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Use of IGP Metric as a second TE Metric

Status of this Memo

Abstract

   This draft describes a common practice on how the existing IGP
   Metric can be used as an alternative metric to the TE Metric for
   Constraint Based Routing of MPLS TE Tunnels. This effectively
   results in the ability to perform Constraint Based Routing with
   optimization of one metric (e.g. link bandwidth) for some TE Tunnels
   (e.g. Data Trunks) while optimizing another metric (e.g. propagation
   delay) for some other TE Tunnels with different requirements (e.g.
   Voice Trunks).

   No protocol extensions or modifications are required. This text

documents current router implementations and deployment practices.

1.   **Introduction**

   IGP routing protocols (OSPF and IS-IS) as well as MPLS Signaling
   protocols (RSVP-TE and CR-LDP) have been extended (as specified in
   [ISIS-TE], [OSPF-TE], [RSVP-TE] and [CR-LDP]) in order to support
   the traffic engineering functionality as defined in [TE-REQ].

   These IGP routing protocol extensions currently include
   advertisement of a single additional TE Metric to be used for
   Constraint Based Routing of TE Tunnels.

   However, the objective of traffic engineering is to optimize the use
   and the performance of the network. So it seems relevant that TE
   tunnel placement may be optimized according to different
   optimization criteria. For example, some Service Providers want to
   perform traffic engineering of different classes of service
   separately so that each class of Service is transported on a
   different TE Tunnel. One example motivation for doing so is to apply
   different fast restoration policies to the different classes of
   service. Another example motivation is to take advantage of separate
   Constraint Based Routing in order to meet the different QoS
   objectives of each Class of Service. To achieve different QoS
   objectives may require enforcement by Constraint Based Routing of
   different bandwidth constraints for the different classes of service
   as defined in [DS-TE]. In some Service Provider environments, it
   also requires optimizing on a different metric during Constraint
   Based Routing.

   The most common scenario for a different metric calls for
   optimization of a metric reflecting delay (mainly propagation delay)
   when Constraint Based Routing TE LSPs that will be transporting
   voice, while optimizing a more usual metric (e.g. reflecting link
   bandwidth) when Constraint Based Routing TE LSPs that will be
   transporting data.

   [METRICS] proposes extensions so that multiple TE Metrics can be
   advertised in the IGP. If/once those are fully specified and
   implemented, they will address the above scenario. However this
   draft describes how the above scenario is currently addressed in the
   meantime by existing implementations and deployments, without any
   additional IGP extensions beyond [ISIS-TE] and [OSPF-TE], by

effectively using the IGP Metric as a "second" TE Metric.

.   **Common Practice**

   In current MPLS TE deployments, network administrators often want
   Constraint Based Routing of TE LSPs carrying data traffic to be
   based on the same metric as the metric used for Shortest Path

   Routing. Where this is the case, this practice allows the Constraint
   Based Routing algorithm running on the Head-End LSR to use the IGP
   Metric advertised in the IGP to compute paths for data TE LSPs
   instead of the advertised TE Metric. The TE Metric can then be used
   to convey another metric (e.g. a delay-based metric) which can be
   used by the Constraint Based Routing algorithm on the Head-End LSR
   to compute path for the TE LSPs with different requirements (e.g.
   Voice TE LSP).

   In some networks, network administrators configure the IGP metric to
   a value factoring the link propagation delay. In that case, this
   practice allows the Constraint Based Routing algorithm running on
   the Head-End LSR to use the IGP Metric advertised in the IGP to
   compute paths for delay-sensitive TE LSPs (e.g. Voice TE LSPs)
   instead of the advertised TE Metric. The TE Metric can then be used
   to convey another metric (e.g. bandwidth based metric) which can be
   used by the Constraint Based Routing algorithm to compute paths for
   the data TE LSPs.

   More generally, the TE Metric can be used to carry any arbitrary
   metric that may be useful for Constraint Based Routing of the set of
   LSPs which need optimization on another metric than the IGP metric.

2.1.   **Head-End LSR Implementation Practice**

   A Head-End LSR implements the current practice by:

   (i)   Allowing configuration, for each TE LSP to be routed, of
          whether the IGP Metric or the TE Metric is to be used by the
          Constraint Based Routing algorithm.

   (ii)   Enabling the Constraint Based Routing algorithm to make use
          of either the TE Metric or the IGP Metric, depending on the
          above configuration for the considered TE-LSP

2.2.   **Network Deployment Practice**

A Service Provider deploys this practice by:

(i)   Configuring, on every relevant link, the TE Metric to reflect
        whatever metric is appropriate (e.g. delay-based metric) for
        Constraint Based Routing of some LSPs as an alternative
        metric to the IGP Metric

(ii)   Configuring, for every TE LSP, whether this LSP is to be
        constraint based routed according to the TE Metric or IGP
        Metric

2.3.   Constraints

The practice described in this document has the following
constraints:

(i)   it only allows TE Tunnels to be routed on either of two
        metrics (i.e. it cannot allow TE Tunnels to be routed on one
        of three, or more, metrics). [METRICS] proposes extensions
        which could be used to relax this constraints when necessary.

(ii)   it can only be used where the IGP Metric is appropriate as
        one of the two metrics to be used for constraint based
        routing (i.e. it cannot allow TE Tunnels to be routed on
        either of two metrics while allowing IGP SPF to be based on a
        third metric). [METRICS] proposes extensions which could be
        used to relax this constraint when necessary.

Note that, as with [METRICS], this practice does not recommend that
the TE Metric and the IGP metric be used simultaneously during path
computation for a given LSP. This is known to be an NP-complete
problem.

2.4.   Interoperability

Where path computation is entirely performed by the Head-End (e.g.
intra-area operations with path computation on Head-end), this
practice does not raise any interoperability issue among LSRs since
the use of one metric or the other is a matter purely local to the
Head-End LSR.

Where path computation involves another component than the Head-End
(e.g. with inter-area operations where path computation is shared
between the Head-End and Area Boundary Routers or a Path Computation
Server), this practice requires that which metric to optimize on be

signaled along with the other constraints (bandwidth, affinity) for
the LSP. See [PATH-COMP] for a proposal on how to signal which
metric to optimize to another component involved in path computation
when RSVP-TE is used as the protocol to signal path computation
information.

3.   Migration Considerations

Service Providers need to consider how to migrate from the current
implementation to the new one supporting this practice.

Although the head-end routers act independently from each other,
some migration scenarios may require that all head-end routers be
upgraded to the new implementation to avoid any disruption on
existing TE-LSPs before two metrics can effectively be used by TE.
The reason is that routers with current implementation are expected
to always use the TE metric for Constraint Based Routing of all
tunnels; so when the TE metric is reconfigured to reflect the
"second metric" (say to a delay-based metric) on links in the
network, then all TE-LSPs would get routed based on the "second
metric" metric, while the intent may be that only the TE-LSPs

explicitly configured so should be routed based on the "second
metric".

A possible migration scenario would look like this:

    1) upgrade software on all head-end routers in the network to
       support this practice.

    2) change the TE-LSPs configuration on the head-end routers to
       use the IGP metric (e.g. bandwidth-based) for Constraint
       Based Routing rather than the TE metric.

    3) configure TE metric on the links to reflect the "second
       metric" (e.g. delay-based).

    4) modify the LSP configuration of the subset of TE-LSPs
       whichneed to beConstraint Based routed using the "second
       metric" (e.g. delay-based), and/or create new TE-LSPs with
       such a configuration.

It is desirable that step 2 is non-disruptive (i.e. the routing of a
LSP will not be affected in any way, and the data transmission will
not be interrupted) by the change of LSP configuration to use "IGP

Metric" as long as the actual value of the "IGP Metric" and "TE Metric" are equal on every link at the time of LSP reconfiguration (as would be the case at step 2 in migration scenario above which assumed that TE Metric was initially equal to IGP Metric).

4. Security Considerations

The practice described in this draft does not raise specific security issues beyond those of existing TE.

5. Acknowledgment

This document has benefited from discussion with Jean-Philippe Vasseur.

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