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Multipath Traffic Engineering Capabilities
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Abstract

Multipath Traffic Engineering (MPTE) combines two approaches to traffic management: equal-cost multipath and constraint-based traffic engineering, offering a powerful new way to engineer networks. To avail of this, a node (possibly an ingress of a MPTE tunnel, or a path computation agent) must have information about the topology, link and node characteristics of a network so that it can compute the components of the MPTE tunnel. One important (node) characteristic is whether a given node supports MPTE, i.e., whether it can participate in the provisioning and maintenance of the tunnel.

This memo shows how this information can be distributed in the IGP via Link State Routing TE Capabilities.

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Table of Contents

| | |
|--|---|
| 1. Introduction | 2 |
| 1.1. Terminology | 3 |
| 1.1.1. Definition of Commonly Used Terms | 3 |
| 2. MPTE Capabilities | 4 |
| 3. IANA Considerations | 4 |
| 4. Security Considerations | 4 |
| 5. References | 4 |
| 5.1. Normative References | 4 |
| 5.2. Informative References | 5 |
| Author's Address | 6 |

1. Introduction

[I-D.kompella-teas-mppte] introduces the notion of multipath traffic engineering (MPTE). It describes how an entity (MPTE DAG computer or MC) can compute a directed acyclic graph (DAG) from one or more ingress nodes to one or more egress nodes that meets given traffic engineering (TE) constraints. This entity (usually one of the ingresses, or a path computation engine) will need information about the network to do the computation, most of which is available in IGP TE extensions. Once the computation is done, the MC communicates the result to the signaling source (SS) which then signals (or provisions) the MPTE tunnel via one of the following protocols: RSVP-TE [RFC3209], PCEP [RFC5440] or BGP [RFC4271].

One key piece of information that is not currently in the IGP extensions is whether or not a given node supports MPTE, i.e., is capable of sending and receiving MPTE updates that create and maintain the tunnel. An MPTE tunnel cannot be setup through such a node, and thus the MC has to take this into account. This memo fills this gap.

1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here. These words may also appear in this document in lower case as plain English words, absent their normative meanings.

1.1.1. Definition of Commonly Used Terms

This section provides definitions for terms and abbreviations that have a specific meaning to the MPTE protocol and that are used throughout this memo.

constraints: desired properties of paths between ingresses and egresses.

directed acyclic graph: a directed graph that has no cycles.

directed graph (DAG): a set of nodes and directed links. A network is represented by a directed graph.

egress: an end node of an MPTE DAG.

ingress: a starting node of an MPTE DAG.

link: A (directed) edge between two nodes. A pair of nodes may have 0 or more links between them. A link between nodes *u* and *v* will be denoted by (*u*, *v*, *i*), where *i* is *u*'s oif for the link. A link may have associated attributes, in particular, a metric.

MPTE: multipath TE with constraints that uses multiple paths from one or more ingresses to one or more egresses.

MPTED: an MPTE DAG result of computation on MPTE constraints.

MPTED computer (MC): the entity computing the MPTED, typically the ingress (if there is a single ingress) or a Path Computation Element

MPTEP: MPTE protocol: the protocol used to signal MPTEDs.

MPTE tunnel: the signaled entity that carries the traffic from ingresses to egresses along the MPTED.

node: a vertex of a graph. A node may have associated attributes.

PCEP: Path Computation Element communication protocol.

signaling source (SS): the initiator of MPTE signaling to establish, update or destroy an MPTE tunnel.

TE: traffic engineering

2. MPTE Capabilities

[RFC5073] describes IGP protocol extension for the discovery of the TE capabilities of a node. This memo extends that with three new capabilities: whether a node is capable of processing MPTE RSVP-TE messages, and whether a node is capable of processing MPTE PCEP messages. The two capabilities are as follows:

- * MR bit: when set, this flag indicates that the node can process MPTE RSVP-TE messages.
- * MP bit: when set, this flag indicates that the node can process MPTE PCEP messages.
- * MB bit: when set, this flag indicates that the node can process MPTE BGP messages.

These bits are encoded in the TE Node Capability Descriptor defined in [RFC5073].

This Descriptor is carried in ISIS and OSPF as defined in the same RFC.

3. IANA Considerations

IANA is asked to allocate three bits for the above capabilities in the Link State Routing TE Capabilities registry.

4. Security Considerations

This document specifies the content of the TE Node Capability Descriptor TLV in IS-IS and OSPF to be used for MPLS-TE path computation. As this TLV is not used for SPF computation or normal routing, the extensions specified here have no direct effect on IP routing. Tampering with this TLV may have an effect on Traffic Engineering computation. Mechanisms defined to secure IS-IS Link State PDUs [RFC3567], OSPF LSAs [RFC2154], and their TLVs can be used to secure this TLV as well.

5. References

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