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**DHCP Options for the Port Control Protocol (PCP)**  
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**Abstract**

This document specifies DHCP (IPv4 and IPv6) options to configure hosts with Port Control Protocol (PCP) Server addresses. The use of DHCPv4 or DHCPv6 depends on the PCP deployment scenario.

**Requirements Language**

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

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## 1. Introduction

This document defines IPv4 DHCP [[RFC2131](#)] and DHCPv6 [[RFC3315](#)] options which can be used to provision PCP Server [[I-D.ietf-pcp-base](#)] reachability information; more precisely it defines DHCP options to convey a Fully Qualified Domain Name (FQDN, as per [Section 3.1 of \[RFC1035\]](#)) of PCP Server(s). In order to make use of these options, this document assumes appropriate name resolution means (see [Section 6.1.1 of \[RFC1123\]](#)) are available on the host client.

The use of IPv4 DHCP or DHCPv6 depends on the PCP deployment scenarios.

## 2. Terminology

This document makes use of the following terms:

- o PCP Server: A functional element which receives and processes PCP requests from a PCP Client. A PCP Server can be co-located with or be separated from the function (e.g., NAT, Firewall) it controls. Refer to [[I-D.ietf-pcp-base](#)].
- o PCP Client: a PCP software instance responsible for issuing PCP requests to a PCP Server. Refer to [[I-D.ietf-pcp-base](#)].
- o DHCPv4 refers to IPv4 DHCP [[RFC2131](#)].
- o DHCP refers to both DHCPv4 [[RFC2131](#)] and DHCPv6 [[RFC3315](#)].
- o DHCP client (or client) denotes a node that initiates requests to obtain configuration parameters from one or more DHCP servers [[RFC3315](#)].
- o DHCP server (or server) refers to a node that responds to requests from DHCP clients [[RFC3315](#)].

## 3. Rationale

Both IP Address and Name DHCP options have been defined in previous versions of this document. This flexibility aims to let service providers to make their own engineering choices and use the convenient option according to their deployment context. Nevertheless, DHC WG's position is this flexibility have some drawbacks such as inducing errors. Therefore, only the Name option is maintained within this document.



This choice of defining the PCP Name option rather than the IP address is motivated by operational considerations: In particular, some Service Providers are considering two levels of redirection: (1) The first level is national-wise is undertaken by DHCP: a regional-specific FQDN will be returned; (2) The second level is done during the resolution of the regional-specific FQDN to redirect the customer to a regional PCP Servers among a pool deployed regionally. Distinct operational teams are responsible for each of the above mentioned levels. A clear separation between the functional perimeter of each team is a sensitive task for the maintenance of the offered services. Regional teams will require to introduce new resources (e.g., new PCP-controlled devices such as Carrier Grade NATs (CGNs, [[I-D.ietf-behave-lsn-requirements](#)])) to meet an increase of customer base. Operations related to the introduction of these new devices (e.g., addressing, redirection, etc.) are implemented locally. Having this regional separation provides flexibility to manage portions of network operated by dedicated teams. This two-level redirection can not be met by the IP Address option.

In addition to the operational considerations:

- o The use of the FQDN for NAT64 [[RFC6146](#)] might be suitable for load-balancing purposes;
- o For the DS-Lite case [[RFC6333](#)], if the encapsulation mode is used to send PCP messages, an IP address may be used since the AFTR selection is already done via the AFTR\_NAME DHCPv6 option [[RFC6334](#)]. Of course, this assumes that the PCP Server is co-located with the AFTR function. If these functions are not co-located, conveying the FQDN would be more convenient.

If the PCP Server is located in a LAN, a simple FQDN such as "pcp-server.local" can be used.

#### **4. Consistent NAT and PCP Configuration**

The PCP Server discovered through DHCP must be able to install mappings on the appropriate upstream PCP-controlled device that will be crossed by packets transmitted by the host or any terminal belonging to the same realm (e.g., DHCP client is embedded in a CP router). In case this prerequisite is not met, customers would experience service troubles and their service(s) won't be delivered appropriately.

Note that this constraint is implicitly met in scenarios where only one single PCP-controlled device is deployed in the network.



## 5. DHCPv6 PCP Server Option

This DHCPv6 option conveys a domain name to be used to retrieve the IP addresses of PCP Server(s). Appropriate name resolution queries should be issued to resolve the conveyed name. For instance, in the context of a DS-Lite architecture [[RFC6333](#)], the retrieved address may be an IPv4 address or an IPv4-mapped IPv6 address [[RFC4291](#)], and in the case of NAT64 [[RFC6146](#)] an IPv6 address can be retrieved.

### 5.1. Format

The format of the DHCPv6 PCP Server option is shown in Figure 1.

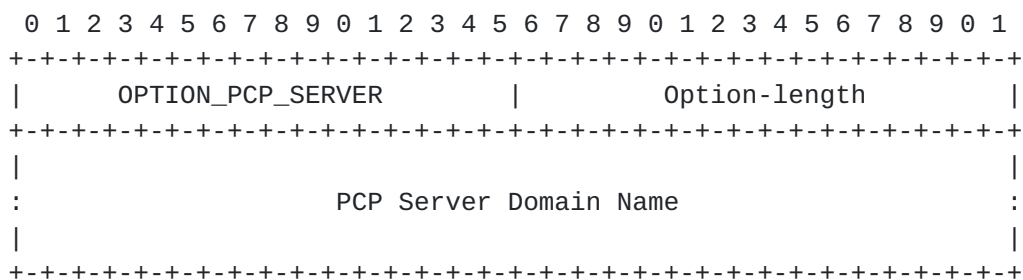


Figure 1: PCP Server FQDN DHCPv6 Option

The fields of the option shown in Figure 1 are as follows:

- o Option-code: OPTION\_PCP\_SERVER (TBA, see [Section 9.1](#))
- o Option-length: Length of the 'PCP Server Domain Name' field in octets.
- o PCP Server Domain Name: The domain name of the PCP Server to be used by the PCP Client. The domain name is encoded as specified in [Section 8 of \[RFC3315\]](#).

### 5.2. Client Behaviour

To discover a PCP Server [[I-D.ietf-pcp-base](#)], the DHCPv6 client MUST include an Option Request Option (ORO) requesting the DHCPv6 PCP Server Name option as described in [Section 22.7 of \[RFC3315\]](#) (i.e., include OPTION\_PCP\_SERVER on its OPTION\_ORO). A client MAY also include the OPTION\_DNS\_SERVERS option on its OPTION\_ORO to retrieve a DNS servers list.

If the DHCPv6 client receives more than one OPTION\_PCP\_SERVER option from the DHCPv6 server, only the first instance of that option MUST be used.





Upon receipt of an OPTION\_PCP\_SERVER option, the DHCPv6 client MUST verify that the option length does not exceed 255 octets [[RFC1035](#)]. The DHCPv6 client MUST verify the FQDN is a properly encoded as detailed in [Section 8 of \[RFC3315\]](#).

Once the FQDN conveyed in a OPTION\_PCP\_SERVER option is validated, the included Name is passed to the name resolution library (see [Section 6.1.1 of \[RFC1123\]](#) or [[RFC6055](#)]) to retrieve the corresponding IP address (IPv4 or IPv6). If more than one IPv6/IPv4 address are retrieved, the PCP Client MUST use the procedure defined in [[I-D.ietf-pcp-base](#)] for address selection.

It is RECOMMENDED to associate a TTL with any address resulting from resolving the Name conveyed in a OPTION\_PCP\_SERVER DHCPv6 option when stored in a local cache. Considerations on how to flush out a local cache are out of the scope of this document.

## 6. DHCPv4 PCP Option

### 6.1. Format

The PCP Server DHCPv4 option can be used to configure a FQDN to be used by the PCP Client to contact a PCP Server. The format of this option is illustrated in Figure 2.

```

      Code  Length  PCP Server Domain Name
+-----+-----+-----+-----+-----+-----+-----+-----+
| TBA |  n  |  s1 |  s2 |  s3 |  s4 |  s5 |  ... |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

The values s1, s2, s3, etc. represent the domain name labels in the domain name encoding.

Figure 2: DHCPv4 PCP Option

The description of the fields is as follows:

- o Code: OPTION\_PCP\_SERVER (TBA, see [Section 9.2](#));
- o Length: Includes the length of the "PCP Server Domain Name" field in octets; The maximum length is 255 octets.
- o PCP Server Domain Name: The domain name of the PCP Server to be used by the PCP Client when issuing PCP messages. The encoding of the domain name is described in [Section 3.1 of \[RFC1035\]](#).



## **6.2. Client Behaviour**

DHCPv4 client expresses the intent to get OPTION\_PCP\_SERVER by specifying it in Parameter Request List Option [[RFC2132](#)].

If the DHCPv4 client receives more than one OPTION\_PCP\_SERVER option from the DHCPv4 server, only the first instance of that option MUST be used. If the selected OPTION\_PCP\_SERVER includes more than one FQDN, only the first instance of that option MUST be used.

The client invokes the underlying name resolution library (see [Section 6.1.1 of \[RFC1123\]](#) or [[RFC6055](#)]) to retrieve the IPv4 address(es) of the PCP server(s).

It is RECOMMENDED to associate a TTL with any address resulting from resolving the Name conveyed in a OPTION\_PCP\_SERVER DHCPv4 option when stored in a local cache. Considerations on how to flush out a local cache are out of the scope of this document.

## **7. Dual-Stack Hosts**

A PCP Server configured using OPTION\_PCP\_SERVER over DHCPv4 is likely to be resolved to IPv4 address(es).

A PCP Server configured using OPTION\_PCP\_SERVER over DHCPv6 may be resolved to IPv4 address(es) (e.g., DS-Lite [[RFC6333](#)]) or IPv6 address(es) (e.g., NAT64 [[RFC6146](#)], IPv6 firewall [[RFC6092](#)], NPTv6 [[RFC6296](#)]).

In some deployment contexts, the PCP Server may be reachable with an IPv4 address but DHCPv6 is used to provision the PCP Client. In such scenarios, a plain IPv4 address or an IPv4-mapped IPv6 address can be configured to reach the PCP Server.

A Dual-Stack host may receive OPTION\_PCP\_SERVER via both DHCPv4 and DHCPv6. The content of these OPTION\_PCP\_SERVER options may refer to the same or distinct PCP Servers. This is deployment-specific and as such it is out of scope of this document.

## **8. Security Considerations**

The security considerations in [[RFC2131](#)], [[RFC3315](#)] and [[I-D.ietf-pcp-base](#)] are to be considered.



## **9. IANA Considerations**

### **9.1. DHCPv6 Option**

Authors of this document request the following DHCPv6 option code:

Option Name	Value
OPTION_PCP_SERVER	TBA

### **9.2. DHCPv4 Option**

Authors of this document request the following DHCPv4 option code:

Option Name	Value
OPTION_PCP_SERVER	TBA

## **10. Acknowledgements**

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