LFA selection for Multi-homed Prefixes

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Agenda

- Background
- Update on version 01
- Next Steps

Background

- Version-00 presented in IETF-92
- Implementation Guidelines
  - Explicit Inequalities
  - LFA selection for internal Multi-homed Prefixes(MHPs).
  - LFA selection for external Multi-homed Prefixes(MHP).
    - Special rules to handle various scenarios in OSPF
- Use Cases
  - Increase Coverage for FRR
  - Tail-end Protection

Downstream Paths Consideration

1. Downstream Path criterion MUST be standardized
   - Micro-loops may form if different routers use different criteria.

2. RFC 5286 is not decisive about downstream criterion for multi-homed prefix
   - MUST prefix cost be considered or not?
     - §1: "No" (Inequality 2 refers to Nodes)
     - §6.1 (Multi-Homed): "SHOULD" but "MAY NOT"
   - Inconsistent implementations MAY use different downstream path criteria
     - MAY form Micro-loops.

Update in 01 version

- More contributors
- New section added with more explicit text on rules to select
  - Link-protecting LFA for MHPs
  - Downstream-only LFA for MHPs
  - Node-protecting LFA for MHPs

Update in 01 version

Rules for selecting Link/Node-protecting LFA for MHPs via alternate neighbor N

1. If **alternate neighbor N is also prefix-originator of P**,
    1. **Select N** as a LFA for prefix P (**irrespective of the metric advertised by N for the prefix P**)
2. Else, **evaluate the link/node-protecting LFA inequality** for P with the N as the alternate neighbor.
    1. If LFA inequality condition is met,
        1. select N as a LFA for prefix P.
    2. Else,
        1. N is not a LFA for prefix P.

Update in 01 version

Rules for selecting Link-protecting + Downstream-only LFA for MHPs via alternate neighbor N

1. **Evaluate the link-protecting + downstream-only LFA inequality** for P with the N as the alternate neighbor.
   1. If LFA inequality condition is met,
      1. select N as a LFA for prefix P.
   2. Else,
      1. N is not a LFA for prefix P.

Next Steps

- Questions ?

- Adoption as a WG draft ?

Motivations

- Lack of specific inequalities for MHPs
  - Diferrent scenarios need different handling
    - Specially external MHPs.
  - Erroneous implementations
    - Less coverage than feasible.
    - Backup path chosen may still loop.
- Share experience gained from existing implementations and provide future guidance
  - Propose MHP LFA inequalities
    - For all types of MHPs
      - Internal Prefixes
      - External Prefixes
    - For all applicable protocols(ISIS, OSPF)

Background

Inequalities for LFA selection for MHPs

- Link-Protection:

$D\_opt(N,PO\_i)+$ **Cost(PO_i,P)** $<$

$D\_opt(N,S) +$ **D_opt(S,PO_best**) **+ Cost (PO_best,P)**

- Link-Protection + Downstream-paths-only:

$D\_opt(N,PO\_i)+$ **Cost(PO_i,P)** $<$

D_opt(S,PO_best) + Cost (PO_best,P)

- Node-Protection:

$D\_opt(N,PO\_i)+$ **Cost(PO_i,P)** $<$

$D\_opt(N,E) +$ **D_opt(E,PO_best) + Cost (PO_best,P)**

Background

Notations

P   - The Multi-homed prefix being evaluated.

S   - The computing router

N   - The alternate router being evaluated

E   - The primary next-hop on shortest path from S to MHP prefix P.

PO_i - The specific prefix-originating router being evaluated.

PO_best - The prefix-originating router on the shortest path from the computing router S to prefix P.

Cost (X,P)   - Cost of reaching the prefix P from prefix originating node X.

$D\_opt(X,Y)$ - Distance on the shortest path from node X to node Y.

LFA Selection for External MHPs

- ISIS
  - Same as LFA selection for internal MHPs
- OSPF
  - Multiple Considerations to *select and trim alternate ASBRs*
    - *RFC1583Compatibility* is required or not. If not,
      - Primary ASBR and Alternate ASBR *belonging to different* areas or not. If not,
        - » ASBR is permitted as per the *pruning rules of OSPF* [RFC2328 section 16.4.1] or not.
    - *Cost Type* advertised by the ASBR same or not
    - *Route-type* advertised by the ASBR same or not
  - Apply Inequalities on selected ASBRs.

OSPF Inequalities for External MHPs

- Link-Protection:

    $F\_opt(N,PO\_i)$ + $Cost(PO\_i,P)$ <
        $D\_opt(N,S)$ + $F\_opt(S,PO\_best)$ + $Cost(PO\_best,P)$

- Link-Protection + Downstream-paths-only:

    $F\_opt(N,PO\_i)$ + $Cost(PO\_i,P)$ <
        $F\_opt(S,PO\_best)$ + $Cost(PO\_best,P)$

- Node-Protection:

    $F\_opt(N,PO\_i)$ + $Cost(PO\_i,P)$ <
                        $)$ + $Cost(PO\_best,P)$

$F\_opt(X,Y)$ - Distance on the shortest path from node X to
                Forwarding address specified by ASBR Y.

OSPF Inequalities for External MHPs

N,PO_i)+ **Cost(PO_i,P**

D_opt(N,S) + **D_opt**   **Cost (PO_best,P)**

-only:

D_opt(N,PO_i)+   **PO_i,P) <**

     D_opt(S,PO_best) + Cost (PO_best,P)

- ## Node-Protection:

D_opt(N,PO_i)+ **Cost(PO_i,P) <**

     D_opt   **D_opt(E,PO_best) + Cost (PO_best,P)**