            A Link-Type sub-TLV to Convey the Number of
        Traffic Engineering Label Switched Paths Signalled with
                Zero Reserved Bandwidth across a Link

Status of This Memo

Abstract

   Several Link-type sub-Type-Length-Values (sub-TLVs) have been defined
   for Open Shortest Path First (OSPF) and Intermediate System to
   Intermediate System (IS-IS) in the context of Multiprotocol Label
   Switching (MPLS) Traffic Engineering (TE), in order to advertise some
   link characteristics such as the available bandwidth, traffic
   engineering metric, administrative group, and so on. By making
   statistical assumptions about the aggregated traffic carried onto a
   set of TE Label Switched Paths (LSPs) signalled with zero bandwidth
   (referred to as "unconstrained TE LSP" in this document), algorithms
   can be designed to load balance (existing or newly configured)
   unconstrained TE LSP across a set of equal cost paths. This requires
   knowledge of the number of unconstrained TE LSPs signalled across a
   link. This document specifies a new Link-type Traffic Engineering
   sub-TLV used to advertise the number of unconstrained TE LSPs
   signalled across a link.

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1. Introduction

   It is not uncommon to deploy MPLS Traffic Engineering for the sake of
   fast recovery, relying on a local protection recovery mechanism such
   as MPLS TE Fast Reroute (see [RFC4090]). In this case, a deployment
   model consists of deploying a full mesh of TE LSPs signalled with
   zero bandwidth (also referred to as unconstrained TE LSP in this
   document) between a set of LSRs (Label Switching Routers) and
   protecting these TE LSPs against link, SRLG (Shared Risk Link Group),
   and/or node failures with pre-established backup tunnels. The
   traffic routed onto such unconstrained TE LSPs simply follows the IGP
   shortest path, but is protected with MPLS TE Fast Reroute. This is
   because the TE LSP computed by the path computation algorithm (e.g.,
   CSPF) will be no different than the IGP (Interior Gateway Protocol)
   shortest path should the TE metric be equal to the IGP metric.

   When a reoptimization process is triggered for an existing TE LSP,
   the decision on whether to reroute that TE LSP onto a different path
   is governed by the discovery of a lower cost path satisfying the
   constraints (other metrics, such as the percentage of reserved
   bandwidth or the number of hops, can also be used). Unfortunately,
   metrics such as the path cost or the number of hops may be
   ineffective in various circumstances. For example, in the case of a
   symmetrical network with ECMPs (Equal Cost Multi-Paths), if the
   network operator uses unconstrained TE LSP, this may lead to a poorly
   load balanced traffic; indeed, several paths between a source and a
   destination of a TE LSP may exist that have the same cost, and the
   reservable amount of bandwidth along each path cannot be used as a
   tie-breaker.

By making statistical assumptions about the aggregated traffic
carried by a set of unconstrained TE LSPs, algorithms can be designed
to load balance (existing or newly configured) unconstrained TE LSPs
across a set of equal cost paths. This requires knowledge of the
number of unconstrained TE LSPs signalled across each link.

   Note that the specification of load balancing algorithms is
   outside the scope of this document and is referred to for the sake
   of illustration of the motivation for gathering such information.

Furthermore, the knowledge of the number of unconstrained TE LSPs
signalled across each link can be used for other purposes -- for
example, to evaluate the number of affected unconstrained TE LSPs in
case of a link failure.

A set of Link-type sub-TLVs have been defined for OSPF and IS-IS (see
[RFC3630] and [RFC5305]) in the context of MPLS Traffic Engineering
in order to advertise various link characteristics such as the
available bandwidth, traffic engineering metric, administrative
group, and so on. As currently defined in [RFC3630] and [RFC5305],
the information related to the number of unconstrained TE LSPs is not
available. This document specifies a new Link-type Traffic
Engineering sub-TLV used to indicate the number of unconstrained TE
LSPs signalled across a link.

Unconstrained TE LSPs that are configured and provisioned through a
management system MAY be omitted from the count that is reported.

2. Terminology

Terminology used in this document:

CSPF: Constrained Shortest Path First

IGP : Interior Gateway Protocol

LSA: Link State Advertisement

LSP: Link State Packet

MPLS: Multiprotocol Label Switching

LSR: Label Switching Router

SRLG: Shared Risk Link Group

TE LSP: Traffic Engineering Label Switched Path

   Unconstrained TE LSP: A TE LSP signalled with a bandwidth equal to 0

2.1. 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 RFC 2119 [RFC2119].

3. Protocol Extensions

   Two Unconstrained TE LSP Count sub-TLVs are defined that specify the
   number of TE LSPs signalled with zero bandwidth across a link.

3.1. IS-IS

   The IS-IS Unconstrained TE LSP Count sub-TLV is OPTIONAL and MUST NOT
   appear more than once within the extended IS reachability TLV (type
   22) specified in [RFC5305] or the Multi-Topology (MT) Intermediate
   Systems TLV (type 222) specified in [RFC5120]. If a second instance
   of the Unconstrained TE LSP Count sub-TLV is present, the receiving
   system MUST only process the first instance of the sub-TLV.

   The IS-IS Unconstrained TE LSP Count sub-TLV format is defined below:

   Type (1 octet): 23

   Length (1 octet): 2

   Value (2 octets): number of unconstrained TE LSPs signalled across
   the link.

3.2. OSPF

   The OSPF Unconstrained TE LSP Count sub-TLV is OPTIONAL and MUST NOT
   appear more than once within the Link TLV (Type 2) that is itself
   carried within either the Traffic Engineering LSA specified in
   [RFC3630] or the OSPFv3 Intra-Area-TE LSA (function code 10) defined
   in [RFC5329]. If a second instance of the Unconstrained TE LSP Count
   sub-TLV is present, the receiving system MUST only process the first
   instance of the sub-TLV.

The OSPF Unconstrained TE LSP Count sub-TLV format is defined below:

Type (2 octets): 23

Length (2 octets): 4

Value (4 octets): number of unconstrained TE LSPs signalled across
the link.

4. Elements of Procedure

The absence of the Unconstrained TE LSP Count sub-TLV SHOULD be
interpreted as an absence of information about the link.

Similar to other MPLS Traffic Engineering link characteristics,
LSA/LSP origination trigger mechanisms are outside the scope of this
document. Care must be given to not trigger the systematic flooding
of a new IS-IS LSP or OSPF LSA with a too high granularity in case of
change in the number of unconstrained TE LSPs.

5. IANA Considerations

IANA has defined a sub-registry for the sub-TLVs carried in the IS-IS
TLV 22 and has assigned a new TLV codepoint for the Unconstrained TE
LSP Count sub-TLV carried within the TLV 22.

Value   TLV Name   Reference

23   Unconstrained TE LSP Count (sub-)TLV   RFC 5330

IANA has defined a sub-registry for the sub-TLVs carried in an OSPF
TE Link TLV (type 2) and has assigned a new sub-TLV codepoint for the
Unconstrained TE LSP Count sub-TLV carried within the TE Link TLV.

Value   TLV Name   Reference

23   Unconstrained TE LSP Count (sub-)TLV   RFC 5330

6. Security Considerations

The function described in this document does not create any new
security issues for the OSPF and IS-IS protocols. Security
considerations are covered in [RFC2328] and [RFC5340] for the base
OSPF protocol and in [RFC1195] and [RFC5304] for IS-IS.

A security framework for MPLS and Generalized MPLS can be found in
[G/MPLS].

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