IGP for Temporal Links

draft-chen-lsr-tl-00

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IETF 117
Overview

- Temporal Link Cost Functions
  - Example Network with Temporal Links
  - Periodic Cost Function
  - Change in Given Periods
- Extensions to IGP
Introduction

• Cost of link is normally constant such as $C_0$

![Figure 1. Link cost is constant](image)

• Link whose cost is function of time, called temporal link

![Figure 2. Link cost is a function of time](image)
A satellite moves around the earth in its orbit once in a period. E.g., a star link satellite (e.g., Sc) moves around the earth once every 95 minutes (i.e., 5,700 seconds). During this period, the satellite (e.g., Sc) can see or have link from it to a node (e.g., A) on the earth in a time interval such as ~400 seconds.

Figure 3. Network with Temporal Links
Periodic Cost Function

The cost of a temporal link such as link from A to Sa is $C_0$ for a time interval (e.g., 400s) from a given time $T_0$, in every time period (e.g., 95 m = 5,700s), and Infinity for rest of the period.

When the given time $T_0$ is now, the cost of the link is $C_0$ from now for 400s, and then Infinity for 5,300s (i.e., the rest of the first 95m); $C_0$ from 95m later for 400s and then Infinity for 5,300s; and so on.

Link cost function sub-TLV:
Recurrent time interval sub-TLV as shown left: Its body contains Start-time,
Interval-length, and
Period.
The cost of the link is normal link cost (e.g., $C_0$) from a time indicated by Start-time (e.g., $T_0$) for a time interval indicated by Interval-length (e.g., 400s) in every period indicated by Period (e.g., 5,700s), and Infinity for the rest of time in every period.
Change in Given Periods

The cost of a temporal link is $C_0$ for a time interval from a given time $T0$, in every time period, and is Infinity for rest of the period except for some given periods. In each of the given periods, the cost of the link is $C_a$ (e.g., $C_a = 2*C_0$) for the interval.

When given periods are two periods from given time $T0'$, the cost of the link is $C_a$ from $T0'$ for 400s and then Infinity for 5,300s, $C_a$ from $T2'$ for 400s and then Infinity for 5,300s.

Link cost function sub-TLV:
Limited Recurrent time interval sub-TLV: Its body contains Start-time, Interval-length, Period, Number-periods, and Cost.
The cost of the link is Cost (= $C_a$) from a time indicated by Start-time (=T0') for a time interval indicated by Interval-length (=400s) in each period indicated by Period (=5,700s) for the number of periods indicated by Number-periods (=2), and Infinity for the rest of time in each of these periods.
Change in Given Interval

The cost of a temporal link is $C_0$ for a time interval from a given time $T0$, in every time period, and is Infinity for rest of the period except for a given interval. In the given interval, the cost of the link is $C_b$ (e.g., $C_b = 3 \times C_0$).

When the given interval is 5,000s from given time $T0'$, the cost of link is $C_b$ from $T2$ for $(T1' - T2)s$, $C_0$ from $T1'$ for $(T3 - T1')s$ and then Infinity for 5,300s.

**Link cost function sub-TLV:**
Fixed time interval sub-TLV: Its body contains Start-time, Interval-length, Cost.
The cost of the link is Cost (= $C_b$) from a time indicated by Start-time (= $T0'$) for a time interval indicated by Interval-length (= 5,000s).
Extensions to IGP

➢ Cost function by combination of Sub-TLVs
  Recurrent time interval Sub-TLV, Limited Recurrent time interval Sub-TLV and Fixed time interval Sub-TLV.

➢ Distributes cost function configured on link
  OSPFv2: in OSPFv2 Extended Link TLV for the link in OSPFv2 Extended Link Opaque LSA
  OSPFv3: in Router-Link TLV for the link in OSPFv3 E-Link-LSA
  IS-IS: in Extended IS Reachability TLV for the link in LSP

➢ Maintains status of each link
  cost function sub-TLVs, the down or up state,
  earliest link change time (ELCT) at which cost of a link will change from C to Infinity or vice versa.

➢ Computes paths using costs of links at ELCT before ELCT and
  builds a next routing/forwarding table (NRT) based on the paths.

➢ Uses its NRT as its current RIB/FIB when the time is ELCT, and
  then finds a new ELCT, computes shortest paths using the costs of links at the new ELCT before
  the new ELCT and builds a new NRT based on the paths.
Next Steps

- Welcome comments