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Path Computation Element communication Protocol extension for
relationship between LSPs and Attributes
draft-dhody-pce-association-attr-06

Abstract

The Path Computation Element (PCE) provides functions of path computation in support of traffic engineering in networks controlled by Multi-Protocol Label Switching (MPLS) and Generalized MPLS (GMPLS).

This document defines a mechanism to create associations between a set of LSPs and a set of attributes (such as configuration parameters).

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[1.](#) Introduction

[RFC5440] describes the Path Computation Element communication Protocol (PCEP) which enables the communication between a Path Computation Client (PCC) and a Path Control Element (PCE), or between two PCEs based on the PCE architecture [[RFC4655](#)].

[I-D.ietf-pce-association-group] introduces a generic mechanism to create a grouping of LSPs which can then be used to define associations between a set of LSPs and a set of attributes (such as configuration parameters) and is equally applicable to the active and passive modes of a stateful PCE and a stateless PCE.

This document specifies a PCEP extension to associate one or more LSPs with a set of attributes.

PCEP Extensions for Stateful PCE Model [[I-D.ietf-pce-stateful-pce](#)] describes a set of extensions to PCEP to enable active control of MPLS-TE and GMPLS tunnels. [[I-D.ietf-pce-pce-initiated-lsp](#)] describes the setup and teardown of PCE-initiated LSPs under the active stateful PCE model, without the need for local configuration on the PCC, thus allowing for a dynamic network. The mechanism described in this document is equally applicable to these deployment models.

[1.1.](#) 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 [[RFC2119](#)].

[2.](#) Terminology

The following terminology is used in this document.

AAG: Attribute Association Group.

LSR: Label Switch Router.

MPLS: Multi-protocol Label Switching.

PAG: Policy Association Group.

PCC: Path Computation Client. Any client application requesting a path computation to be performed by a Path Computation Element.

PCE: Path Computation Element. An entity (component, application, or network node) that is capable of computing a network path or route based on a network graph and applying computational

constraints.

PCEP: Path Computation Element Communication Protocol.

[3.](#) Motivation

This section discusses in more detail the motivation and use cases for such an association including but not limited to -

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[3.1.](#) Opaque Identifier

An opaque identifier may represent attributes such as configured parameters or constraints that a PCEP speaker may invoke on a peer. Thus a PCEP speaker may only need an opaque identifier to invoke these attributes (parameters or constraints) rather than encoding them explicitly in each PCEP message.

This can also be used for tagging bunch of LSP to a particular customer or for creation of virtual network like in case of Abstraction and Control of TE Networks (ACTN)

[[I-D.ietf-teas-actn-requirements](#)]. (See
[[I-D.leedhody-pce-vn-association](#)])

[3.2.](#) Bundled requests

In some scenarios(e.g.,the topology example described in [Section 4.6 of \[RFC6805\]](#)), there is a need to send multiple requests with the same constraints and attributes to the PCE. Currently these requests are either sent in a separate path computation request (PCReq) messages or bundled together in one (or more) PCReq messages. In either case, the constraints and attributes need to be encoded separately for each request even though they are exactly identical.

If a association is used to identify these constraints and attributes shared by multiple requests and grouped together via association mechanism, thus simplifying the path computation message exchanges.

[4.](#) Overview

As per [[I-D.ietf-pce-association-group](#)], LSPs are associated with other LSPs with which they interact by adding them to a common association group. This grouping can then be used to define associations between sets of LSPs or between a set of LSPs and a set of attributes (such as configuration parameters). A new optional Association Object-type is defined based on the generic Association object -

- o Attribute Association Group (AAG)

Thus this document defines a new association type called "Attribute Association Type" of value TBD1. An AAG can have one or more LSPs and its associated attributes. The scope and handling of AAG identifier is similar to the generic association identifier defined in [[I-D.ietf-pce-association-group](#)].

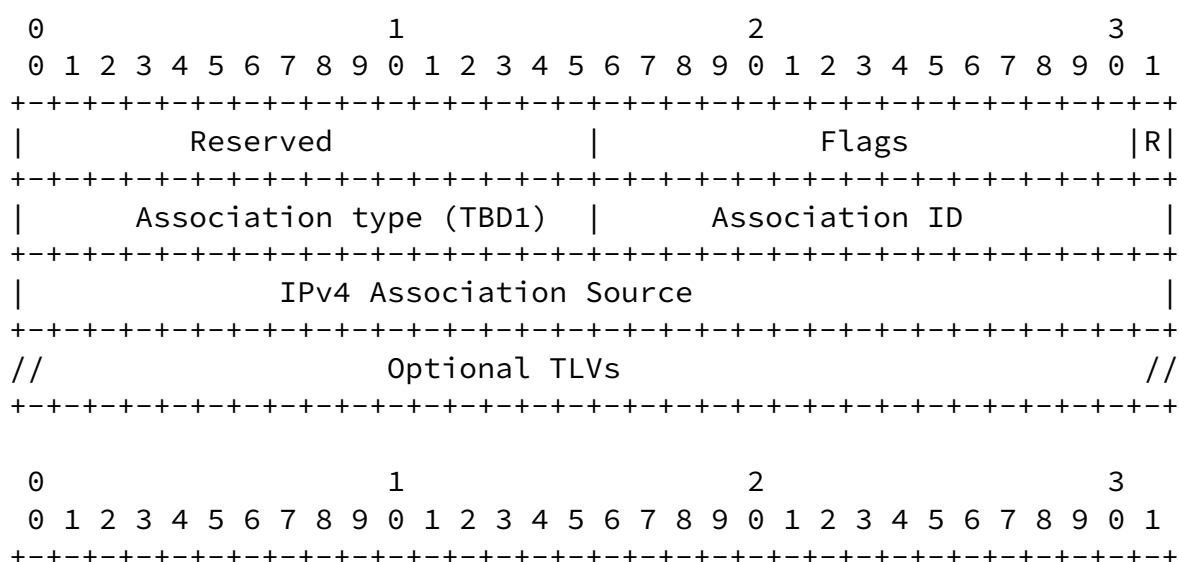
One or more LSP are grouped via a single group identifier as defined in [[I-D.ietf-pce-association-group](#)]. The attributes that may be associated with this set of LSPs may either are -

- o known to the PCEP peers via some external means like configuration, policy enforcement etc (can be considered as 'out-of-band'). PCEP speaker simply use the AAG identifier in the PCEP message and the peer is supposed to be aware of the associated attributes. This is suitable for stateless PCE where the PCEP peers should be aware of the association and its significance outside of the protocol.
- o or communicated to the PCEP peer via PCEP itself on first use (can be considered as 'in-band'). PCEP speaker creates a new AAG by using a new identifier and the associated attributes are communicated via TLVs in association object. This is applicable for stateful PCE only.

Error handling would be taken up in future revision.

[5.](#) Attribute Association Group

The format of the generic Association object used for AAG is shown in Figure 1:



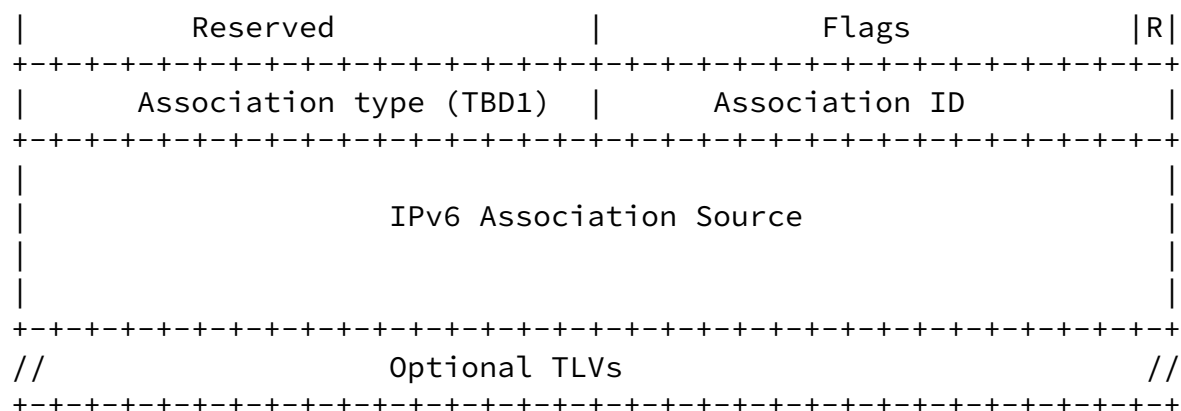


Figure 1: The AAG Object formats

Type = TBD1 for the Attribute Association Type.

AAG may carry optional TLVs including but not limited to -

- o ATTRIBUTE-OBJECT-TLV: Used to communicate associated attributes in form of PCEP objects, described in this document.
- o VENDOR-INFORMATION-TLV: Used to communicate arbitrary behavioral information, described in [RFC7470].

5.1. ATTRIBUTE-OBJECT-TLV

The ATTRIBUTE-OBJECT-TLV(s) maybe included in AAG object to associate attributes encoded in PCEP objects.

The format of the ATTRIBUTE-OBJECT-TLV is shown in the following figure:



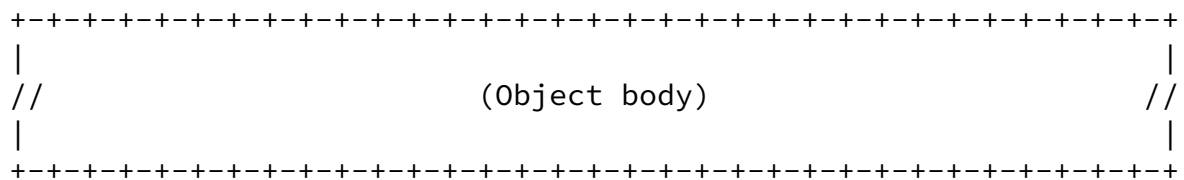


Figure 2: ATTRIBUTE-OBJECT-TLV format

The type of the TLV is TBD2 and it has a variable length. The value part consist of a 32-bit Flag filed followed by a PCEP object (including common header [[RFC5440](#)] identifying the object) that is associated with this AAG.

Following Flags are defined:

R (Remove - 1 bit): This is set to indicate that the attribute is being removed from the attribute-list.

M (Modify - 1 bit): This is set to indicate that a previous attribute is being modified, and the peer should overwrite the attribute with the new value as per the object-body.

This TLV identifies the attributes associated with this group. For each attribute a separate TLV is used. Future PCEP message exchanges may only carry the AAG with no ATTRIBUTE-OBJECT-TLV.

6. Security Considerations

This document defines a new types for association and a new ATTRIBUTE-OBJECT-TLV which do not add any new security concerns beyond those discussed in [[RFC5440](#)], [[I-D.ietf-pce-stateful-pce](#)] and [[I-D.ietf-pce-association-group](#)] in itself.

Some deployments may find the associations and their implications as extra sensitive and thus should employ suitable PCEP security mechanisms like TCP-AO or [[I-D.ietf-pce-pceps](#)].

7. IANA Considerations

[7.1.](#) Association object Type Indicators

This document defines the following new association type originally defined in [[I-D.ietf-pce-association-group](#)].

Value	Name	Reference
TBD1	Attribute Association Type	[This I.D.]

[7.2.](#) PCEP TLV Type Indicators

This document defines the following new PCEP TLV; IANA is requested to make the following allocations from this registry.

<http://www.iana.org/assignments/pcep/pcep.xhtml#pcep-tlv-type-indicators>

Value	Name	Reference
TBD2	ATTRIBUTE-OBJECT-TLV	[This I.D.]

[7.3.](#) Flag field in ATTRIBUTE-OBJECT-TLV

This document requests that a new sub-registry, named "ATTRIBUTE-OBJECT-TLV Flag Field", is created within the "Path Computation Element Protocol (PCEP) Numbers" registry to manage the Flag field of the ATTRIBUTE-OBJECT-TLV. New values are to be assigned by Standards Action [[RFC5226](#)]. Each bit should be tracked with the following qualities:

- o Bit number (counting from bit 0 as the most significant bit)
- o Capability description
- o Defining RFC

The following values are defined in this document:

Bit	Description	Reference
31	Remove	[This I.D.]
30	Modify	[This I.D.]

[8.](#) Manageability Considerations

[8.1.](#) Control of Function and Policy

An operator MUST BE allowed to configure the attribute associations at PCEP peers and associate it with the LSPs.

[8.2.](#) Information and Data Models

[RFC7420] describes the PCEP MIB, there are no new MIB Objects for this document.

[8.3.](#) Liveness Detection and Monitoring

Mechanisms defined in this document do not imply any new liveness detection and monitoring requirements in addition to those already listed in [[RFC5440](#)].

[8.4.](#) Verify Correct Operations

Mechanisms defined in this document do not imply any new operation verification requirements in addition to those already listed in [[RFC5440](#)].

[8.5.](#) Requirements On Other Protocols

Mechanisms defined in this document do not imply any new requirements on other protocols.

[8.6.](#) Impact On Network Operations

Mechanisms defined in this document do not have any impact on network operations in addition to those already listed in [[RFC5440](#)].

[9.](#) Acknowledgments

A special thanks to author of [[I-D.ietf-pce-association-group](#)], this document borrow some of the text from it.

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[Appendix A](#). Policy

An earlier version of this document also had details about Policy association group. This has been moved to an independent document - [\[I-D.ietf-pce-association-policy\]](#).

[Appendix B](#). Contributor Addresses

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