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# IPv6 pools support

The IPv6 address pool name is specified by the `Framed-IPv6-Pool` attribute in `Access-Accept`.



Attributes that set IPv6 addresses to the subscriber (`Framed-IPv6-Address`, `Framed-IPv6-Prefix`, `Delegated-IPv6-Prefix`) take precedence over `Framed-IPv6-Pool`: if there is a pool in the response and at least one of the above attributes specifying an IPv6 address or prefix, PCRF ignores `Framed-IPv6-Pool`

Upon detecting the `Framed-IPv6-Pool` attribute in the Radius response, the PCRF shall:

- contact the DHCPv6 server for the address and/or prefix of the subscriber by passing the pool name to the DHCPv6 server in one of the DHCPv6 options;
- after receiving a DHCPv6 server response, generate a general authorization response by combining the DHCPv6 response options and the `Access-Accept` attributes

## Configuring fastPCRF

At least one DHCPv6 server serving the pools must be specified in `fastpcrf.conf`. The server address is set in the `dhcp6_server` parameter of the following form:

```
# Each server is specified by a separate parameter dhcp6_server
# Format:
#   dhcp6_server = [ipv6% dev] {:: port} {; option} +
# where:
#   ipv6 - DHCPv6 server address
#   dev is the name of the interface from which to connect
#   port - port, default = 547
#   options: additional options:
#     source_ip = address - source IPv6 address, on behalf of which the
request to the DHCPv6 server is made
#           If source_ip is not set, then:
#             - if the server address is link-local - the link-local
address of the dev interface is taken
#             - if the server address is global - the global address of
the dev interface is taken
#   relay_ip = address - IPv6 address of the relay. It is this address
that the DHCPv6 server regards as the relay address.
#           If not set - equal to source_ip
# Example: two DHCPv6 servers: one with a global address, the other with a
link-local address
#
dhcp6_server=[2001:4860:4860::8888%eth1];source_ip=2a01:a282:3:11:92b1:1cff:
fe18:d298;relay_ip=2001::1
#   dhcp6_server=[fe80::92b1:1cff:fe18:d298%em2];relay_ip=2001::1
dhcp6_server=[fe80::92b1:1cff:fe18:d298%em2];relay_ip=2001::1
```

Each DHCPv6 server is specified in `fastpcrf.conf` with a separate parameter. For example, two servers can be defined like this:

```
# Main server - on interface eth1
dhcp6_server=[fe80::92b1:1cff:fe18:d298%eth1];relay_ip=2001::1
# Backup server - on em2 interface
dhcp6_server=[fe80::92b1:1cff:fe18:4509%em2];relay_ip=2001::1
```

Supports up to 16 DHCPv6 servers. This parameter does not have any default value - to support `Framed-IPv6-Pool`, it is necessary to register at least one DHCPv6 server in `fastpcrf.conf`.

In addition to DHCPv6 servers, you should also specify in which DHCPv6 request option to send the pool name. This is done using the `dhcp6_poolname_opt` parameter. The following DHCP options are supported:

1. `dhcp6_poolname_opt=1` - [15] User-Class. If the option is already present, its value is replaced with the name of the pool
2. `dhcp6_poolname_opt=2` - [17] Vendor-Specific (vendorId=43823, subopt=1). Option is always added

If `dhcp6_poolname_opt=0` (default) - the pool name will be passed in the Vendor-Specific option.

FastPCRF addresses DHCPv6 servers as a relay to make DHCPv6 traffic unique. All DHCPv6 requests are always sent to all servers specified in the `dhcp6_server` parameters. If multiple DHCPv6 servers are configured, PCRF takes into account the first timed response, replies from other DHCPv6 servers are ignored.

## Peculiarities of issuing IPv6 addresses/prefixes in Stingray Service Gateway

Note that Stingray SG currently requires the client to be given a prefix with the length specified by the `ipv6_subnetwork` parameter in `fastdpi.conf` (by default `ipv6_subnetwork=64`). This applies to both PD prefixes and the actual IPv6 address given to the client. That is, in fact, the client is given two prefixes - a PD-prefix and a prefix, from which SSG itself forms the client's full IPv6 address.

Most DHCPv6 servers can issue a PD prefix of any length to a client, but they cannot - a specified length prefix as the client's IPv6 address. In other words, the DHCPv6 server cannot be instructed to "issue IPv6 addresses to clients at this step" (for example, with a / 64 step). To get around this limitation, SSG uses the following trick: only the PD-prefix is requested, and the DHCPv6-server must issue a PD-prefix of length `ipv6_subnetwork` - 1 to the subscriber (that is, by default, 64 - 1 = 63 - /63 prefix). SSG itself divides such a PD-prefix into two / `ipv6_subnetwork`-prefixes: the lower prefix is for allocating an IPv6 address to the client, and the older one is for the client's PD prefix.

## Kea DHCPv6 Server Configuration Examples

The DHCPv6 server is configured differently depending on which DHCPv6 option the pool name will come in (the `dhcp6_poolname_opt` parameter). Below are not complete configuration files `/etc/kea/kea-dhcp6.conf` [Kea DHCP](#), but only extracts related to configpool management

1. [example for option 17](#) (`dhcp6_poolname_opt=2`)

## 2. example for option 15 User-Class (dhcp6\_poolname\_opt=1)

### Forming a DHCPv6 request in DHCPv6 Radius Proxy mode

In the [DHCP Radius Proxy](#) mode, the original DHCPv6 subscriber request is sent to the DHCPv6 server with the addition of the pool name in accordance with the `dhcp6_poolname_opt` parameter. But the server is requested **only** PD-prefix, see above "peculiarities of issuing IPv6 addresses/prefixes in SSG".



Be careful when specifying the pool name in the opt15 User-Class option: if this option is already present in the DHCPv6 subscriber request, its value is changed to the pool name. If the original value of this option is important when configuring a DHCPv6 server, you should use option 17 for the pool name, which is always added

### Forming a DHCPv6 request for PPPoE clients

For [PPPoE](#)-PCRF subscribers form a DHCPv6 request, in which `Client-Id` (option 1, client DUID) is built as DUID-EN (vendorId=43823, 32 bits), then the client's VLANs (2 fields of 16 bits, if there is no VLAN, its value is 0), then 6 bytes of the client's MAC address. This Client-Id design ensures that the DUID remains unchanged, which is important for a DHCPv6 server.

The option format when using the configuration parameter `dhcp_client_id=1` is as follows:

```
[comtype] [subs_id] [tunnel_ip]
```



For PPPoE subscribers, the tunnel IP (`tunnel_ip`) is always 0.

### Forming Access-Accept

After receiving a response from the DHCPv6 server, PCRF combines it with the one previously received from the "Access-Accept" Radius. Recall that in Access-Accept you can also specify DHCPv6 options in the form [special VSA](#). When aggregating responses, DHCPv6 options returned by the DHCPv6 server take precedence over these VSA attributes; for example, if a different list of DNS servers is specified in both the DHCPv6 response and the Access-Accept, then the subscriber will be sent a list of DNS servers from the DHCPv6 server response.