed because the type or format of `value` may not facilitate conversion.

Examples

1. *$BYTES ("00-A0-24-2F-10-26")*

   Returns a sequence of bytes having the value 00-A0-24-2F-10-26.

$STR (`value`, `[delimiter]`)

Arguments Any value

Returns string

Description This function converts `value` to a string. It is always possible to convert a non-string type to a string. Use the optional delimiter argument to specify your own delimiter for data types that support them.

Examples

1. *$STR (00-A0-24-2F-10-26)*

   Returns a string whose value is "00-A0-24-2F-10-26".

2. *$STR ($HWADDR(),"_")*

   Returns a string whose value is "00_A0_24_2F_10_26".

$TEXT(`bytes`)

Arguments Byte sequence

Returns string

Description This function converts a byte sequence to a human-readable string. This function is not the same as the *$STRING* function, which simply gives a text representation of the bytes.

Examples

1. *$TEXT ('*68-65-6C-6C-6F-00*')*

   Returns a string whose value is "hello".

String Manipulation

$UCASE (`string`)

Arguments source string

Returns string in upper case

Description This function returns the input string as all upper case. If this function is called with an argument that is not of type string, the argument is returned unmodified.

Examples

1. *$UCASE ("hello, world")*

   Returns a string whose value is "HELLO, WORLD".

$LCASE (`string`)

Arguments source string

Returns string in lower case

Description This function returns the input string as all lower case. If this function is called with an argument that is not of type string, the argument is returned unmodified.

Examples

1. *$UCASE ("HELLO, WORLD")*

   Returns a string whose value is "hello, world".

$LEFT (`string`, `count`)

Arguments source string, number of elements

Returns string

Description This function returns the left-most `count` elements from `string`. The string argument need not be of type string; it may be any type that can be converted to a string.

Examples

1. *$LEFT ("hello, world",5)*

   Returns a string whose value is "hello".

2. *$BYTES ($LEFT (*'00-A0-24-2F-10-26'*,5))*

   The result is a hardware address containing two bytes, 00 and 0A.

$RIGHT (`string`, `count`)

Arguments source string, number of elements

Returns string

Description This function returns the right-most `count` elements from `string`. The string argument need not be of type string; it may be any type that can be converted to a string.

Examples

1. *$RIGHT ("hello, world",5)*

   Returns a string whose value is "world".

2. *$BYTES ($RIGHT (*'00-A0-24-2F-10-26'*,5))*

   The result is a hardware address containing two bytes, 00 and 0A.

$MID (`string`, `count`, `pos`)

Arguments source string, number of elements, starting position

Returns string

Description This function returns `count` elements from string, starting at position `pos`. The `pos` argument specifies the zero-based index of the starting character.

Examples

1. *$MID ("hello, world",1,4)*
   Returns a string containing "ello".
2. *$MAC ($MID (00-A0-24-2F-10-26,3,5))*
   The result is a hardware address containing two bytes, A0 and 24.

$LEN (`value`)

Arguments any value

Returns integer

Description This function computes the length of the input value, in bytes

Examples

1. *$LEN ("hello, world")*
   Returns the integer valule 12.

$INSTR (`string`, `substring`)

Arguments string, search string

Returns integer

Description This function searches `string` for the first occurence of `substring` and returns the zero-based index of the position at which `substring` appears in `string`. Returns -1 if `substring` doesn't appear in `string`.

Examples

1. *$INSTR ("hello, world","wo")*
   Returns the integer valule 7.

$BASE64.ENCODE (`byte sequence`)

Arguments byte sequence

Returns string

Description This function encodes the byte sequence argument as a base-64 string.

Examples

1. *$BASE64.ENCODE (*01-11-11-11-11-11-11*)*
   Returns a string containing "ARERERERREQ==".

$BASE64.DECODE (`string`)

Arguments string

Returns byte sequence

Description This function decodes the string from base-64 to a byte sequence.

Examples

1. *$BASE64.DECODE ("ARERERERREQ==")*
   Returns the byte sequence 01-11-11-11-11-11-11.

$STARTSWITH (`haystack`, `needle`)

Arguments string, string

Returns string or `invalid`

Description This function returns *needle* if *haystack* begins with *needle*, otherwise it returns `invalid`. This function is useful in conjunction with the LISP-style COND function for creating flow control.

Examples

1. *$STARTSWITH ("haystack","hay")*
   Returns the string "hay"

Encryption and Decryption

$ENCRYPT (`byte sequence`)

Arguments byte sequence

Returns byte sequence

Description This function encodes the byte sequence with the server's shared system key. The encoded value is an even multiple of 8 bytes with an 8-bit length prefix.

Examples

1. *$ENCRYPT (*01-A0-24-20-2F*)*
   Returns a byte sequence representing the encrypted input argument.

$DECRYPT (`byte sequence`)

Arguments byte sequence

Returns byte sequence

Description This function decodes the byte sequence with the server's shared system key. The length of the input argument must be an even multiple of 8 bytes with an 8-bit length prefix.

Examples

1. *$DECRYPT (*01-A0-24-20-2F*)*
   Returns a byte sequence representing the unencrypted input argument.

$SENCRYPT (`string`)

Arguments string

Returns byte sequence

Description This function encodes the string argument with the server's shared system key. The encoded value is an even multiple of 8 bytes with an 8-bit length prefix.

Examples

1. *$SENCRYPT ("hello, world")*
   Returns a byte sequence representing the encrypted string.

$SDECRYPT (`byte sequence`)

Arguments byte sequence

Returns string

Description This function decodes the byte sequence with the server's shared system key. The length of the input argument must be an even multiple of 8 bytes with an 8-bit length prefix.

Examples

1. *$SDECRYPT (*01-A0-24-20-2F*)*
   Returns the decrypted string.

$MD5 (`byte sequence`)

Arguments byte sequence

Returns byte sequence

Description This function computes an MD5 hash of the input argument.

Examples

1. *$MD5 (*01-A0-24-20-2F*)*
   Returns the md5 hash.

Miscellaneous

$USLEEP (`usec`)

Arguments integer

Returns nothing

Description This function causes the server to pause for `usec` microseconds.

Examples

1. *$USLEEP (1000)*
   Pauses for 1000 microseconds and returns no value.

$EVAL (`string`)

Arguments any valid expression syntax

Returns result of expression execution

Description This function parses and executes the input string as an expression.

Examples

1. *$EVAL ("DATE()")*
   Calls the $DATE() function and returns its value.

$LOG (`value`)

Arguments any value

Returns nothing

Description This function prints an *audit* message in the system log containing `value`.

Examples

1. *$LOG ("Hello, World")*
   Logs "Hello, World" to the system log.

$MATCH (`haystack`, `needle`)

Arguments A haystack and a needle

Returns haystack if needle is found, otherwise `unknown`

Description This function performs wildcard matching on `haystack` using `needle`. The result can always be evaluated as a boolean, but in some cases it may be preferable to use the native result type such as with the COND function.

Examples

1. *$MATCH ("Hello, World","Hello*")*
   Returns "Hello, World".

$UNKNOWN ()

Arguments None

Returns The `unknown` data type

Description This function returns data type `unknown`. This can be useful to explicitly induce an expression to fail.

Examples

1. *$UNKNOWN ()*

   Returns the `unknown` data type.

DHCPv4 Functions

Device Identification

Device Identification functions are useful for runtime provisioning of devices on your network. These functions each return a piece of information that identifies the specific device or class of device the server is communicating with.

If you can't find a function that handles the information you want, take a look at the $INP() function.

$RELAY.RID()

Arguments None

Returns byte sequence

Description This function returns the remote identifier of the device as specified by the relay agent through which the device is communicating. This is the Option 82 Remote ID.

Examples

1. *$RELAY.RID()*

   Returns a byte sequence representing a trusted identifier for an end host.

2. *$RELAY.RID()* == '04-0A-14-00'

   Returns true if the trusted identifier matches the specified value.

$RELAY.CID()

Arguments None

Returns byte sequence

Description This function returns the identifier of the relay agent's circuit through which the device is communicating. This is the Option 82 Circuit ID.

Examples

1. *$RELAY.CID()*

   Returns a byte sequence representing a circuit identifier.

$RELAY.DEVICEID()

Arguments None

Returns byte sequence

Description This function returns the Option 82 DOCSIS device class.

Examples

1. *$RELAY.DEVICECLASS()*

   The result is a single 32 bit number, where each bit has a specific meaning. Use the bitwise operators (|) or (&) to test individual bits.

$RELAY.ADDRESS()

Arguments None

Returns ip address

Description This function returns the IP address of the relay agent through which the device is communicating.

Examples

1. *$RELAY.ADDRESS ()*

   Returns the relay agent's IP address.

$CM()

Arguments None

Returns `true` or `false`

Description This function returns true if the device is a Cablelabs cable modem, false otherwise.

Examples

1. *$CM()*

   Returns true if the device is a cable modem.

$HWADDR()

Arguments None

Returns byte sequence

Description This function returns the link-layer address (MAC address) of the device the server is communicating with.

Examples

1. *$HWADDR()*

   Returns the device's link-layer hardware address.

$HLEN()

Arguments None

Returns integer

Description This function returns the length of the link-layer address (MAC address) in octets.

Examples

1. *$HLEN()*
   Returns the length of device's link-layer address.

$HTYPE()

Arguments None

Returns integer

Description This function returns the IANA hardware type (e.g. Ethernet) of the device the server is communicating with.

Examples

1. *$HWTYPE()*
   Returns an integer representing the device's hardware type.

$CLIENTID()

Arguments None

Returns byte sequence

Description This function returns the device's self-proclaimed identifier. See $DEVICE.ID() for a more thorough identifier.

Examples

1. *$CLIENTID()*
   Returns an identifier for an end host.

$DEVICE.ID()

Arguments None

Returns byte sequence

Description This function returns the value of the client identifier option if it exists, otherwise a byte sequence comprised of the hardware type and hardware address.

Examples

1. *$DEVICE.ID()*
   Returns an identifier for the DHCP client.

$DEVICE.DESCRIPTION(`optional_vendor_class`)

Arguments None - returns a description of the device currently being processed String - returns a description of the device identified by the specified vendor class

Returns A text description of the device

Description This function returns the description associated with the vendor class for this device. Vendor classes are complete descriptions for different types of devices as well as the information required to match an input packet to a vendor class item. In all cases if no match is available, this function returns type *unknown*.

Examples

1. *$DEVICE.DESCRIPTION()*
   Returns a description of the device currently being processed.

$CLASSID()

Arguments None

Returns string

Description This function returns an identifier denoting the class of device the server is communicating with.

Examples

1. *$CLASSID()*
   Returns the device-class identifier if one was supplied.

$USERCLASS()

Arguments None

Returns string

Description This function returns an identifier denoting the type of user or application the server is communicating with.

Examples

1. *$USERCLASS()*
   Returns the device's user-class identifier if one was supplied.

$BOOTP()

Arguments None

Returns boolean

Description This function returns `true` if the device is using the BOOTP protocol, `false` otherwise.

Examples

1. *$BOOTP ()*
   Returns true or false depending on the protocol the device is using.

Packet/Device Inspection

$INP(`tagpath`, `[index]`)

Arguments A tag path having the form `"1"` or `"43/2"`

Returns any data type

Description This is a general-purpose function that allows you to inspect the value of any DHCP option or field found in the packet received by the server.

The index argument is optional, and specifies the 1-based index used to access arbitrary elements of an arrayed DHCP option. When writing expressions using $INP, the tag you're inspecting dictates the return type. For packets that do not contain the specified option, the return type is `unknown`.

Any data type can be converted at runtime to a boolean type. The `unknown` data type is always converted to boolean `false`, and a valid data type is converted to boolean `true`. This allows you to evaluate the result as a simple boolean to test for the existence of the option.

Examples

1. *$INP (77)*

   The result is a string containing the user class identifier.

2. *$INP (60) == true*

   Returns true if option 60 is present in the device's DHCP packet.

$OUTP(`tagpath`, `[index]`)

Arguments A tag path having the form `"1"` or `"43/2"`

Returns any data type

Description This is a general-purpose function that allows you to inspect the value of any DHCP option or field found in the packet to be transmitted to the client.

The index argument is optional, and specifies the 1-based index used to access arbitrary elements of an arrayed DHCP option. When writing expressions using $OUTP, the tag you're inspecting dictates the return type. For packets that do not contain the specified option, the return type is `unknown`.

Any data type can be converted at runtime to a boolean type. The `unknown` data type is always converted to boolean `false`, and a valid data type is converted to boolean `true`. This allows you to evaluate the result as a simple boolean to test for the existence of the option.

Examples

1. *$OUTP (12)*

   The result is a string containing the host name to be sent to the device.

2. *$OUTP (60) == true*

   Returns true if option 60 is present in the packet to be transmitted.

$OUTP.YIADDR()

Arguments None

Returns An ip address

Description This method returns the ip address to be assigned to the device. Only valid for `ack` packets.

$IS_DISCOVER()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `discover` packet, false otherwise.

$IS_REQUEST()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `request` packet, false otherwise.

$IS_RELEASE()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `release` packet, false otherwise.

$IS_INFORM()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `inform` packet, false otherwise.

$IS_DECLINE()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `decline` packet, false otherwise.

$IS_LEASEQUERY()

Arguments None

Returns boolean

Description This method returns `true` if processing a DHCP `leasequery` packet, false otherwise.

$DEVICE.VENDORID(`optional_vendor_class`)

Arguments None - returns the IANA vendor identifier of the device currently being processed String - returns the IANA vendor identifier that most closely matches the vendor class string

Returns An integer representing the IANA identifier for the vendor, or *unknown* if no vendor id can be determined.

Description When called with no arguments, returns the IANA vendor identifier of the device currently being processed. When called with a vendor class string argument, returns the IANA vendor identifier that most closely matches the vendor class string. In all cases if no match is available, this function returns type *unknown*.

Examples

1. *$DEVICE.VENDORID()*

   Returns the current vendor id for the packet being processed.

$DEVICE.TYPEID(`optional_vendor_class`)

Arguments None - returns a device type identifier that uniquely identifies the kind of device currently being processed String - returns a device type identifier that uniquely identifies the type of device identified by the vendor class string

Returns A string representing a device type id path, or *unknown* if no type id can be determined.

Description A device type id is numeric path, such as *4491/1*, that uniquely identifies a specific type of device. If the device communicating with the server supplies a vendor class identifier and the server is configured to recognize this type of device, this function returns a type id that can be used to dictate specific processing for this kind of device.

This function is most useful as an auto-provision expression because it can be used in conjunction with the DB.KEYVALUE function to find a set of domains with which a new device should be associated.

In all cases if no vendor class was supplied or the server does not recognize the class of device, this function returns type *unknown*.

Examples

1. *$DEVICE.TYPEID()*

   Returns the device type identifier for the device being processed.

$BOOTFILE()

Arguments None

Returns string

Description If the device has requested a specific boot file, this function returns it. If no boot file was requested, the return value is an empty string.

Examples

1. *$BOOTFILE ()*

   Returns a string value representing the requested boot file.

$HOSTNAME()

Arguments None

Returns string

Description This function returns the client-supplied hostname if one was provided.

Examples

1. *$HOSTNAME()*

   Returns the device's self-appointed host name.

$HOPS()

Arguments None

Returns integer

Description Returns the number of relay agent hops the device's packet made to get to the server.

Examples

1. *$HOPS()*
   Returns the number of relay agent hops.

$XID()

Arguments None

Returns integer

Description This function returns the current transaction id the device is using to communicate with the server.

Examples

1. *$XID()*
   Returns the transaction id.

$SECS()

Arguments None

Returns integer

Description This function returns the number of seconds the device has been attempting to get an address.

Examples

1. *$SECS()*
   Returns a number of seconds.

$COOKIE()

Arguments None

Returns ip address

Description This function returns the dhcpv4 magic cookie the device is using.

Examples

1. *$COOKIE()*
   Returns the cookie.

$SERVER.IP()

Arguments None

Returns ip address

Description This function returns the local ip address on which the dhcpv4 packet was received.

Examples

1. *$SERVER.IP()*
   Returns the server's ip address.

Database Inspection

$DB.KEYVALUE(`class`, `subclass`, `key`)

Arguments A class, subclass and key. `class` and `subclass` can be any value, and `key` should be unique within `class` and `subclass` unless you explicitly want multiple values for a single `key`.

Returns The value associated with the key

Description This function allows you to find a value associated with a key in the *associations* table. Associations are useful for assigning arbitrary values for use by the DHCP server.

The value stored in an association is always a string, but the return value of this function will be automatically converted to the required data type where possible.

Examples

1. *$DB.KEYVALUE ("geolocation","gps",$RELAY.IP())*
   The result is a string containing the gps coordinates of the relay agent.
2. *$DB.KEYVALUE ("VLAN","VLAN-ID",$HWADDR())*
   Returns a vlan identifier for the specified hardware address.

$DB.KEYVALUE.EXISTS(`class`, `subclass`, `key`, `return`)

Arguments A class, subclass, key and return value

Returns `return` if the association exists, otherwise `unknown`

Description This function allows you to check if an association exists. It does not return the value of the association, but rather it returns `return` if the association exists.

Examples

1. *$DB.KEYVALUE.EXISTS ("VLAN","VLAN-ID",$HWADDR(),16777215)*
   Returns 16777215 if the association exists, otherwise `unknown`.

Server Environment

$PROV.RULE()

Arguments None

Returns The result of a rule that has been executed by the provisioner when identifying the device

Description This function allows you to access the result of any rule that was executed by the provisioner. It can be useful for creating dependencies when writing provisioning rules. Rules are executed in order starting with rule #0.

Examples

1. *$PROV.RULE (0)*

   The result is the value returned by the first rule that was executed (rule number 0) when provisioning this device.

$PROV.ENABLED(`boolean_value`)

Arguments Boolean - *true* or *false*, denoting whether the provisioner should automatically enable a new account

Returns The same value passed in, `boolean_value`

Description When the provisioner is configured to automatically create new device accounts, this function can allows you to instruct the provisioner to enable or disable a new account at the time of initial creation.

Examples

1. *$PROV.ENABLED (false)*

   Instructs the provisioner to disable the device account being created. Returns `false`, the same value passed in.

$PROV.ACCNAME()

Arguments None

Returns The account name for the account created or located for this device

Description The provisioner locates device accounts, or optionally creates new accounts when configured to do so with rules. This function returns the account *name* which is typically the device ID.

Examples

1. *$PROV.ACCNAME ()*

   Returns the name of the account for the device being processed.

DHCPv6 Functions

Device Identification

Device Identification functions are useful for runtime provisioning of devices on your network. These functions each return a piece of information that identifies the specific device or class of device the server is communicating with.

If you can't find a function that handles the information you want, take a look at the $INP() function.

$RELAY.RID()

Arguments None

Returns byte sequence

Description This function returns the remote identifier of the device as specified by the relay agent through which the device is communicating. This is the Option 82 Remote ID.

Examples

1. *$RELAY.RID()*

   Returns a byte sequence representing a trusted identifier for an end host.

2. *$RELAY.RID()* == '04-0A-14-00'

   Returns true if the trusted identifier matches the specified value.

$RELAY.CID()

Arguments None

Returns byte sequence

Description This function returns the identifier of the relay agent's circuit through which the device is communicating. This is the Option 82 Circuit ID.

Examples

1. *$RELAY.CID()*

   Returns a byte sequence representing a circuit identifier.

$RELAY.DEVICEID()

Arguments None

Returns byte sequence

Description This function returns the Option 82 DOCSIS device class.

Examples

1. *$RELAY.DEVICECLASS()*

   The result is a single 32 bit number, where each bit has a specific meaning. Use the bitwise operators (|) or (&) to test individual bits.

$RELAY.ADDRESS()

Arguments None

Returns ip address

Description This function returns the IP address of the relay agent through which the device is communicating.

Examples

1. *$RELAY.ADDRESS ()*
   Returns the relay agent's IP address.

$CM()

Arguments None

Returns `true` or `false`

Description This function returns true if the device is a Cablelabs cable modem, false otherwise.

Examples

1. *$CM()*
   Returns true if the device is a cable modem.

$CLIENTID()

Arguments None

Returns byte sequence

Description This function returns the device's unique identifier.

Examples

1. *$CLIENTID()*
   Returns an identifier for an end host.

$DEVICE.ID()

Arguments None

Returns byte sequence

Description This function returns the device's unique identifier.

Examples

1. *$DEVICE.ID()*
   Returns an identifier for an end host.

$DEVICE.DESCRIPTION(`optional_vendor_enterprise_number`,`optional_vendor_data`)

Arguments None - returns a description of the device currently being processed Integer, String - returns a description of the device identified by the specified enterprise number and optional vendor data

Returns A text description of the device

Description This function returns the description associated with the vendor class for this device. Vendor classes are complete descriptions for different types of devices as well as the information required to match an input packet to a vendor class item. In all cases if no match is available, this function returns type *unknown*.

Examples

1. *$DEVICE.DESCRIPTION()*
   Returns a description of the device currently being processed.

$CLASSID()

Arguments None

Returns string

Description This function returns an identifier denoting the class of device the server is communicating with.

Examples

1. *$CLASSID()*
   Returns the device-class identifier if one was supplied.

$USERCLASS()

Arguments None

Returns string

Description This function returns an identifier denoting the type of user or application the server is communicating with.

Examples

1. *$USERCLASS()*
   Returns the device's user-class identifier if one was supplied.

Packet/Device Inspection

$INP(`tagpath`, `[index]`)

Arguments A tag path having the form `"1"` or `"43/2"`

Returns any data type

Description This is a general-purpose function that allows you to inspect the value of any DHCP option or field found in the packet received by the server.

The index argument is optional, and specifies the 1-based index used to access arbitrary elements of an arrayed DHCP option. When writing expressions using $INP, the tag you're inspecting dictates the return type. For packets that do not contain the specified option, the return type is `unknown`.

Any data type can be converted at runtime to a boolean type. The `unknown` data type is always converted to boolean `false`, and a valid data type is converted to boolean `true`. This allows you to evaluate the result as a simple boolean to test for the existence of the option.

Examples

1. *$INP (77)*

   The result is a string containing the user class identifier.

2. *$INP (60) == true*

   Returns true if option 60 is present in the device's DHCP packet.

$OUTP(`tagpath, [index]`)

Arguments A tag path having the form `"1"` or `"43/2"`

Returns any data type

Description This is a general-purpose function that allows you to inspect the value of any DHCP option or field found in the packet to be transmitted to the client.

The index argument is optional, and specifies the 1-based index used to access arbitrary elements of an arrayed DHCP option. When writing expressions using $OUTP, the tag you're inspecting dictates the return type. For packets that do not contain the specified option, the return type is `unknown`.

Any data type can be converted at runtime to a boolean type. The `unknown` data type is always converted to boolean `false`, and a valid data type is converted to boolean `true`. This allows you to evaluate the result as a simple boolean to test for the existence of the option.

Examples

1. *$OUTP (12)*

   The result is a string containing the host name to be sent to the device.

2. *$OUTP (60) == true*

   Returns true if option 60 is present in the packet to be transmitted.

$DEVICE.VENDORID(`optional_vendor_class`)

Arguments None - returns the IANA vendor identifier of the device currently being processed String - returns the IANA vendor identifier that most closely matches the vendor class string

Returns An integer representing the IANA identifier for the vendor, or *unknown* if no vendor id can be determined.

Description When called with no arguments, returns the IANA vendor identifier of the device currently being processed. When called with a vendor class string argument, returns the IANA vendor identifier that most closely matches the vendor class string. In all cases if no match is available, this function returns type *unknown*.

Examples

1. *$DEVICE.VENDORID()*

   Returns the current vendor id for the packet being processed.

$DEVICE.TYPEID(`optional_vendor_enterprise_number,optional_vendor_data`)

Arguments None - returns a device type identifier that uniquely identifies the kind of device currently being processed Integer,String - Returns a device type identifier that uniquely identifies the type of device identified by the vendor enterprise number. Specify an optional vendor data string for a more closely matched device type.

Returns A string representing a device type id path, or *unknown* if no type id can be determined.

Description A device type id is numeric path, such as *4491/1*, that uniquely identifies a specific type of device. If the device communicating with the server supplies a vendor class identifier and the server is configured to recognize this type of device, this function returns a type id that can be used to dictate specific processing for this kind of device.

This function is useful when writing auto-provisioning rules.

In all cases if no vendor enterprise number was supplied or the server does not recognize the class of device, this function returns type *unknown*.

Examples

1. *$DEVICE.TYPEID()*

   Returns the device type identifier for the device being processed.

$HOPS()

Arguments None

Returns integer

Description Returns the number of relay agent hops the device's packet made to get to the server.

Examples

1. *$HOPS()*

   Returns the number of relay agent hops.

$XID()

Arguments None

Returns integer

Description This function returns the current transaction id the device is using to communicate with the server.

Examples

1. *$XID()*

   Returns the transaction id.

$SERVER.IP()

Arguments None

Returns ip address

Description This function returns the local ip address on which the dhcpv4 packet was received.

Examples

1. *$SERVER.IP()*

   Returns the server's ip address.

Database Inspection

$DB.KEYVALUE(`class`, `subclass`, `key`)

Arguments A class, subclass and key. `class` and `subclass` can be any value, and `key` should be unique within `class` and `subclass` unless you explicitly want multiple values for a single `key`.

Returns The value associated with the key

Description This function allows you to find a value associated with a key in the *associations* table. Associations are useful for assigning arbitrary values for use by the DHCP server.

The value stored in an association is always a string, but the return value of this function will be automatically converted to the required data type where possible.

Examples

1. *$DB.KEYVALUE ("geolocation","gps",$RELAY.IP())*

   The result is a string containing the gps coordinates of the relay agent.

2. *$DB.KEYVALUE ("VLAN","VLAN-ID",$HWADDR())*

   Returns a vlan identifier for the specified hardware address.

$DB.KEYVALUE.EXISTS(`class`, `subclass`, `key`, `return`)

Arguments A class, subclass, key and return value

Returns `return` if the association exists, otherwise `unknown`

Description This function allows you to check if an association exists. It does not return the value of the association, but rather it returns `return` if the association exists.

Examples

1. *$DB.KEYVALUE.EXISTS ("VLAN","VLAN-ID",$HWADDR(),16777215)*

   Returns 16777215 if the association exists, otherwise `unknown`.

Server Environment

$PROV.RULE()

Arguments None

Returns The result of a rule that has been executed by the provisioner when identifying the device

Description This function allows you to access the result of any rule that was executed by the provisioner. It can be useful for creating dependencies when writing provisioning rules. Rules are executed in order starting with rule #0.

Examples

1. *$PROV.RULE (0)*

   The result is the value returned by the first rule that was executed (rule number 0) when provisioning this device.

$PROV.ENABLED(`boolean_value`)

Arguments Boolean - *true* or *false*, denoting whether the provisioner should automatically enable a new account

Returns The same value passed in, `boolean_value`

Description When the provisioner is configured to automatically create new device accounts, this function can allows you to instruct the provisioner to enable or disable a new account at the time of initial creation.

Examples

1. *$PROV.ENABLED (false)*

   Instructs the provisioner to disable the device account being created. Returns `false`, the same value passed in.

$PROV.ACCNAME()

Arguments None

Returns The account name for the account created or located for this device

Description The provisioner locates device accounts, or optionally creates new accounts when configured to do so with rules. This function returns the account *name* which is typically the device ID.

Examples

1. *$PROV.ACCNAME ()*

   Returns the name of the account for the device being processed.

Performance Tuning

The DHCP server includes many configuration settings that can be used to increase the performance of the server. Changing these settings can result in drastic performance improvements, but care should be taken to keep the system as a whole in balance. In particular, all high throughput sub-systems should be tuned to process data fast enough to keep up with the other high throughput sub-systems.

Note
One tell-tale sign of a sub-system not keeping up with another sub-system is when your system event log shows the error "*Failed to send command X to task Y. Command queue overflow.*"

Engines

The DHCP server contains two independent DHCP engines implemented as plugins: the **DHCPv4 Server** plugin and **DHCPv6 Server** plugin. You may install either or both of these plugins, but at least one DHCP server plugin must be installed for the DHCP server to operate.

The DHCP engines are multi-threaded, which allows them to achieve very high performance on multi-core hardware platforms. On servers with multiple CPUs or cores, you should consider enabling multiple engine threads for each DHCP engine.

To enable multiple DHCP engine threads, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.engine.thread_count = 4

ipv6.dhcpv6.engine.thread_count = 4
```

When running multiple threads, you should also disable shared database connections for the DHCP engines. Shared connections use less memory, but slow down the engines. To disable shared connections, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.engine.db.shared_connections = false

ipv6.dhcpv6.engine.db.shared_connections = false
```

The optimal number of engine threads depends on many factors. The best results are usually achieved by thorough system testing on specific platforms, but a good starting point is to configure the total number of engine threads (for both engines) as the total CPU core count minus the number of threads dedicated to other high throughput sub-systems.

For example, with both DHCPv4 and DHCPv6 engines running on a 16-core system, and having historical packet collection and DDNS enabled, you might configure 7 threads per DHCP engine, leaving one thread for historical packet collection and one for dynamic DNS.

Packet-Store

The packet-store module is responsible for collecting historical packets. This module is multi-threaded, which allows it to achieve very high performance on multi-core hardware platforms. On servers with multiple CPUs or cores, you should consider enabling multiple packet-store threads if you are running multiple engine threads.

To enable multiple packet-store threads, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.pktstore.thread_count = 2

ipv6.dhcpv6.pktstore.thread_count = 2
```

When running multiple threads, you should also disable shared database connections for the packet-store module. Shared connections use less memory, but slow down the engines. To disable shared connections, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.pktstore.db.shared_connections = false

ipv6.dhcpv6.pktstore.db.shared_connections = false
```

The optimal number of packet-store threads depends on the total number of engine threads. To gauge the number of packet-store threads needed, place the engine threads under high load and increase the packet-store thread count until the service does not report a command-queue overflow in your event log.

Reclaimer

The **reclaimer** is a subsystem built into the DHCP server that's responsible for finding free IP addresses and delivering them to the DHCP engines in a timely manner.

The reclaimer is multi-threaded, which allows it to achieve very high performance on multi-core hardware platforms. You should consider enabling multiple reclaimer threads if your network has high transience and your servers have multiple CPUs or cores.

To enable multiple reclaimer threads, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.reclaimer.thread_count = 4

ipv6.dhcpv6.reclaimer.thread_count = 4
```

When running multiple threads, you should also disable shared database connections for the reclaimer. Shared connections use less memory, but slow down the reclaimer database access. To disable shared connections, adjust the configuration values shown below and restart the DHCP server:

```
ipv4.dhcpv4.reclaimer.db.shared_connections = false

ipv6.dhcpv6.reclaimer.db.shared_connections = false
```

The optimal number of reclaimer threads depends on many factors, most of which are unfortunately very dynamic. A good rule of thumb is that high transience networks require more reclaimer threads than low transience networks **if** the number of addresses is limited. In other words, if you have relatively few IP addresses and DHCP clients are constantly coming and going on your network (such as a conference hall network), you will likely benefit from more reclaimer threads.

Hardware

We have specific hardware recommendations (available separately), but in general the following specifications should be considered:

- CPU speed
- Number of CPUs and CPU cores
- Hard drive throughput
- Amount of RAM
- L1 and L2 cache size
- Number of memory controllers
- NIC speed

All of these factors make a difference in the speed of the protocol engines.

Software

- Linux® and Solaris® perform better than Windows®
- Other processes should minimize use of CPU and memory
- Real hardware is faster than virtualized hardware

Database

This system uses the **Firebird** database for primary storage. Firebird is a robust database that supports SQL, but it also (crucially) has very low per-transaction latencies. The default database settings are overridden by the protocol engines on startup, typically increasing performance by a large factor.

Firebird is available in two build configuration - *Classic* and *Super*. The Classic configuration scales better across multiple CPUs and is therefore the recommended build configuration for this product.

System Configuration

The DHCP server stores process-wide configuration settings in an ASCII text file. Most of these settings are available through the user interface, but some can only accessed by directly editing the text file with an external editor. If you edit this file with an external editor you must restart the DHCP server process.

On Windows The configuration file is located in the DHCP server's program directory

On Linux The configuration file is located under the `/etc/dhcpt` directory

---

Note
It's possible to tell the service to use a different configuration file by passing a command line parameter when starting the service. Use the --help command line argument to see a full list of supported command line arguments.

The table below shows the complete set of configuration file settings for the DHCP server. The settings that begin with `ipvN.dhcpvN` are placeholders for the two DHCP protocols. In other words, the `ipvN.dhcpvN.engine.authoritative` key is actually *two* keys: `ipv4.dhcpv4.engine.authoritative` and `ipv6.dhcpv6.engine.authoritative`.

Key	Data Type	Description
rconsole.encryption	boolean	When true, specifies that the remote console should encryption all traffic.
rconsole.listen_on	endpoints	A list of address:port endpoints the remote console should listen on.
rconsole.password	byte sequence	The administrator password, in encrypted form.
rconsole.port	integer	The default port the remote console should listen on.
rconsole.private_key_path	string	The path to the private key file.
rconsole.max_select_count	integer	Specifies the maximum number of records that can be returned in a command line query.
rconsole.force_commit_after_select	boolean	When true, forces a commit after every select. The default is false.
system.db.path	string	The path where the database is located.
system.db.cache_buffers	integer	The number of cache buffers to use for database access.
system.db.name	string	The name of the database this application should use.
system.db.page_size	integer	The page size to use (in bytes) when connecting to the database.
system.db.password	string	The password to use when connecting to the database.
system.db.secondary_files.count	integer	The maximum number of secondary files the database should use (if supported by the database).
system.db.soft_vs_hard_commit_ratio	integer	The maximum soft commits to the database before a hard commit is required.
system.db.statements.file	string	The path name of the file containing SQL select statements to be precompiled.
system.db.table_groups.file	string	The name of the file containing mappings between SQL tables and precompiled statement groups.
system.db.user	string	The user name to use when connecting to the database.
system.db.versions_path	string	The path containing the dsql version files.
system.limits.max_open_files	integer	The maximum number of files that may be opened at one time.
system.log.facility	string	The facility with which syslog messages are logged.
system.log.levels	string	A list of names specifying the types of messages to log (error,warning,info,audit,debug,verbose).
system.log.targets	string	A list of output devices for logging (stdout,eventlog,rsyslog,file).
system.log.target.file	string	The fully qualified path to a log file. Used when system.log.targets includes file.
system.log.target.rsyslog	endpoint	The hostname or address of a remote syslog server. Used when system.log.targets includes rsyslog.

Key	Data Type	Description
system.plugins	string	A list of plugins this process should load. This can be any combination of directories, relative paths or fully qualified paths.
system.priv.chroot_path	string	The path to use when changing the process root.
system.priv.gid	integer	The group id this process should assume.
system.priv.uid	integer	The user id this process should assume.
system.shared_key	byte sequence	A secret key used to authenticate cooperating servers.
system.storage.path	string	The path to use for general-purpose storage.
udp_publisher.latency	integer	The interval, in msec, at which the UDP publisher should publish historical events.
udp_publisher.max_history	integer	The maximum number of historical events the UDP publisher may hold at any time.
udp_publisher.subscribers.file	string	The name of a file that holds a list of subscribers to receive event notifications over udp.
ipv6.enable	boolean	When true, the server's general communication subsystems will attempt to use ipv6 if available.
ddns.default_server	addresses	The hostname or address of the default dns server to use for ddns updates.
ddns.default_ttl	integer	The default ttl to use for ddns updates.
ipvN.dhcpvN.engine.authoritative	boolean	When true, this server authoritatively NAKs dhcp clients the server believes should be reconfigured.
ipvN.dhcpvN.engine.db.commit_retain_count	integer	The max number of soft commits the engine will do before starting a new transaction.
ipvN.dhcpvN.engine.db.shared_connections	boolean	When false, the engine threads use more memory but scale well across multiple cores. The default is false.
ipvN.dhcpvN.engine.def_port	integer	Port number the dhcp server should listen on if not otherwise specified.
ipvN.dhcpvN.engine.delete_on_release	boolean	When true, the dhcp server drops all knowledge of a binding when it's released by the client.
ipvN.dhcpvN.engine.listen_on	endpoints	A comma-delimited list of local address:port endpoints the server should listen on.
ipvN.dhcpvN.engine.match_local_segment_pools	boolean	For local segment, only choose address pools that have implicitly associated interfaces.
ipvN.dhcpvN.engine.max_applicable_policies	integer	The maximum number of policies the DHCP server can apply to a client. The default is 1000.

Key	Data Type	Description
ipvN.dhcpvN.engine.max_options	integer	The maximum number of options that can be created by a single engine thread. The default is 2000.
ipvN.dhcpvN.engine.max_dg_rcv	integer	The maximum size datagram the dhcp server will accept.
ipvN.dhcpvN.engine.pool_cache_size	integer	The maximum number of pools an engine thread can cache. Enable pool caching in the engine to increase performance when extending leases.
ipvN.dhcpvN.engine.pendings.garbage_interval	integer	The interval, in seconds, at which garbage pending records should be cleaned. (0 = never)
ipvN.dhcpvN.engine.pendings.max_age	integer	The maximum number of seconds a pended address may be considered valid. The default is 10 seconds.
ipvN.dhcpvN.engine.thread_count	integer	The number of engine threads to be created. The default is to create one engine thread only.
ipvN.dhcpvN.engine.repeat_offers	bool	When true, the dhcp server is allowed to repeat an offer for an ip address when a client issues multiple simultaneous requests.
ipvN.dhcpvN.lbalancer.ds	integer	A delayed service setting. If a client has tried to boot more than this number of seconds, the load balancer will accept the client regardless of its configuration. A value of zero indicates that DS is not in use.
ipvN.dhcpvN.lbalancer.hba	byte sequence	A sequence of 32 bytes of the form XX-XX-XX, where each bit of the bytes represents a hash bucket assignment. The format is described in RFC 3074.
ipvN.dhcpvN.lq.options.allowed	string	A comma-delimited list of option numbers the server is allowed to respond with for lease-query messages. The default is to allow any option.
ipvN.dhcpvN.lq.sources.allowed	addresses	A comma-delimited list of addresses to which the server is allowed to respond for lease-query messages. The default is to allow any source.
ipvN.dhcpvN.mprovisioner.auto_provision.domains.create	boolean	If true, any undefined domains listed in *auto_provision.domains.list* are automatically created.
ipvN.dhcpvN.mprovisioner.account_name.primary	expression	If defined, this expression should return the name to use when locating a provisioner account. This configuration setting allows you to provision devices using arbitrary criteria such as option 82 identifiers.

Key	Data Type	Description
ipvN.dhcpvN.provisioner.account_name.secondary	expression	If the primary account name expression fails to yield a result, this expression is evaluated as a backup.
ipvN.dhcpvN.options.specfile	string	The name of the file containing option definitions for the dhcp server.
ipvN.dhcpvN.reclaimer.interval	integer	How often the reclaimer runs, in minutes.
ipvN.dhcpvN.reclaimer.markers.enable	boolean	Setting this value to true gives a big performance gain during startup on large databases, but may result in (harmless) gaps between leased addresses across restarts.
ipvN.dhcpvN.reclaimer.min_inactive_days	integer	Minimum lease retention age, in days.
ipvN.dhcpvN.reclaimer.select_count	integer	The maximum number of records the reclaimer can receive in a single database read.
ipvN.dhcpvN.pktstore.db.shared_connections	boolean	When false, the statistics collector threads use more memory but scale well across multiple cores. The default is false.
ipvN.dhcpvN.pktstore.commit_count	string	Increases packet store performance by delaying database commits until this many packets have been processed.
ipvN.dhcpvN.pktstore.packet_types	string	A list of packet types, by name, that the packet store module should store. The default is not to store any packets sent or received.
ipvN.dhcpvN.pktstore.thread_count	integer	The number of statistics collector threads to be created. The default is to create one collector thread only.
ipvN.dhcpvN.vendors.specfile	string	The name of the file containing vendor class definitions for the dhcp server.
ipv4.dhcpv4.engine.dynamic_bootp	boolean	When true, the DHCPv4 server supports dynamic bootp.
ipv4.dhcpv4.engine.client_id_generator	expression	An expression that overrides how the server identifies a node (legacy - use the option instead).
ipv4.dhcpv4.engine.deny_ras	boolean	When true, the DHCPv4 server drops requests from Windows RAS servers.
ipv6.enable	boolean	When true, the server's general communication subsystems will attempt to use ipv6 if available.
license.reclaim_percent	integer	When a license reclaim starts, this value indicates the number of licenses to reclaim, in percent.
system.duid	byte sequence	This server's device unique identifier (duid).
system.misc.arp_helper_dll	string	The name of the arp helper dll.

Key	Data Type	Description
system.misc.snmp_ext_dll	string	For Win32, the name of the OS snmp extension dll.

Object Classes

Many commands require that you specify one or more types of objects. This table lists the types of objects the DHCP server understands.

Class	Description
*	All classes
domain	Domains
account	Device accounts
access_control	Access Controls
keyvalue	Associations
address_pool	Address Pools
network_pool	Network Pools (Prefix Pools)
address_binding	Address Bindings
network_binding	Network Bindings (Prefix Bindings)
address_pending	Address Pendings
network_pending	Network Pendings (Prefix Pendings)
policy	Policies
option	Option Types
vendor_class	Vendor Classes
historical_packet	Historical Packets
sql_query	SQL Queries
sql_query_group	SQL Query Groups
capability	Capabilities

Table 4: Object Classes

Configuring A Minimal DHCP Server

DHCP Turbo can be re-configured without many of the default plugins in order to strip the service down to a minimal system footprint.

Begin by stopping the DHCP service. Next, locate the plugins directory:

On Windows The plugin directory is in the Program Files "plugin" folder

On Linux The plugin directory is in /usr/lib/dhcptd (lib,lib32 or lib64 depending on your distribution)

By limiting the plugins in use you can achieve a minimal system configuration. To limit plugins, either move the unwanted plugin files to another directory or specify exactly which plugins the service should use by listing each plugin's fully qualified path name, separated with a comma, in the configuration file (`system.plugins`).

The minimal plugins required are:

- database_init
- dhcp_basicaddrmgr
- dhcp_rconsole
- dhcp4_server

- oodb_fb
- system_bus

The dhcp_rconsole is not technically required, but you will not be able to configure or manage the service without it.

You may switch out dhcp4_server with dhcp6_server if you require DHCP for IPv6. You can also use both if you require support for both protocols.

With this mininal configuration you have no device accounts and no classification system. The DHCP server leases addresses from pools, and uses the policies you define.

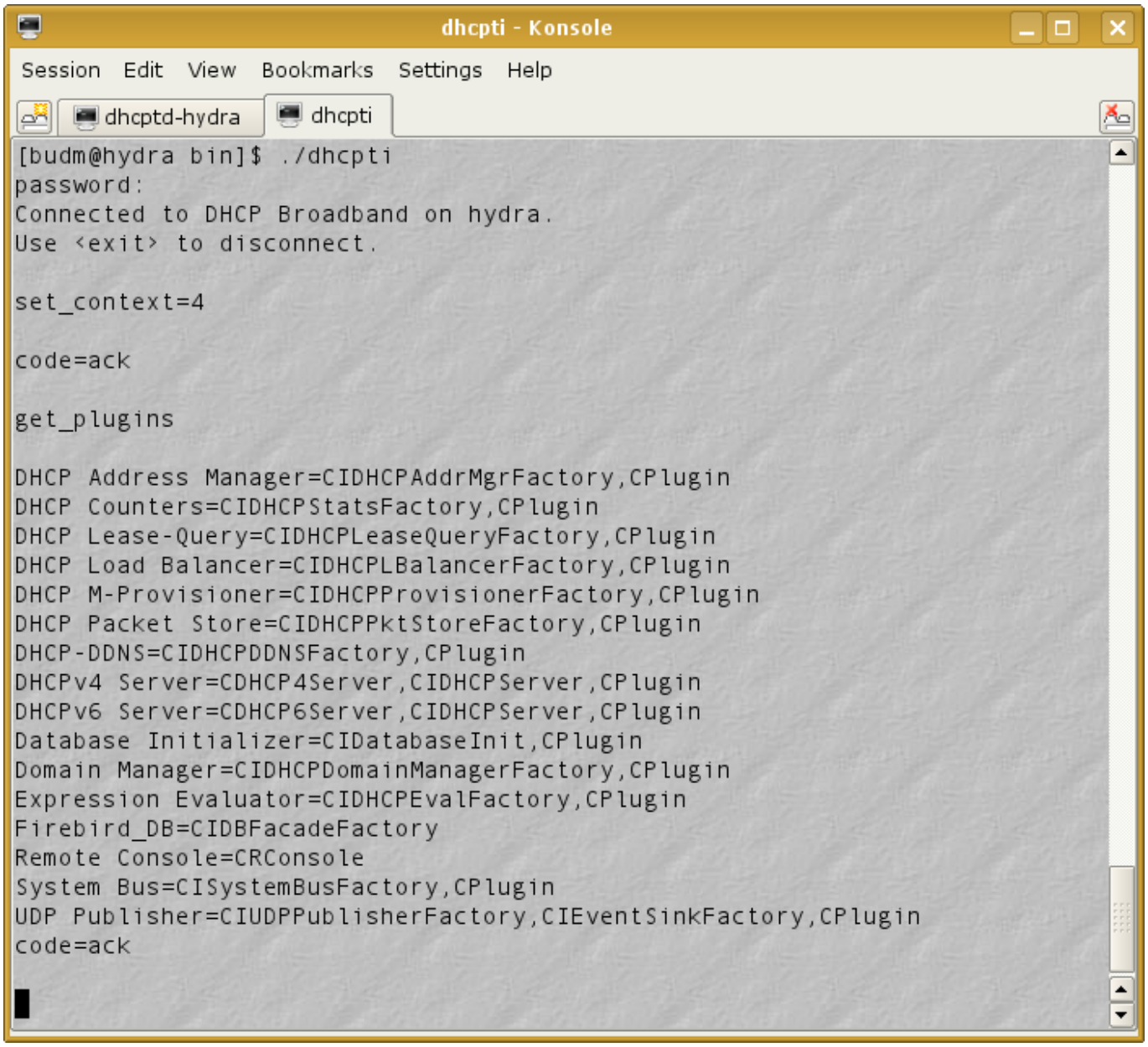
This minimal configuration reduces the DHCP server's RAM use by about half. Further reductions are possible with more advanced techniques - please contact Weird Solutions for more information.

Command-line Reference

The DHCP server package includes `dhcpti`, a utility that provides a remote command line interface for the DHCP server. You can use `dhcpti` to remotely administer most aspects of the DHCP server, including provisioning devices.

The `dhcpti` program defaults to connecting to the DHCP server on *localhost*, but can also be used to connect to a DHCP server across a network. Run `dhcpti --help` for a list of available arguments.

After launching dhcpti you may be prompted for a pasword if the server has network communications enabled. If you have not defined a password, just press enter when prompted.



Once connected, the server accepts single or multi-line text commands and issues responses. To issue a command, simply type the command on a line and press `ENTER` on a new line to have the command executed.

Commands come in three forms: commands without arguments, commands with one argument, and multi-argument commands.

Commands without an argument can be executed by simply typing in the command name and pressing `ENTER` on a new line, as shown below:

```
binding_count
[ENTER]
```

Commands with one argument usually include the argument as part of the command. The `set_context` command is an example of this:

```
set_context=4
[ENTER]
```

Commands that can potentially accept multiple arguments are specified with the command first, followed by zero or more arguments. For example, the `insert_access_control` command requires two arguments:

```
insert_access_control
access_id=100
domain_id=245
[ENTER]
```

The server always responds after each command with a set of `key=value` pairs. When the response includes multiple database records, each record is delimited by a dash character (-) on a line by itself.

The server always appends a return code to the end of its output using a key=value pair. For example, when an operation succeeds, the last data returned is `code=ack`. If an error occured during processing, the server also appends the error message.

Objects that accept DHCP options are prefixed with 'option ' followed by the name of the DHCP option, with each option on its own line. You can remove a specific option from an object by including '-option ' followed by the DHCP option name. When removing an option, no value is required.

Most of the server's objects have permission settings as defined by the *domains* key. You can set this value as you would any other value (as a comma-delimited lists of domain names), or you can add a set of domains to the current set of domains by including a *domains*+= key, with the right of the equal sign holding a list of domains to add. Conversely, you can remove a set of domains from an object by including a *domains*-= key.

The above syntax also works for access control lists, i.e. *acl*+= and *acl*-= are acceptable with objects that have an access control list.

The rest of this chapter contains documentation for all commands the DHCP server accepts.

Commands

set_context

Description This command sets the DHCP server context to DHCPv4 or DHCPv6. Must be executed after first login to set an initial server context.

Shorthand None

Arguments `4` or `6`. Issued directly with the command.

Returns Nothing

Example

```
set_context=4
[ENTER]

code=ack
```

get_context

Description Returns information about the currently selected DHCP context.

Shorthand None

Arguments None

Returns Information about the current context

Example

```
get_context
[ENTER]

context=4
name=dhcpv4
code=ack
```

get_properties

Description This command returns all configuration values from the server's main configuration file.

Shorthand None

Arguments None

Returns Server configuration settings

Example

```
get_properties
[ENTER]

ddns.default_server=
ddns.default_ttl=
ipv4.dhcpv4.engine.deny_ras=false
ipv4.dhcpv4.engine.dynamic_bootp=true
ipv4.dhcpv4.engine.listen_on=
<output clipped for brevity>
code=ack
```

set_properties

Description This command sets one or more configuration values in the server's main configuration file. Changes take effect immediately.

Shorthand None

Arguments Key/values to change

Returns Nothing

Example

```
set_properties
ipv4.dhcpv4.stats.store.packet_types=offer,request/ack,discover
[ENTER]

code=ack
```

get_session

Description Returns various operating parameters for this interactive session.

Shorthand None

Arguments None

Returns Operating parameters

Example

```
get_session
[ENTER]

atomic_option_updates=false
numeric=false
code=ack
```

set_session

Description Sets various operating parameters for this interactive session.

Shorthand None

Arguments Operating parameters as key/value pairs

Returns Nothing

Example

```
set_session
numeric=true
json_options=true
localtime=true
[ENTER]

code=ack
```

get_system

Description Displays system-wide operational attributes. The only currently defined attribute is `mode`, which is used to indicate the current operating mode of the system.

Shorthand None

Arguments None

Returns Operational mode

Example

```
get_system
[ENTER]

mode=paused
code=ack
```

set_system

Description Sets system-wide operational attributes. The only currently defined attribute is `mode`, which is used to place the system in servicing, standby, learning or paused mode.

Shorthand None

Arguments mode=`m`, where `m` is one of: `servicing`, `paused`, `standby`, `learning`

Returns Nothing

Example

```
set_system
mode=paused
[ENTER]

code=ack
```

get_counters

Description Get an instantaneous reading of all system counters.

Shorthand None

Arguments filter=x - this optional argument limits the output to those counters that contain the filter string.

Returns The current values for system counters. Each value is broken down by DHCP subsystem (4 or 6), task or object to which the count belongs, and thread instance the count is for. In addition, totals are provided for all threads in a task, all tasks in a subsystem, and all subsystems.

Example

```
get_counters
[ENTER]

[4].[task.dhcpv4-addrmgr-be].[0].address.available=0
[4].[task.dhcpv4-addrmgr-be].[0].address.frame_swap=0
[4].[task.dhcpv4-addrmgr-be].[0].address.requests=0
[4].[task.dhcpv4-addrmgr-be].[0].address.unavailable=0
[4].[task.dhcpv4-addrmgr-be].[0].binding.reclaimed=0
[4].[task.dhcpv4-addrmgr-be].[0].hole.reclaimed=1
[4].[task.dhcpv4-addrmgr-be].[0].job.executed=1
[4].[task.dhcpv4-addrmgr-be].[total].address.available=0
[4].[task.dhcpv4-addrmgr-be].[total].address.frame_swap=0
[4].[task.dhcpv4-addrmgr-be].[total].address.requests=0
[4].[task.dhcpv4-addrmgr-be].[total].address.unavailable=0
[4].[task.dhcpv4-addrmgr-be].[total].binding.reclaimed=0
<output clipped for brevity>
-
time=21217851 minutes, 7 seconds, 534 ms, 128 us
code=ack
```

help

Description Display a list of commands the interactive session supports.

Shorthand None

Arguments None

Returns A list of supported commands

Example

```
help
[ENTER]

admin_password
binding_count
da
dab
dac
dap
dd
delete_access_control
<output clipped for brevity>
code=ack
```

get_config_names

Description Display a list of configuration keys supported by the application.

Shorthand None

Arguments None

Returns A list of supported configuration keys

Example

```
get_config_names
[ENTER]

ddns.default_server=name or address - The hostname or address of the default dns server ↩
    to use for ddns updates.
ddns.default_ttl=int - The default ttl to use for ddns updates.
<output clipped for brevity>
code=ack
```

info

Description Display various data about the product, machine and software registration.

Shorthand None

Arguments None

Returns Various data

Example

```
info
[ENTER]

_activation_code=
_company=XYZ Corporation
_edition=Broadband NFR Edition - NOT FOR RESALE
_name=DHCP Broadband
_product_id=20
_user=John Doe
build=1503
max_bindings=10000
name=offset-vm
platform=Windows NT 5.1
version=4.1
code=ack
```

dump

Description Display a complete dump of the data held in the server. Refer to the Object Types table for a list of type names that can be used with the *exclude* arguments.

Shorthand None

Arguments

exclude=name1,name2 This optional argument lists objects to exclude from the dump

exclude.v4=name1,name2 This optional argument lists DHCPv4 objects to exclude from the dump

exclude.v6=name1,name2 This optional argument lists DHCPv6 objects to exclude from the dump

Returns All data stored in the DHCP server

Example

```
dump
[ENTER]

<output completely supressed>
code=ack
```

get_functions

Description Display a list of functions supported within this context.

Shorthand None

Arguments None

Returns A list of supported functions

Example

```
get_functions
[ENTER]

BASE64.DECODE=No description
BASE64.ENCODE=No description
BOOL=No description
BOOTFILE=No description
<output clipped for brevity>
code=ack
```

get_license

Description Display information about the binding licenses in use.

Shorthand None

Arguments None

Returns Information about the number of binding licenses free and currently in use.

Example

```
get_license
[ENTER]

claimed=2500
unclaimed=7500
code=ack
```

get_plugins

Description Displays the list of plugins that are loaded and operational.

Shorthand None

Arguments None

Returns The list of operational plugins

Example

```
get_plugins
[ENTER]

DHCP Address Manager=CIDHCPAddrMgrFactory,CPlugin
DHCP Lease-Query=CIDHCPLeaseQueryFactory,CPlugin
DHCP Load Balancer=CIDHCPLBalancerFactory,CPlugin
DHCP M-Provisioner=CIDHCPProvisionerFactory,CPlugin
DHCP Publishing=CIDHCPPublisherFactory,CPlugin
DHCP Rewriter=CIDHCPRewriteFactory,CPlugin
DHCP Statistics=CIDHCPStatsFactory,CPlugin
DHCP-DDNS=CIDHCPDDNSFactory,CPlugin
DHCPv4 Server=CDHCP4Server,CIDHCPServer,CPlugin
Domain Manager=CIDHCPDomainManagerFactory,CPlugin
Expression Evaluator=CIDHCPEvalFactory,CPlugin
External Service Balancer=CIDHCPEBalancerFactory,CPlugin
Firebird_DB=CIDBFacadeFactory
Remote Console=CRConsole
UDP Publisher=CIUDPPublisherFactory,CIEventSinkFactory,CPlugin
code=ack
```

get_query_responses

Description Displays a list of acceptable queries the DHCP engine will accept and their pre-determined responses.

Shorthand None

Arguments None

Returns A set of queries and responses

Example

```
get_query_responses
[ENTER]

config_port=3079,clear
query_ping=pong
query_rconsole_port=3079,clear
code=ack
```

binding_count

Description Displays the number of bindings in the server.

Shorthand None

Arguments None

Returns The number of bindings

Example

```
binding_count
[ENTER]

count=2500
code=ack
```

refresh_config

Description Re-reads the configuration settings from the application's configuration file.

Shorthand None

Arguments None

Returns Nothing

Example

```
refresh_config
[ENTER]

code=ack
```

insert_account

Description Insert a new account record.

Shorthand ia

Arguments `name`, `pass`, `class`, `description`, `domains`, `enabled`

Returns Nothing

Example

```
insert_account
name=01-11-11-11-11-11-11
pass=
class=device4
description=An account for this device
domains=Admin
enabled=true
[ENTER]

code=ack
```

delete_account

Description Delete an account record.

Shorthand da

Arguments SQL where clause

Returns Nothing

Example

```
delete_account
where=T.enabled=0
[ENTER]

code=ack
```

update_account

Description Modify an account record.

Shorthand ua

Arguments SQL where clause and any of: `name`, `pass`, `class`, `description`, `domains`, `enabled`

Returns Nothing

Example

```
update_account
where=T.enabled=0
domains=Disabled
[ENTER]

code=ack
```

select_account

Description Select one or more account records.

Shorthand sa

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more account records

Example

```
select_account
where=T.enabled=1
count=2
[ENTER]

class=login
description=Administrator
domains=Admin
enabled=true
```

```
    id=0
    mod_time=Fri Aug 08 13:29:53 2008
    name=Admin
    pass=
    pk=2
    -
    class=device4
    description=All devices on your network
    domains=Admin
    enabled=true
    id=2
    mod_time=Fri Aug 08 13:29:53 2008
    name=All devices
    pass=
    pk=3
    -
    code=ack
```

select_next_account

Description Continue traversing the result set of a prior select_account command.

Shorthand snxa

Arguments zero or more of: `count`

Returns Zero or more account records

Example

```
    select_next_account
    [ENTER]

    class=device4
    description=
    domains=Admin
    enabled=true
    id=107
    mod_time=Tue Aug 12 20:58:02 2008
    name=01-11-11-11-11-11-11
    pass=
    pk=7
    -
    code=ack
```

count_account

Description Count the total number of account records matching the given WHERE clause.

Shorthand ca

Arguments SQL where clause

Returns A count value

Example

```
count_account
where=T.enabled=1
[ENTER]

count=143652
-
code=ack
```

insert_domain

Description Insert a new domain record.

Shorthand id

Arguments `name`, `groups`, `description`, `domains`

Returns Nothing

Example

```
insert_domain
name=Fiber modems
class=device4
description=A domain for all fiber modems
domains=Admin
[ENTER]

code=ack
```

delete_domain

Description Delete a domain record.

Shorthand dd

Arguments SQL where clause

Returns Nothing

Example

```
delete_domain
where=T.name='Fiber modems'
[ENTER]

code=ack
```

update_domain

Description Modify a domain record.

Shorthand ud

Arguments SQL where clause and any of: `name`, `groups`, `description`, `domains`

Returns Nothing

Example

```
update_domain
where=T.name='Fiber modems'
description=New description
[ENTER]

code=ack
```

select_domain

Description Select one or more domain records.

Shorthand sd

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more domain records

Example

```
select_domain
where=T.name='Fiber Modems'
[ENTER]

groups=Fiber Devices
description=A domain for all fiber modems
domains=Admin
oid=109
name=Fiber Modems
pk=9
-
code=ack
```

select_next_domain

Description Continue traversing the result set of a prior select_domain command.

Shorthand snxd

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_domain
[ENTER]

code=ack
```

count_domain

Description Count the total number of domain records matching the given WHERE clause.

Shorthand cd

Arguments SQL where clause

Returns A count value

Example

```
count_domain
where=T.name='Fiber Modems'
[ENTER]

count=1
-
code=ack
```

insert_domain_group

Description Insert a new domain group record.

Shorthand idg

Arguments `name`, `description`, `domains`

Returns Nothing

Example

```
insert_domain_group
name=Fiber Devices
description=A domain group for all fiber devices
domains=Admin
[ENTER]

code=ack
```

delete_domain_group

Description Delete a domain group record.

Shorthand ddg

Arguments SQL where clause

Returns Nothing

Example

```
delete_domain_group
where=T.oid=2460
[ENTER]

code=ack
```

update_domain_group

Description Modify a domain group record.

Shorthand udg

Arguments SQL where clause and any of: `name`, `description`, `domains`

Returns Nothing

Example

```
update_domain_group
where=T.oid=2460
name='Fiber Devices'
[ENTER]

code=ack
```

select_domain_group

Description Select one or more domain group records.

Shorthand sdg

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more domain records

Example

```
select_domain_group
where=T.oid=2460
[ENTER]

description=A domain group for fiber devices
domains=Admin
oid=2460
name=Fiber Devices
-
code=ack
```

select_next_domain_group

Description Continue traversing the result set of a prior select_domain_group command.

Shorthand snxdg

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_domain_group
[ENTER]

code=ack
```

count_domain_group

Description Count the total number of domain group records matching the given WHERE clause.

Shorthand cdg

Arguments SQL where clause

Returns A count value

Example

```
count_domain_group
where=T.oid=2460
[ENTER]

count=1
-
code=ack
```

insert_sample

Description Insert a new system sample.

Shorthand is

Arguments `version`, `data`, `domains`

Returns Nothing

Example No example is provided. This command is not for administrative use.

delete_sample

Description Delete a system sample.

Shorthand ds

Arguments SQL where clause

Returns Nothing

Example

```
delete_sample
where=T.oid=1680
[ENTER]

code=ack
```

update_sample

Description Modify a system sample.

Shorthand us

Arguments SQL where clause and any of: `name`, `description`, `domains`

Returns Nothing

Example No example is provided. This command is not for administrative use.

select_sample

Description Select one or more system sample records.

Shorthand ss

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more system sample records

Example

```
select_sample
where=T.mod_time > 1267027547 AND t.mod_time < 1267027747
[ENTER]

<output not shown>
_
code=ack
```

select_next_sample

Description Continue traversing the result set of a prior select_sample command.

Shorthand snxdg

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_sample
[ENTER]

code=ack
```

count_sample

Description Count the total number of system sample records matching the given WHERE clause.

Shorthand cdg

Arguments SQL where clause

Returns A count value

Example

```
count_sample
where=T.mod_time > 1267027547 AND t.mod_time < 1267027747
[ENTER]

count=1000
_
code=ack
```

insert_access_control

Description Insert a new access control record.

Shorthand iac

Arguments `access_id`, `domain_id`, `rights`

Returns Nothing

Example

```
insert_access_control
access_id=107
domain_id=110
rights=read,write,execute
[ENTER]

code=ack
```

delete_access_control

Description Delete an access control record.

Shorthand dac

Arguments SQL where clause

Returns Nothing

Example

```
delete_access_control
where=T.access_id=107
[ENTER]

code=ack
```

update_access_control

Description Modify an access control record.

Shorthand uac

Arguments SQL where clause and any of: `access_id`, `domain_id`, `rights`

Returns Nothing

Example

```
update_acccess_control
where=T.access_id=107 AND T.domain_id=110
domain_id=111
[ENTER]

code=ack
```

select_access_control

Description Select one or more access control records.

Shorthand sac

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more access control records

Example

```
select_access_control
where=T.access_id=107
count=1
[ENTER]

access_id=107
domain_id=111
rights=read
-
code=ack
```

select_next_access_control

Description Continue traversing the result set of a prior select_access_control command.

Shorthand snxac

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_access_control
[ENTER]

code=ack
```

count_access_control

Description Count the total number of access control records matching the given WHERE clause.

Shorthand cac

Arguments SQL where clause

Returns A count value

Example

```
count_access_control
where=T.access_id=10
[ENTER]

count=1000
-
code=ack
```

insert_keyvalue

Description Insert a new key/value record.

Shorthand ikv

Arguments `class`, `subclass`, `key`, `value`, `enabled`, `domains`

Returns Nothing

Example

```
insert_keyvalue
class=option-mappings
subclass=hostnames-mac-mappings
key=01-00-A0-24-2F-10-26
value="printer42.mydomain.com"
domains=Admin
enabled=true
[ENTER]

code=ack
```

delete_keyvalue

Description Delete a key/value record.

Shorthand dkv

Arguments SQL where clause

Returns Nothing

Example

```
delete_key_value
where=T.kkey='01-00-A0-24-2F-10-26' AND T.subclass='hostnames-mac-mappings'
[ENTER]

code=ack
```

update_keyvalue

Description Modify a key/value record.

Shorthand ukv

Arguments SQL where clause and any of: `class`, `subclass`, `key`, `value`, `enabled`, `domains`

Returns Nothing

Example

```
update_keyvalue
where=T.kclass='option-mappings'
enabled=true
[ENTER]

code=ack
```

select_keyvalue

Description Select one or more key/value records.

Shorthand skv

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more key/value records

Example

```
select_keyvalue
where=T.enabled=1
[ENTER]

class=option-mappings
subclass=hostnames-mac-mappings
key=01-00-A0-24-2F-10-26
value="printer42.mydomain.com"
domains=Admin
enabled=true
-
code=ack
```

select_next_keyvalue

Description Continue traversing the result set of a prior select_keyvalue command.

Shorthand snxkv

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_keyvalue
[ENTER]

class=relay-mappings
subclass=city
key=192.168.1.1
value="Chicago"
domains=Admin
enabled=true
-
code=ack
```

count_key_value

Description Count the total number of key/value records matching the given WHERE clause.

Shorthand ckv

Arguments SQL where clause

Returns A count value

Example

```
count_key_value
where=T.kvalue='Chicago'
[ENTER]

count=26
-
code=ack
```

insert_historical_packet

Description Insert a new historical packet record.

Shorthand ihp

Arguments `pkt`, `pkt_type`, `primary_id`, `secondary_id`, `domains`

Returns Nothing

Example

```
insert_historical_packet
pkt=<binary data>
pkt_type=discover
primary_id=01-00-A0-24-2F-10-26
secondary_id=00-A0-24-2F-10-26
domains=Admin
[ENTER]

code=ack
```

delete_historical_packet

Description Delete a historical packet record.

Shorthand dhp

Arguments SQL where clause

Returns Nothing

Example

```
delete_historical_packet
where=T.primary_id='01-00-A0-24-2F-10-26' AND T.pkt_type='discover'
[ENTER]

code=ack
```

update_historical_packet

Description Modify a historical packet record.

Shorthand uhp

Arguments SQL where clause and any of: `pkt`, `pkt_type`, `primary_id`, `secondary_id`, `domains`

Returns Nothing

Example

```
update_historical_packet
where=T.primary_id='01-00-A0-24-2F-10-26'
domains=All users
[ENTER]

code=ack
```

select_historical_packet

Description Select one or more historical packet records.

Shorthand shp

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more historical packet records

Example

```
select_historical_packet
where=T.primary_id='01-00-14-0B-0C-2E-9B'
[ENTER]

domains=Admin
mod_time=Sat Aug  2 19:43:35 2008
option Broadcast address=192.168.3.255
option DHCP address lease time=300
option DHCP message type=5
option DHCP rebinding time=262
option DHCP renewal time=150
option Domain name="chaos.se"
option Domain name servers=192.168.3.5
option Gateways=192.168.3.1
option Hostname="00-14-0B-0C-2E-9B"
option PKT:Boot file=""
option PKT:CHAddr=00-14-0B-0C-2E-9B
option PKT:CIAddr=0.0.0.0
option PKT:Flags=0
option PKT:GIAddr=0.0.0.0
option PKT:HLen=6
option PKT:HType=1
option PKT:Hops=0
option PKT:Magic cookie=99.130.83.99
option PKT:Opcode=2
option PKT:SIAddr=192.168.3.5
option PKT:SName="storage"
option PKT:Seconds=0
option PKT:XID=2673796978
```

```
    option PKT:YIAddr=192.168.3.237
    option Server identifier=192.168.3.5
    option Subnet mask=255.255.255.0
    option Time offset=3600
    pk=2576
    pkt=02-01-06-00-9F-5E-E7-72-00-00-00-00-00-00-00-00-C0-A8- <clipped for brevity>
    pkt_type=request/ack
    primary_id=01-00-14-0B-0C-2E-9B
    secondary_id=01-00-14-0B-0C-2E-9B
    -
    code=ack
```

select_next_historical_packet

Description Continue traversing the result set of a prior select_historical_packet command.

Shorthand snxhp

Arguments zero or more of: `count`

Returns Nothing

Example

```
    select_next_historical_packet
    [ENTER]

    code=ack
```

count_historical_packet

Description Count the total number of historical packet records matching the given WHERE clause.

Shorthand chp

Arguments SQL where clause

Returns A count value

Example

```
    count_historical_packet
    where=T.primary_id='01-00-14-0B-0C-2E-9B'
    [ENTER]

    count=1
    -
    code=ack
```

insert_address_binding

Description Insert a new address binding record.

Shorthand iab

Arguments for DHCPv4 `client_id`, `fixed`, `ipaddr`, `lease_commit`, `lease_duration`, `protocol`, `relay`, `source_pool`, `tid`, `tid_type`, `domains`

Arguments for DHCPv6 duid, iaid, iatype, fixed, ipaddr, lease_commit, lease_duration, protocol, relay, source_pool, tid, tid_type, domains

Returns Nothing

Example

```
insert_address_binding
client_id=01-00-14-0B-0C-2E-9B
domains=Admin,FM
fixed=true
ipaddr=192.168.3.237
lease_commit=Sat Aug  2 19:43:35 2008
lease_duration=0:5:0
protocol=dhcpv4
relay=0.0.0.0
source_pool=FM
tid=0122
tid_type=1
[ENTER]

code=ack
```

delete_address_binding

Description Delete an address binding.

Shorthand dab

Arguments SQL where clause

Returns Nothing

Example

```
delete_address_binding
where=T.client_id='01-00-A0-24-2F-10-26' AND T.fixed = 1
[ENTER]

code=ack
```

update_address_binding

Description Modify an address binding.

Shorthand uab

Arguments for DHCPv4 SQL where clause and any of: client_id, fixed, ipaddr, lease_commit, lease_duration, protocol, relay, source_pool, tid, tid_type, domains

Arguments for DHCPv6 SQL where clause and any of: duid, iaid, iatype, fixed, ipaddr, lease_commit, lease_duration, protocol, relay, source_pool, tid, tid_type, domains

Returns Nothing

Example

```
update_address_binding
where=T.client_id='01-00-A0-24-2F-10-26'
domains=FM
[ENTER]

code=ack
```

select_address_binding

Description Select one or more address binding records.

Shorthand sab

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more address binding records

Example

```
select_address_binding
where=T.client_id='01-00-14-0B-0C-2E-9B'
[ENTER]

client_id=01-00-14-0B-0C-2E-9B
domains=Admin,Not Weird
fixed=false
ipaddr=192.168.3.237
lease_commit=Sat Aug  2 19:43:35 2008
lease_duration=0:5:0
pk=22
protocol=dhcpv4
relay=0.0.0.0
source_pool=Weird
tid=
tid_type=1
-
code=ack
```

select_next_address_binding

Description Continue traversing the result set of a prior select_address_binding command.

Shorthand snxab

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_address_binding
[ENTER]

code=ack
```

count_address_binding

Description Count the total number of address binding records matching the given WHERE clause.

Shorthand cab

Arguments SQL where clause

Returns A count value

Example

```
count_address_binding
where=T.relay='000.000.000.000'
[ENTER]

count=1
-
code=ack
```

insert_address_pending

Description Insert a new address pending record.

Shorthand none

Arguments for DHCPv4 `client_id`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Arguments for DHCPv6 `duid`, `iaid`, `iatype`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Returns Nothing

Example

```
insert_address_pending
client_id=01-00-14-0B-0C-2E-9B
domains=Admin,FM
ipaddr=192.168.3.237
offer_time=Sat Aug  2 19:43:35 2008
source_pool=FM
relay=0.0.0.0
[ENTER]

code=ack
```

delete_address_pending

Description Delete an address pending.

Shorthand none

Arguments SQL where clause

Returns Nothing

Example

```
delete_address_pending
where=T.client_id='01-00-A0-24-2F-10-26'
[ENTER]

code=ack
```

update_address_pending

Description Modify an address pending.

Shorthand none

Arguments for DHCPv4 SQL where clause and any of: `client_id`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Arguments for DHCPv6 SQL where clause and any of: `duid`, `iaid`, `iatype`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Returns Nothing

Example

```
update_address_pending
where=T.client_id='01-00-A0-24-2F-10-26'
domains=FM
[ENTER]

code=ack
```

select_address_pending

Description Select one or more address pending records.

Shorthand none

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more address pending records

Example

```
select_address_pending
where=T.client_id='01-00-14-0B-0C-2E-9B'
[ENTER]

client_id=01-00-14-0B-0C-2E-9B
domains=Admin,Not Weird
ipaddr=192.168.3.237
offer_time=Sat Aug  2 19:43:35 2008
pk=22
relay=0.0.0.0
source_pool=Test
-
code=ack
```

select_next_address_pending

Description Continue traversing the result set of a prior select_address_pending command.

Shorthand none

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_address_pending
[ENTER]

code=ack
```

count_address_pending

Description Count the total number of address pending records matching the given WHERE clause.

Shorthand cap

Arguments SQL where clause

Returns A count value

Example

```
count_address_pending
where=T.relay='000.000.000.000'
[ENTER]

count=0
-
code=ack
```

insert_network_pending

Description Insert a new network pending record. Network pendings are only valid in a DHCPv6 context.

Shorthand none

Arguments `duid`, `iaid`, `iatype`, `prefix_len`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Returns Nothing

Example

```
insert_network_pending
duid=01-00-14-0B-0C-2E-9B
iaid=1
ia_type=2
domains=Admin,FM
ipaddr=dead:beef::1
offer_time=Sat Aug  2 19:43:35 2008
source_pool=FM
relay=::
[ENTER]

code=ack
```

delete_network_pending

Description Delete a network pending. Network pendings are only valid in a DHCPv6 context.

Shorthand none

Arguments SQL where clause

Returns Nothing

Example

```
delete_network_pending
where=T.duid='01-00-A0-24-2F-10-26'
[ENTER]

code=ack
```

update_network_pending

Description Modify a network pending. Network pendings are only valid in a DHCPv6 context.

Shorthand none

Arguments SQL where clause and any of: `duid`, `iaid`, `iatype`, `prefix_len`, `offer_time`, `source_pool`, `ipaddr`, `relay`, `domains`

Returns Nothing

Example

```
update_network_pending
where=T.duid='01-00-A0-24-2F-10-26'
domains=FM
[ENTER]

code=ack
```

select_network_pending

Description Select one or more network pending records. Network pendings are only valid in a DHCPv6 context.

Shorthand none

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more network pending records

Example

```
select_network_pending
where=T.duid='01-00-14-0B-0C-2E-9B'
[ENTER]

duid=01-00-14-0B-0C-2E-9B
iaid=1
ia_type=2
domains=Admin,FM
```

```
ipaddr=dead:beef::1
offer_time=Sat Aug  2 19:43:35 2008
source_pool=FM
pk=22
relay=::
-
code=ack
```

select_next_network_pending

Description Continue traversing the result set of a prior select_network_pending command.

Shorthand none

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_network_pending
[ENTER]

code=ack
```

count_network_pending

Description Count the total number of network pending records matching the given WHERE clause.

Shorthand cnp

Arguments SQL where clause

Returns A count value

Example

```
count_network_pending
where=T.relay='000.000.000.000'
[ENTER]

count=0
-
code=ack
```

insert_network_binding

Description Insert a new network binding record. Network bindings are only valid in a DHCPv6 context.

Shorthand inb

Arguments `duid`, `iaid`, `iatype`, `prefix_len`, `fixed`, `ipaddr`, `lease_commit`, `lease_duration`, `protocol`, `relay`, `source_pool`, `tid`, `tid_type`, `domains`

Returns Nothing

Example

```
insert_network_binding
duid=01-00-14-0B-0C-2E-9B
iaid=1
ia_type=2
domains=Admin,FM
fixed=true
ipaddr=dead:beef::1
lease_commit=Sat Aug  2 19:43:35 2008
lease_duration=0:5:0
protocol=dhcpv6
source_pool=FM
tid=2431
tid_type=1
relay=::
[ENTER]

code=ack
```

delete_network_binding

Description Delete a network binding. Network bindings are only valid in a DHCPv6 context.

Shorthand dnb

Arguments SQL where clause

Returns Nothing

Example

```
delete_network_binding
where=T.duid='01-00-A0-24-2F-10-26'
[ENTER]

code=ack
```

update_network_binding

Description Modify a network binding. Network bindings are only valid in a DHCPv6 context.

Shorthand unb

Arguments SQL where clause and any of: `duid`, `iaid`, `iatype`, `prefix_len`, `fixed`, `ipaddr`, `lease_commit`, `lease_duration`, `protocol`, `relay`, `source_pool`, `tid`, `tid_type`, `domains`

Returns Nothing

Example

```
update_network_binding
where=T.duid='01-00-A0-24-2F-10-26'
domains=FM
[ENTER]

code=ack
```

select_network_binding

Description Select one or more network binding records. Network bindings are only valid in a DHCPv6 context.

Shorthand snb

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more network binding records

Example

```
select_network_binding
where=T.duid='01-00-14-0B-0C-2E-9B'
[ENTER]

duid=01-00-14-0B-0C-2E-9B
iaid=1
ia_type=2
domains=Admin,FM
fixed=true
ipaddr=dead:beef::1
lease_commit=Sat Aug  2 19:43:35 2008
lease_duration=0:5:0
protocol=dhcpv6
source_pool=FM
tid=2431
tid_type=1
relay=::
-
code=ack
```

select_next_network_binding

Description Continue traversing the result set of a prior select_network_binding command.

Shorthand none

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_network_binding
[ENTER]

code=ack
```

count_network_binding

Description Count the total number of network binding records matching the given WHERE clause.

Shorthand cnb

Arguments SQL where clause

Returns A count value

Example

```
count_network_binding
where=T.relay='000.000.000.000'
[ENTER]

count=0
-
code=ack
```

insert_address_pool

Description Insert a new address pool record.

Shorthand iap

Arguments `allow`, `deny`, `description`, `enabled`, `name`, `pref_lt`, `valid_lt`, `prefix`, `prefix_len`, `ranges tart`, `rangestop`, `relay`, `weight`, `xrange`, `domains`, *any DHCP option*

Returns Nothing

Example

```
insert_address_pool
allow=
deny=
description=
domains=Admin,FM
enabled=true
name=Fiber Modems
option DHCP address lease time=300
option Domain name servers=192.168.3.5
option Gateways=192.168.3.1
option Subnet mask=255.255.255.0
option Hostname=[$STR($HWADDR())]
pref_lt=100
prefix=192.168.3.0
prefix_len=24
rangestart=192.168.3.230
rangestop=192.168.3.239
relay=0.0.0.0
valid_lt=300
weight=0
xrange=
[ENTER]

code=ack
```

delete_address_pool

Description Delete an address pool.

Shorthand dap

Arguments SQL where clause

Returns Nothing

Example

```
delete_address_pool
where=T.name='Fiber Modems'
[ENTER]

code=ack
```

update_address_pool

Description Modify an address pool.

Shorthand uap

Arguments SQL where clause and any of: `allow`, `deny`, `description`, `enabled`, `name`, `pref_lt`, `valid_lt`, `prefix`, `prefix_len`, `rangestart`, `rangestop`, `relay`, `weight`, `xrange`, `domains`, *any DHCP option*

Returns Nothing

Example

```
update_address_pool
where=T.name='Fiber Modems'
description=All fiber modems
option Time offset=3600
-option Hostname
[ENTER]

code=ack
```

select_address_pool

Description Select one or more address pool records.

Shorthand sap

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more address pool records

Example

```
select_address_pool
where=T.name='Fiber Modems'
[ENTER]

allow=
deny=
description=
domains=Admin,FM
enabled=true
name=Fiber Modems
option DHCP address lease time=300
option Domain name servers=192.168.3.5
option Force broadcast=true
option Gateways=192.168.3.1
option Subnet mask=255.255.255.0
option Time offset=3600
```

```
    pk=4
    pref_lt=100
    prefix=192.168.3.0
    prefix_len=24
    rangestart=192.168.3.230
    rangestop=192.168.3.239
    relay=0.0.0.0
    valid_lt=300
    weight=0
    xrange=
    -
    code=ack
```

select_next_address_pool

Description Continue traversing the result set of a prior select_address_pool command.

Shorthand snxap

Arguments zero or more of: `count`

Returns Nothing

Example

```
    select_next_address_pool
    [ENTER]

    code=ack
```

count_address_pool

Description Count the total number of address pool records matching the given WHERE clause.

Shorthand cap

Arguments SQL where clause

Returns A count value

Example

```
    count_address_pool
    where=T.valid_lt > 200
    [ENTER]

    count=1
    -
    code=ack
```

insert_network_pool

Description Insert a new network (prefix) pool record. Network pools are only valid in a DHCPv6 context.

Shorthand inp

Arguments `allow`, `deny`, `description`, `enabled`, `name`, `pref_lt`, `valid_lt`, `prefix`, `prefix_len`, `sub_prefix_len`, `relay`, `weight`, `xrange`, `domains`, *any DHCP option*

Returns Nothing

Example

```
insert_network_pool
allow=
deny=
description=
domains=Admin,FM
enabled=true
name=Fiber Modems
option NIS server=dead:beef::35
option TZ-Posix=America/New_York
pref_lt=100
prefix=dead:dead::
prefix_len=48
sub_prefix_len=64
relay=::
valid_lt=300
weight=0
xrange=
[ENTER]

code=ack
```

delete_network_pool

Description Delete a network (prefix) pool. Network pools are only valid in a DHCPv6 context.

Shorthand dnp

Arguments SQL where clause

Returns Nothing

Example

```
delete_network_pool
where=T.name='Fiber Modems'
[ENTER]

code=ack
```

update_network_pool

Description Modify a network (prefix) pool. Network pools are only valid in a DHCPv6 context.

Shorthand uap

Arguments SQL where clause and any of: `allow`, `deny`, `description`, `enabled`, `name`, `pref_lt`, `valid_lt`, `prefix`, `prefix_len`, `sub_prefix_len`, `relay`, `weight`, `xrange`, `domains`, *any DHCP option*

Returns Nothing

Example

```
update_network_pool
where=T.name='Fiber Modems'
description=All fiber modems
-option TZ-Posix
option BCMCS Controller Addresses=dead:beef::42
[ENTER]

code=ack
```

select_network_pool

Description Select one or more network (prefix) pool records. Network pools are only valid in a DHCPv6 context.

Shorthand snp

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more network pool records

Example

```
select_network_pool
where=T.name='Fiber Modems'
[ENTER]

allow=
deny=
description=
domains=Admin,FM
enabled=true
name=Fiber Modems
option NIS server=dead:beef::35
option BCMCS Controller Addresses=dead:beef::42
pk=4
pref_lt=100
prefix=dead:dead::
prefix_len=48
sub_prefix_len=64
relay=::
valid_lt=300
weight=0
xrange=
-
code=ack
```

select_next_network_pool

Description Continue traversing the result set of a prior select_network_pool command. Network pools are only valid in a DHCPv6 context.

Shorthand snxnp

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_network_pool
[ENTER]

code=ack
```

count_network_pool

Description Count the total number of network pool records matching the given WHERE clause.

Shorthand cnp

Arguments SQL where clause

Returns A count value

Example

```
count_network_pool
where=T.valid_lt > 200
[ENTER]

count=1
-
code=ack
```

insert_policy

Description Insert a new policy record.

Shorthand ip

Arguments `name`, `description`, `enforce`, `domains`, *any DHCP option*

Returns Nothing

Example

```
insert_policy
name=MyGroup
description=My group of options
domains=MyGroup
enforce=false
option NIS servers=192.168.1.1
[ENTER]

code=ack
```

delete_policy

Description Delete a policy.

Shorthand dp

Arguments SQL where clause

Returns Nothing

Example

```
delete_policy
where=T.name='MyGroup'
[ENTER]

code=ack
```

update_policy

Description Modify a policy.

Shorthand up

Arguments SQL where clause and any of: `name`, `description`, `enforced`, `domains`, *any DHCP option*

Returns Nothing

Example

```
update_policy
where=T.pk=33
description=Policy for STBs
-option NIS Servers
option Overload tftp server name = server.mydomain.com
[ENTER]

code=ack
```

select_policy

Description Select one or more policy records.

Shorthand sp

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more policy records

Example

```
select_policy
where=T.name='MyGroup'
[ENTER]

description=Policy for STBs
domains=Admin,MyGroup
enforce=false
```

```
    name=MyGroup
    option Overload tftp server name=server.mydomain.com
    pk=33
    -
    code=ack
```

select_next_policy

Description Continue traversing the result set of a prior select_policy command.

Shorthand snxp

Arguments zero or more of: `count`

Returns Nothing

Example

```
    select_next_policy
    [ENTER]

    code=ack
```

count_policy

Description Count the total number of policy records matching the given WHERE clause.

Shorthand cp

Arguments SQL where clause

Returns A count value

Example

```
    count_policy
    where=T.name='MyGroup'
    [ENTER]

    count=1
    -
    code=ack
```

insert_vendor_class

Description Insert a new vendor class record.

Shorthand ivc

Arguments `vendor_name`, `vendor_id`, `vendor_class`, `description`, `domains`

Returns Nothing

Example

```
insert_vendor_class
vendor_name=Acme
vendor_id=28551/42
vendor_class=acme-123.???
description=ACME STB model 123, all revisions
domains=Admin
[ENTER]

code=ack
```

delete_vendor_class

Description Delete a vendor class.

Shorthand dvc

Arguments SQL where clause

Returns Nothing

Example

```
delete_vendor_class
where=T.vendor_id='28551/42'
[ENTER]

code=ack
```

update_vendor_class

Description Modify a vendor class.

Shorthand uvc

Arguments SQL where clause and any of: `vendor_name`, `vendor_id`, `vendor_class`, `description`, `domains`

Returns Nothing

Example

```
update_vendor_class
where=T.vendor_id='28551/42'
vendor_class=acme-stb-123.???
[ENTER]

code=ack
```

select_vendor_class

Description Select one or more vendor class records.

Shorthand svc

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more vendor class records

Example

```
select_vendor_class
where=T.vendor_id='28551/42'
[ENTER]

vendor_name=Acme
vendor_id=28551/42
vendor_class=acme-stb-123.???
description=ACME STB model 123, all revisions
domains=Admin
pk=33
-
code=ack
```

select_next_vendor_class

Description Continue traversing the result set of a prior select_vendor_class command.

Shorthand snxvc

Arguments zero or more of: `count`

Returns Nothing

Example

```
select_next_vendor_class
[ENTER]

code=ack
```

count_vendor_class

Description Count the total number of vendor class records matching the given WHERE clause.

Shorthand cvc

Arguments SQL where clause

Returns A count value

Example

```
count_vendor_class
where=T.vendor_id = '28551/42'
[ENTER]

count=1
-
code=ack
```

insert_option

Description Insert a new option declaration.

Shorthand io

Arguments `arrayed`, `class`, `context_vendor_id`, `default_value`, `description`, `fixed_offsets`, `input_type_encoding_value`, `len_prefix_width`, `max_instances`, `max_value`, `min_value`, `name`, `null_terminated`, `output_type_encoding_value`, `signed`, `sublen_width`, `subtag_width`, `subtype_width`, `tagpath`, `type`, `unit`, `user_definable`, `vendor_id`, `vendor_oro`, `domains`

Returns Nothing

Example

```
insert_option
arrayed=true
class=Standard DHCP
context_vendor_id=
default_value=
description=A list of IP addresses, in preferential order, specifying RFC 1001/1002 ↩
    NetBIOS name servers (NBNS).
domains=Admin
fixed_offsets=
input_type_encoding_value=-1
len_prefix_width=0
max_instances=1
max_value=
min_value=
name=NBT name servers
null_terminated=false
output_type_encoding_value=-1
signed=false
sublen_width=0
subtag_width=0
subtype_width=0
tagpath=44
type=ipaddress
unit=
user_definable=allowed
vendor_id=0
vendor_oro=false
[ENTER]

code=ack
```

delete_option

Description Delete an option declaration.

Shorthand do

Arguments SQL where clause

Returns Nothing

Example

```
delete_option
where=T.tagpath='251'
[ENTER]

code=ack
```

update_option

Description Modify an option declaration.

Shorthand uo

Arguments SQL where clause and any of: `arrayed`, `class`, `context_vendor_id`, `default_value`, `description`, `fixed_offsets`, `input_type_encoding_value`, `len_prefix_width`, `max_instances`, `max_value`, `min_value`, `name`, `null_terminated`, `output_type_encoding_value`, `signed`, `sublen_width`, `subtag_width`, `subtype_width`, `tagpath`, `type`, `unit`, `user_definable`, `vendor_id`, `vendor_oro`, `domains`

Returns Nothing

Example

```
update_option
where=T.tagpath='251'
type=string
[ENTER]

code=ack
```

select_option

Description Select one or more option declaration records.

Shorthand so

Arguments SQL where clause and zero or more of: `count`, `pager`, `pager_type`

Returns Zero or more vendor class records

Example

```
select_option
where=T.tagpath='43'
[ENTER]

arrayed=false
class=Standard DHCP
context_vendor_id=❶
default_value=
description=Used by devices and servers to exchange vendor-specific information.
domains=Admin
fixed_offsets=
input_type_encoding_value=-1
len_prefix_width=0
max_instances=1
max_value=
min_value=
```

```
    name=Vendor specific info
    null_terminated=false
    output_type_encoding_value=-1
    pk=45
    signed=false
    sublen_width=0
    subtag_width=0
    subtype_width=0
    tagpath=43
    type=subencoded
    unit=
    user_definable=allowed
    vendor_id=0
    vendor_oro=false
    .
    code=ack
```

select_next_option

Description Continue traversing the result set of a prior select_option command.

Shorthand snxo

Arguments zero or more of: `count`

Returns Nothing

Example

```
    select_next_option
    [ENTER]

    code=ack
```

count_option

Description Count the total number of option declaration records matching the given WHERE clause.

Shorthand co

Arguments SQL where clause

Returns A count value

Example

```
    count_option
    where=T.type = 'subencoded'
    [ENTER]

    count=11
    .
    code=ack
```

Command-line Examples

Modifying pools

To add an option to a pool:

```
update_address_binding
where=T.oid=1680
option Gateways=10.15.0.1
```

To remove that same option from the pool:

```
update_address_binding
where=T.oid=1680
-option Gateways
```

Note
Some options are not allowed to be removed because they are essential to the pool's configuration. (eg *DHCP address lease time*)

To modify the address range used by a pool:

```
update_address_binding
where=T.oid=1680
rangestart=10.20.0.1
rangestop=10.40.255.255
prefix=10.0.0.0
prefix_len=10
option Subnet mask=255.192.0.0
```

To modify the relay agents for a pool:

```
update_address_binding
where=T.oid=1680
relay=10.20.30.200,10.25.40.100
```

To add a set of exclusion ranges (Excluded addresses cannot be used by the DHCP server):

```
update_address_binding
where=T.oid=1680
xrange=10.40.125.1-10.40.125.255,10.30.125.2-10.30.125.255
```

Selecting Objects

In the simplest case, searchable attributes are referenced with the **T** alias. **T** is an alias for the table in which the object resides.

```
select_address_binding
where=T.oid=2304
```

String arguments must always be enclosed in single quotes (eg *xxx*):

```
select_address_pool
where=T.name='My pool'
```

When searching for an IP address, the *fat* format must be specified (ie, padded with zeros):

```
select_address_binding
where=T.ipaddr>'000.010.020.020'
```

To limit the number of records returned by a query, use the **count** argument:

```
select_address_binding
count=10
```

To retrieve the next set of records matching your query, issue the corresponding `select_next`.

Tip
You can specify a new `count` for the select_next. The default is to use the previous count.

```
select_next_address_binding
count=30
```

Selecting Pools

To select pools that span a specified range:

```
select_address_pool
where=IR.start_ip > '010.020.000.001' and IR.stop_ip < '010.040.255.255'
```

To select pools that are associated with a set of relay agents:

```
select_address_pool
where=I.addr IN ('010.020.030.200','010.025.040.100')
```

To select pools that exclude a particular range of IP addresses:

```
select_address_pool
where=ER.start_ip > '010.040.125.001' and ER.stop_ip < '010.040.125.255'
```

To select pools that have any exclusion range that begins with any of several IP addresses:

```
select_address_pool
where=ER.start_ip IN ('010.040.125.001','010.030.125.002')
```

Tip
All of the where clauses specified above can be combined.

Selecting domains

To select domains that are associated with a particular group:

```
sd
where=DG.name='Device Specific'
```

To select domains that do not belong to a particular group:

```
sd
where=DG.name<>'Device Specific'
```

To select domains that belong to any of several groups:

```
sd
where=DG.name IN ('Cable Devices','Telephone Service Level')
```

Backup and Restore

The Firebird database ships with the *gbak* utility which can be used for online incremental backups.

Gbak is documented in the Firebird documentation.

Glossary

Domain

A domain is essentially a group. If you state the devices that are members of the domain, you can then decide what permissions the entire group should have.

ACL

Access Control List. An ACL is a list of devices that belong to a domain. In the database, ACLs are database records that can be queried, deleted or modified.

Binding

A record in the database that associates an IP address with a unique device identifier.

Lease

When used as a noun, a Lease is the same as a Binding. When used as a verb, Lease refers to the contract (implicit or explicit) associated with a binding. For example: When the server leases an address, it creates a binding.

Address Pool

A record in the database that specifies a start and end range for a block of IP addresses that are eligible for leasing to devices on the network.

Network Pool

A record in the database that specifies a start and end range for a block of IP subnets that are eligible for leasing to devices on the network.

Prefix Pool

A synonym for *Network Pool*.

Expression

A miniature program, associated with some attribute in the server, that is executed every time that attribute is read. Expressions can often be useful when setting the value of an option, because the can vary the option value each time they are executed. Expressions are delimited with `[ ]`, and can be used throughout the server's configuration.

DDNS

Dynamic Domain Name System. Refers to the DHCP server updating or modifying entries in your DNS server to reflect the name and/or IP address(es) associated with a device.

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