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OSPF Two-part Metric
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Abstract

This document specifies an optional extension to the OSPF protocol, to represent the metric on a multi-access network as two parts: the metric from a router to the network, and the metric from the network to the router. The router to router metric would be the sum of the two.

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.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 24, 2014.

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1. Introduction

For a broadcast network, a Network LSA is advertised to list all routers on the network, and each router on the network includes a link in its Router LSA to describe its connection to the network. The link in the Router LSA includes a metric but the listed routers in the Network LSA does not include a metric. This is based on the assumption that from a particular router, all others on the same network can be reached with the same metric.

With some broadcast networks, different routers can be reached with different metrics. RFC 6845 extends the OSPF protocol with a hybrid interface type for that kind of broadcast networks, with which no Network LSA is used and routers simply includes p2p links to all routers on the same network with individual metrics. Broadcast capability is still utilized to optimize database synchronization and adjacency maintenance.

That works well for broadcast networks on which metric between different pair of routers are really independent. For example, VPLS networks.

With certain types of broadcast networks, further optimization can be made to reduce the size of the Router LSAs and number of updates.

Consider a satellite radio network, with the satellite being the central controller and some ground terminals being mobile. All communication go through the satellite. When the mobile terminals move about, their communication capability may change. When OSPF runs over the radio network (routers being or in tandem with the terminals), RFC 6845 hybrid interface can be used, but with the following drawbacks.

Consider that one terminal/router moves into an area where communication capability degrades significantly. Through the radio control protocol all others determine that the metric to this particular one changed and they all need to update their Router LSAs accordingly. This router also determines that its metric to reach all others also changed and it also need to update its Router LSA. Consider that there could be many terminals and many of them can be moving fast and frequently, the number/frequency of updates of those large Router LSAs could become inhibiting.

2. Proposed Enhancement

Notice that in the above scenario, when one terminal's communication capability changes, its metric to all others and the metric from all others to it will all change in a similar fashion. Given this, the

above problem can be easily addressed by breaking the metric into two parts: the metric to the controller and the metric from the controller. The metric from terminal R1 to R2 would be the sum of the metric from R1 to the controller and the metric from the controller to R2.

Now instead of using the RFC6845 hybrid interface type, the network is just treated as a regular broadcast one. A router on the network no longer needs to list individual metrics to each neighbors in its Router LSA. The transit link's metric in the Router LSA either represents the router's symmetric metric to/from the network, or in case of asymetric metric, for OSPFv3 an additional TLV can be added to represent the metric from the network to the router, following draft-acee-ospfv3-lsa-extend (details TBD), and for OSPFv2, an MT metric field can be used.

With this, the size of Router LSA will be significantly reduced. When a router's communication capability changes, only itself need to update its Router LSA and nobody else does.

Note that while the example uses the satellite as the relay point at radio level (layer 2), at layer 3 the satellite does not play any role. It does not need to be running layer 3 protocol at all. Rather, the metric is abstracted as to/from the "network".

3. Speficications

The following protocol specifications are added to or modified from the base OSPF protocol. If an area contains one or more two-part metric networks, then all routers in the area must support the extensions specified here. This document does not currently specify a way to detect a router's capability of supporting this, and relies on operator's due diligence in provisioning. A protocol mechanism may be developer in the future.

The "Router interface parameters" has the following additions:

- Two-part metric: TRUE if the interface connects to a multi-access network that uses two-part metric.

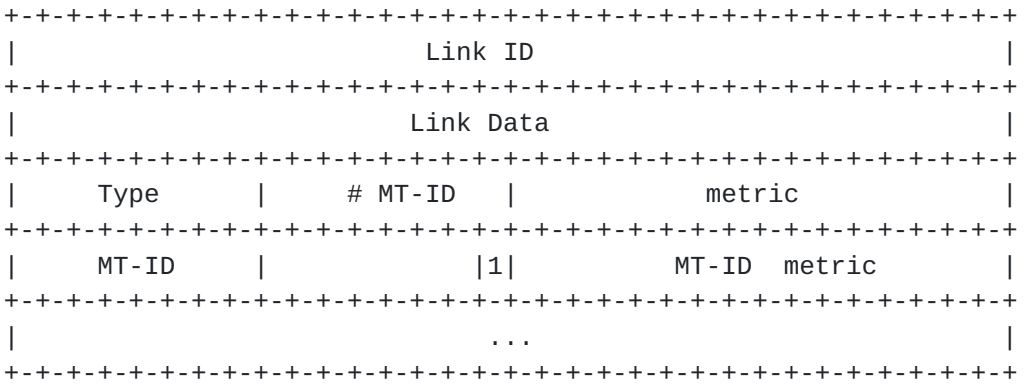
- Interface input cost: Link state metric from the network to this router. Defaulted to "Interface output cost". May be configured or dynamically adjusted to a value different from the "Interface output cost", and in which case, it MUST be advertised in addition to the link (output) cost for this interface in the router's Router LSA, (see details below).

To signal that a network is using Two-part Metric, a new Link Type X

(value TBD) is added. It is similar to Type 2, except that the network uses Two-part Metric, and there may be an optional network-to-router metric (interface input cost).

Link type	Description	Link ID
X	Link to transit network that uses Two-part Metric	Interface of the Designated Router

For the network-to-router metric (interface input cost) that is different from the router-to-network metric (interface output cost), with OSPFv2 it is carried in an MT-ID field ([RFC4915]):



As illustrated above, the lowest bit of the currently reserved field between MT-ID and MT-ID metric fields can be set to indicate that this is the network-to-router metric for the corresponding topology. It is clear that this scheme is compatible with multi-topology.

For OSPFv3, a TLV can be added to represent the network-to-router metric, per draft-acee-ospfv3-lsa-extend (details TBD).

During intra-area SPF calculation, when a vertex W corresponding to a Network LSA is added to the candidate list because of a Type X link in a Router LSA for vertex V (that was just added to the shortest-path tree), W is marked that it uses Two-part Metric. Later, when a vertex V marked with Two-part Metric (which must correspond to a Network LSA) is added to the shortest-path tree, for the vertex W that is reached via a link in V's corresponding LSA, the exact reverse link (of Type X) from W to V is located from W's corresponding Router LSA. If the reverse link does not exist, W is not considered and the next link in V is checked. If the reverse link has a network-to-router metric, that metric is used as the link cost between V and W. Otherwise, that reverse link's (default) metric

is used as the link cost beteen V and W.

4. IANA Considerations

This document makes no request of IANA (unless the Link Type values in Router LSAs are assigned by IANA).

Note to RFC Editor: this section may be removed on publication as an RFC.

5. Security Considerations

This document does not introduce new security risks.

6. References

6.1. Normative References

[I-D.acee-ospfv3-lsa-extend] Lindem, A., Mirtorabi, S., Roy, A., and F. Baker, "OSPFv3 LSA Extendibility", draft-acee-ospfv3-lsa-extend-01 (work in progress), July 2013.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC2328] Moy, J., "OSPF Version 2", STD 54, RFC 2328, April 1998.

[RFC4915] Psenak, P., Mirtorabi, S., Roy, A., Nguyen, L., and P. Pillay-Esnault, "Multi-Topology (MT) Routing in OSPF", RFC 4915, June 2007.

[RFC5340] Coltun, R., Ferguson, D., Moy, J., and A. Lindem, "OSPF for IPv6", RFC 5340, July 2008.

6.2. Informative References

[RFC6845] Sheth, N., Wang, L., and J. Zhang, "OSPF Hybrid Broadcast and Point-to-Multipoint Interface Type", RFC 6845, January 2013.

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