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Extensions to Resource ReSerVation Protocol-Traffic Engineering (RSVP-TE) to Support Route Exclusion Using Path Key Subobject

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Status of this Memo

Abstract

This document extends the Resource ReSerVation Protocol-Traffic Engineering (RSVP-TE) eXclude Route Object (XRO) and Explicit Route Object (ERO) to support specifying route exclusion requirement using Path Key Subobject (PKS).

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1. Introduction

[RFC5520] defines the concept of a Path Key. This object can be used by a Path Computation Element (PCE) in place of a segment of a path that it wishes to keep confidential. The Path Key can be signaled in Resource ReSerVation Protocol-Traffic Engineering (RSVP-TE) protocol by placing it in an Explicit Route Object (ERO) as described in [RFC5553].

When establishing a set of LSPs to provide protection services [RFC4427], it is often desirable that the LSPs should take different paths through the network. This can be achieved by path computation entities that have full end-to-end visibility, but it is more complicated in multi-domain environments when segments of the path may be hidden so that they are not visible outside the domain they traverse.

This document describes how the Path Key object can be used in the RSVP-TE eXclude Route Object (XRO), and the Explicit eXclusion Route subobject (EXRS) of the ERO in order to facilitate path hiding, but allow diverse end-to-end paths to be established in multi-domain environments.

1.1. Example Use

Figure 1 shows a simple network with two domains. It is desired to set up a pair of path-disjoint LSPs from the source in Domain 1 to the destination in Domain 2, but the domains keep strict confidentiality about all path and topology information.

The first LSP will be signaled by the source with ERO {A, B, loose Dst} and will be set up with the path {Src, A, B, U, V, W, Dst}. But when sending the RRO out of Domain 2, node U would normally strip the path and replace it with a loose hop to the destination. With this limited information, the source is unable to include enough detail in the ERO of the second LSP to avoid it taking, for example, the path {Src, C, D, X, V, W, Dst} which is not path-disjoint.

In order to improve the outcome, node U can replace the path segment {U, V, W} in the RRO with a Path Key. The Path Key Object assigns an identifier to the key and also indicates that it was node U that made the replacement.

With this additional information, the source is able to signal the second LSP with ERO set to {C, D, exclude Path Key, loose Dst}. When the signaling message reaches node X, it can consult node U to expand the Path Key and so know to avoid the path of the first LSP. Alternatively, the source could use an ERO of {C, D, loose Dst} and include an XRO containing the Path Key.

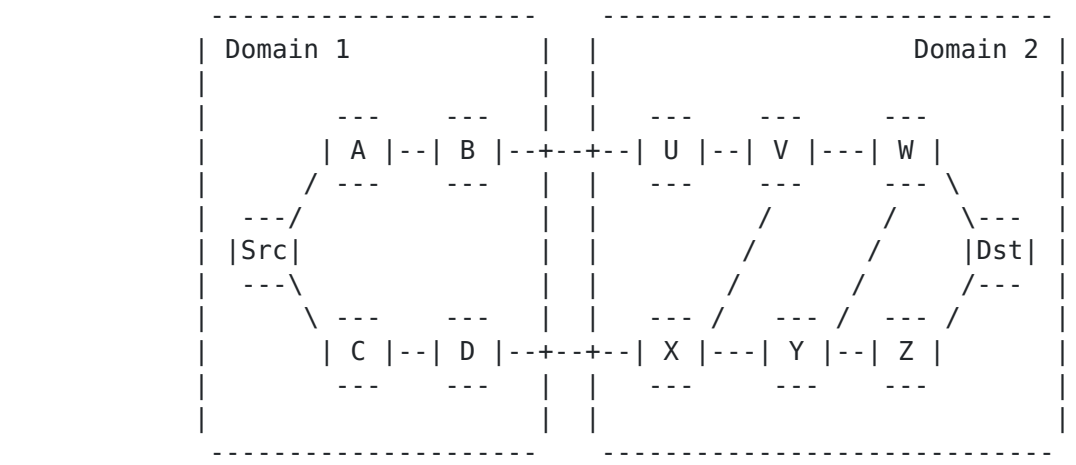


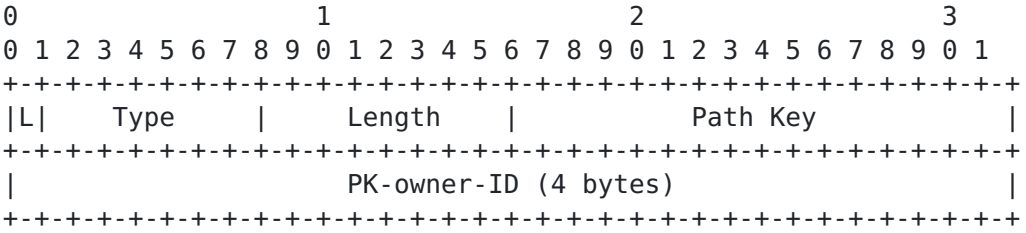
Figure 1: A Simple Multi-Domain Network

2. RSVP-TE Extensions

This section defines the subobject that can be either in the XRO object or Explicit eXclusion Route subobject (EXRS) as defined in [RFC4874].

2.1. Path Key Subobject (PKS)

The IPv4 PKS has the following format:

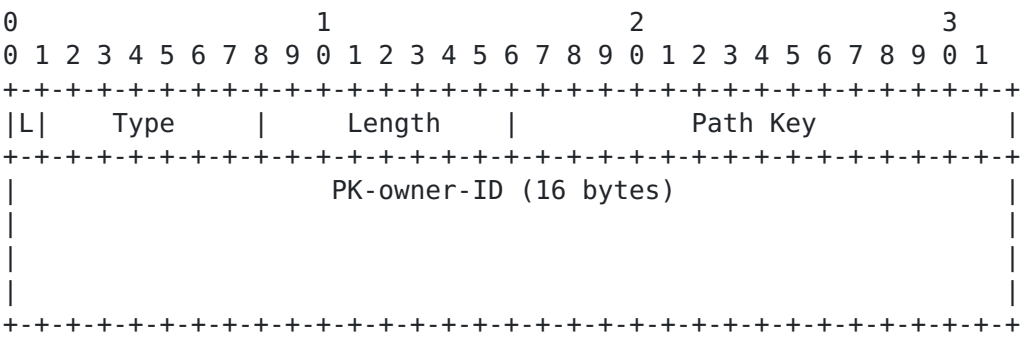


The meaning of the field L bit, Length, Path Key is defined in [RFC4874].

Type: sub-object type for XRO Path Key; TBD.

PK-owner-ID: The IPv4 address of a node that assigned the Path Key identifier and that can return an expansion of the Path Key or use the Path Key as an exclusion in a path computation.

Similarly, the format of IPv6 PKS is as follows:



2.2. PKS Processing Rules

The exclude route list is encoded as a series of subobjects contained in an EXCLUDE_ROUTE object or an EXRS of the ERO. The procedure defined in [RFC4874] for processing XRO and EXRS is not changed by this document.

Irrespective of the L flag, if the node, receiving the PKS, cannot recognize the subobject, it will react according to [RFC4874] and SHOULD ignore the constraint.

Otherwise, if it cannot find a route/route segment meeting the constraint:

-if L flag is set to 0, it will react according to [RFC4874] and SHOULD send a PathErr message with the error code/value combination ''Routing Problem'' / ''Route Blocked by Exclude Route''.

-if L flag is set to 1, which means the node SHOULD try to be as much diversified as possible with the specified resource. If it cannot fully support the constraint, it SHOULD send a PathErr message with the error code/value combination "Notify Error" / "Fail to find diversified path" (TBD).

This mechanism can work together with the presence of a Path Computation Element (PCE) or if the local node generates the PK itself. Note that other mechanisms to use or expand the PK are out of scope of this document.

3. Security Considerations

The use of path keys proposed in this draft allows nodes to hide parts of the path as it is signaled. This can be used to improve the confidentially of the LSP setup. Moreover, it may serve to improve security of the control plane for the LSP as well as data plane traffic carried on this LSP. However, the benefits of using path key are lost unless there is an appropriate access control of any tool that allows expansion of the path key.

4. IANA Considerations

4.1. New Subobject Type

IANA registry: RSVP PARAMETERS
Subsection: Class Names, Class Numbers, and Class Types

This document introduces two new subobjects for the EXCLUDE_ROUTE object [RFC4874], C-Type 1.

Subobject Type	Subobject Description

64(TBD by IANA)	IPv4 Path Key Subobject
65(TBD By IANA)	IPv6 Path Key Subobject

Note well: [RFC5520] defines the PKS for use in PCEP. The above number suggestions for use in RSVP-TE follow that assigned for the PKS in PCEP [RFC5520].

4.2. New Error Code

IANA registry: RSVP PARAMETERS

Subsection: Error Codes and Globally-Defined Error Value Sub-Codes

New Error Values sub-codes have been registered for the Error Code 'Notify Error' (25).

TBD = "Fail to find diversified path"

5. Acknowledgments

TBD.

6. References

6.1. Normative References

[RFC3209] D. Awduche et al, ''RSVP-TE: Extensions to RSVP for LSP Tunnels'', RFC3209, December 2001.

[RFC4874] CY. Lee, A. Farrel, S. De Cnodder, ''Exclude Routes - Extension to Resource ReserVation Protocol-Traffic Engineering (RSVP-TE), RFC4874, April 2007.

[RFC5553] A. Farrel, Ed., ''Resource Reservation Protocol (RSVP) Extensions for Path Key Support'', RFC5553, May 2009.

6.2. Informative References

[RFC5520] R. Bradford, Ed., ''Preserving Topology Confidentiality in Inter-Domain Path Computation Using a Path-Key-Based Mechanism'', RFC5520, April 2009.

[RFC4427] E. Mannie, Ed., ''Recovery (Protection and Restoration) Terminology for Generalized Multi-Protocol Label Switching (GMPLS)'', RFC4427, March 2006.

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