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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 names. 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].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

This document defines DHCPv4 [RFC2131] and DHCPv6 [RFC3315] options which can be used to provision PCP Server [I-D.ietf-pcp-base] names. Motivations for not expressing the PCP option as a 32 or 128-bit binary address are discussed in Appendix A.

In order to make use of these options, this document assumes appropriate name resolution means (e.g., Section 6.1.1 of [RFC1123]) are available on the host client.

The use of DHCPv4 or DHCPv6 depends on the PCP deployment scenarios.

2. Terminology

This document makes use of the following terms:

- PCP Server denotes 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].
- PCP Client denotes a PCP software instance responsible for issuing PCP requests to a PCP Server. Refer to [I-D.ietf-pcp-base].
- DHCP refers to both DHCPv4 [RFC2131] and DHCPv6 [RFC3315].
- DHCP client (or client) denotes a node that initiates requests to obtain configuration parameters from one or more DHCP servers.
- DHCP server (or server) refers to a node that responds to requests from DHCP clients.
- Name is a domain name (as per Section 8 of [RFC3315]) that contains one or more labels. In particular, a PCP name may be structured as DNS qualified name or be composed of strings such as can be passed to getaddrinfo (Section 6.1 of [RFC3493]), including address literals, etc.

3. DHCPv6 PCP Server Option

This DHCPv6 option conveys a 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.

3.1. Format

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

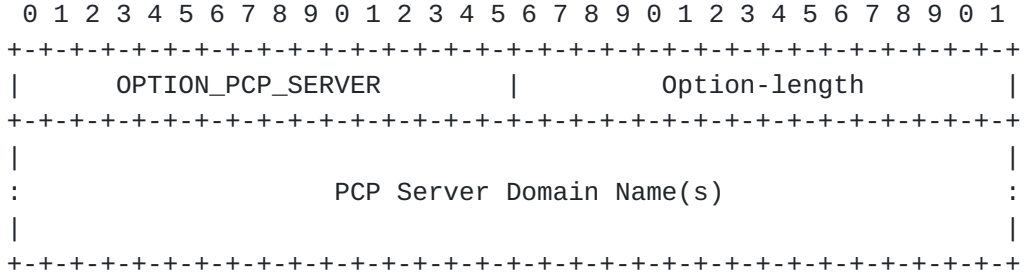

Figure 1: PCP Server Name DHCPv6 Option

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

- Option-code: OPTION_PCP_SERVER (TBA, see Section 9.1)
- Option-length: Length of the 'PCP Server Domain Name' field in octets.
- PCP Server Domain Name(s): The domain name (s) of the PCP Server to be used by the PCP Client. The OPTION_PCP_SERVER option can include multiple PCP Server Domain Names; each name is treated as a separate PCP Server. The domain name is encoded as specified in Section 8 of [RFC3315].

3.2. Client Behavior

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).

If the DHCPv6 client receives an OPTION_PCP_SERVER option from the DHCPv6 server, it extracts the name(s) conveyed in the OPTION_PCP_SERVER option and proceeds to validate it. The DHCPv6 client MUST verify the name(s) is properly encoded as detailed in Section 8 of [RFC3315].

Once each name conveyed in the OPTION_PCP_SERVER option is validated, the DHCPv6 client MUST follow the procedure specified in Section 5.

4. DHCPv4 PCP Option

4.1. Format

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

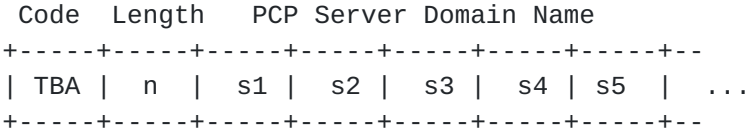

Figure 2: PCP Server Name DHCPv4 Option

The description of the fields is as follows:

- Code: OPTION_PCP_SERVER (TBA, see Section 9.2);
- Length: Includes the length of the "PCP Server Domain Name" field in octets; The maximum length is 255 octets.
- PCP Server Domain Name(s): The domain name(s) of the PCP Server to be used by the PCP Client when issuing PCP messages. The OPTION_PCP_SERVER option can include multiple PCP Server Domain Names; each name is treated as a separate PCP Server. The encoding of the domain name is described in Section 8 of [RFC3315].

The OPTION_PCP_SERVER DHCPv4 option is a concatenation-requiring option. As such, the mechanism specified in [RFC3396] MUST be used if the PCP Server Name option exceeds the maximum DHCPv4 option size of 255 octets.

4.2. Client Behavior

DHCPv4 client expresses the intent to get OPTION_PCP_SERVER by specifying it in Parameter Request List Option [RFC2132].

If the DHCPv4 client receives an OPTION_PCP_SERVER option from the DHCPv4 server, it extracts the name(s) conveyed in the option and proceeds to validate it. The DHCPv4 client MUST verify the name(s) is properly encoded as detailed in Section 8 of [RFC3315].

Once each name conveyed in the OPTION_PCP_SERVER option is validated, the DHCPv4 client MUST follow the procedure specified in Section 5.

5. Use of PCP Server Names

If the OPTION_PCP_SERVER option conveys IP address literals, the trailing dot MUST be removed.

Each configured PCP Server Name is passed to the name resolution library (e.g., Section 6.1.1 of [RFC1123] or [RFC6055]) to retrieve the corresponding IP address(es) (IPv4 or IPv6). It is out of scope of this document to specify how the PCP Client selects the PCP Server(s) to contact.

Multiple PCP Server Names may be configured to a PCP Client in some deployment contexts such as multi-homing. It is out of scope of this document to enumerate all deployment scenarios which require multiple Names to be configured.

A host may have multiple network interfaces (e.g, 3G, WiFi, etc.); each configured differently. Each PCP Server learned MUST be associated with the interface via which it was learned.

6. Dual-Stack Hosts

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.

7. Guidance to Administrators

If IPv4 address literals are to be returned in the OPTION_PCP_SERVER option, administrators should not configure ambiguous strings such as "10.0.258", "0xA000001", and "012.0x102"; the strict form is recommended instead. Refer to Section 3.1.1 and Section 3.1.2 of [I-D.iab-identifier-comparison] for a more generic discussion on IP address literals.

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

IANA is requested to assign the following new DHCPv6 Option Code in the registry maintained in http://www.iana.org/assignments/dhcpv6-parameters:

Option Name	Value
OPTION_PCP_SERVER	TBA

9.2. DHCPv4 Option

IANA is requested to assign the following new DHCPv4 Option Code in the registry maintained in http://www.iana.org/assignments/bootp-dhcp-parameters/:

Option Name	Value
OPTION_PCP_SERVER	TBA

10. Acknowledgements

Many thanks to B. Volz, C. Jacquenet, R. Maglione, D. Thaler, T. Mrugalski, T. Reddy, S. Cheshire and M. Wasserman for their review and comments.

Special thanks to T. Lemon for the review and his continuous effort to enhance this specification.

11. References

11.1. Normative References

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Appendix A. Rationale

Distinct IP-Address and Name DHCP options have been considered in early stages of this specification. This flexibility aims to let service providers make their own engineering choices and use the most convenient option according to their deployment context. Nevertheless, the DHC WG's position is this flexibility has some drawbacks such as inducing errors (See Section 7 of [I-D.ietf-dhc-option-guidelines]). Therefore, only the Name option is maintained within this document.

This choice is motivated by operational considerations: In particular, some Service Providers are considering two levels of redirection:

(1) The first level is national-wise and undertaken by DHCP: a regional-specific Name will be returned;
(2) The second level is done during the resolution of the regional-specific Name to redirect the customer to a regional PCP server 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 in 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:

- The use of the Name for NAT64 [RFC6146] might be suitable for load-balancing purposes;
- 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 Name would be more convenient.

Returning a Name requires the host to embed a name resolution service. Some may present this as an argument against defining a Name option. Nevertheless, this argument may be objected as implementing a name resolution library (e.g., embed a DNS resolver) is cheap and devices which don't embed DNS resolver are uncommon.

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