Extensions to OSPF for Temporal LSP

draft-chen-ospf-tts-00

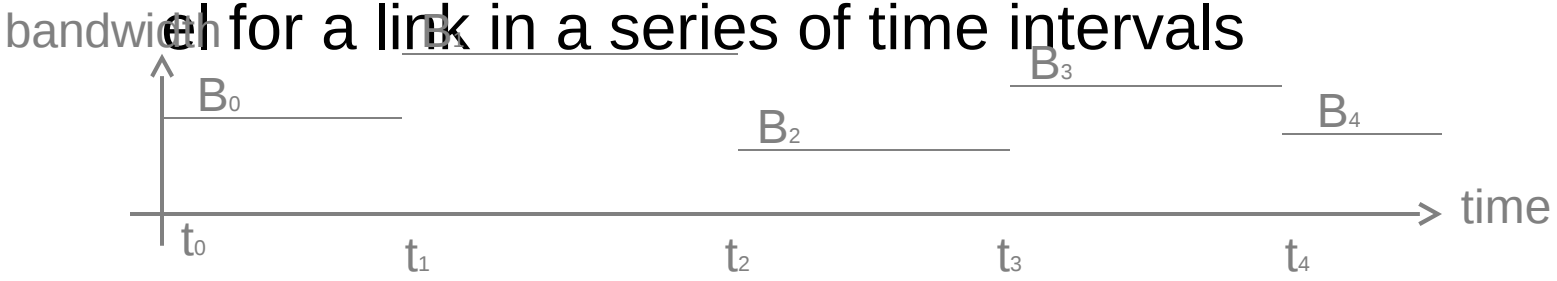
Huaimo Chen (huaimo.chen@huawei.com)
Mehmet Toy (mehmet_toy@cable.comcast.com)
Vic Liu (liuzhiheng@chinamobile.com)
Lei Liu (lliu@us.fujitsu.com)

Introduction

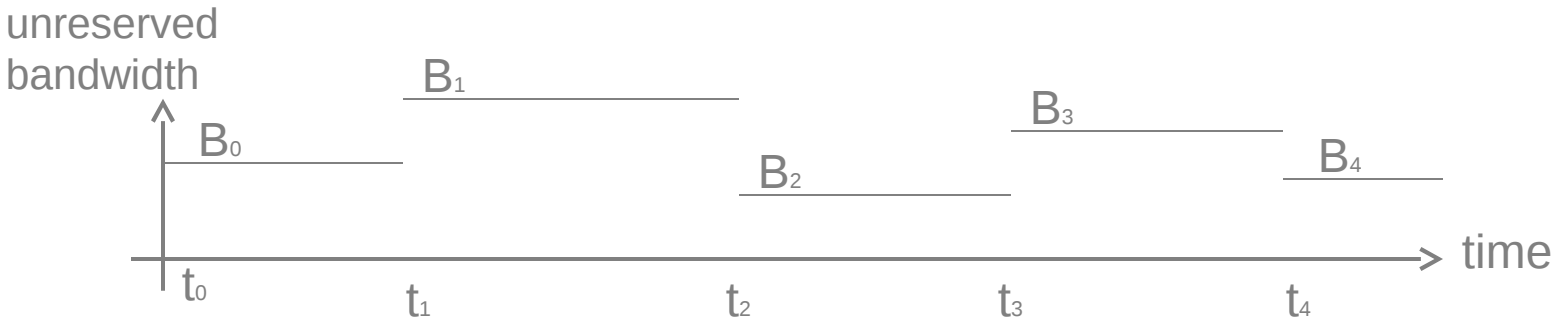
- Existing OSPF TE
  - Distributes and maintains a bandwidth at a priority level for a link at one point of time (i.e., current time)

- Extensions to OSPF for

distributing and maintaining a bandwidth at a priority level for a link in a series of time intervals



Link Bandwidth Representation in Absolute Time

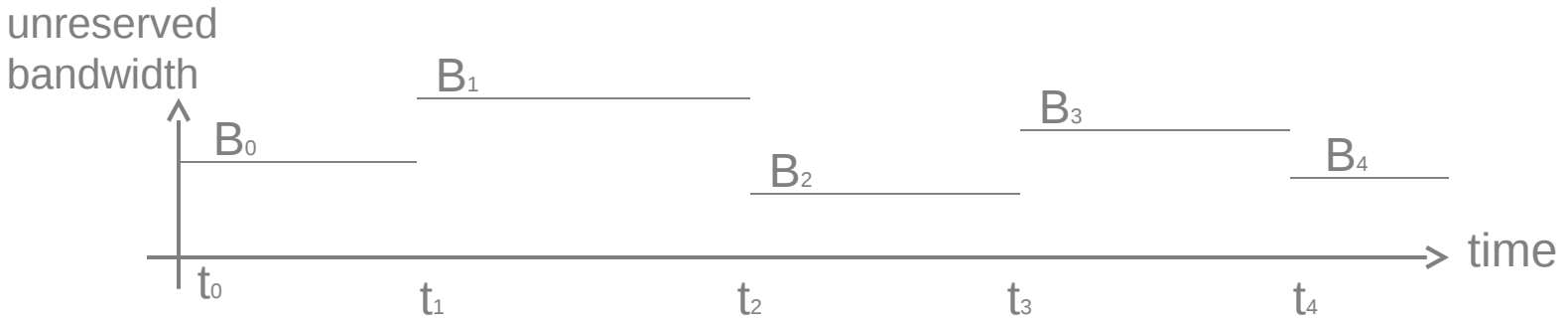


Absolute time representation of bandwidths for a link:

Requirement: The times on all the nodes in a network must be synchronized (the same).

- $[t_0, B_0]$, $[t_1, B_1]$, $[t_2, B_2]$, $[t_3, B_3]$, . . .
- If an LSP is deleted/down at time t and uses bandwidth B, then for every time in erval (after time t) during which bandwidth B is reserved for the LSP on a link at tached to a node, the node adds B to the link for that interval.
- If an LSP is set up at time t and uses bandwidth B, then for every time interval (a fter time t) during which bandwidth B is reserved for the LSP on a link attached t o a node, the node subtracts bandwidth B from the link for that interval.
- If there are significant changes on the bandwidths on a link attached to a node, t he node distributes the bandwidths on the link to other nodes. That is that $[t_0, B_0]$, $[t_1, B_1]$, $[t_2, B_2]$, $[t_3, B_3]$, . . . are distributed to other nodes in the network. O n each of the other nodes, it can construct the figure above for a link (i.e., bandw idth for a series of time intervals for the link) after receiving the information.

Link Bandwidth Representation in Relative Time



Relative time representation of bandwidths for a link:

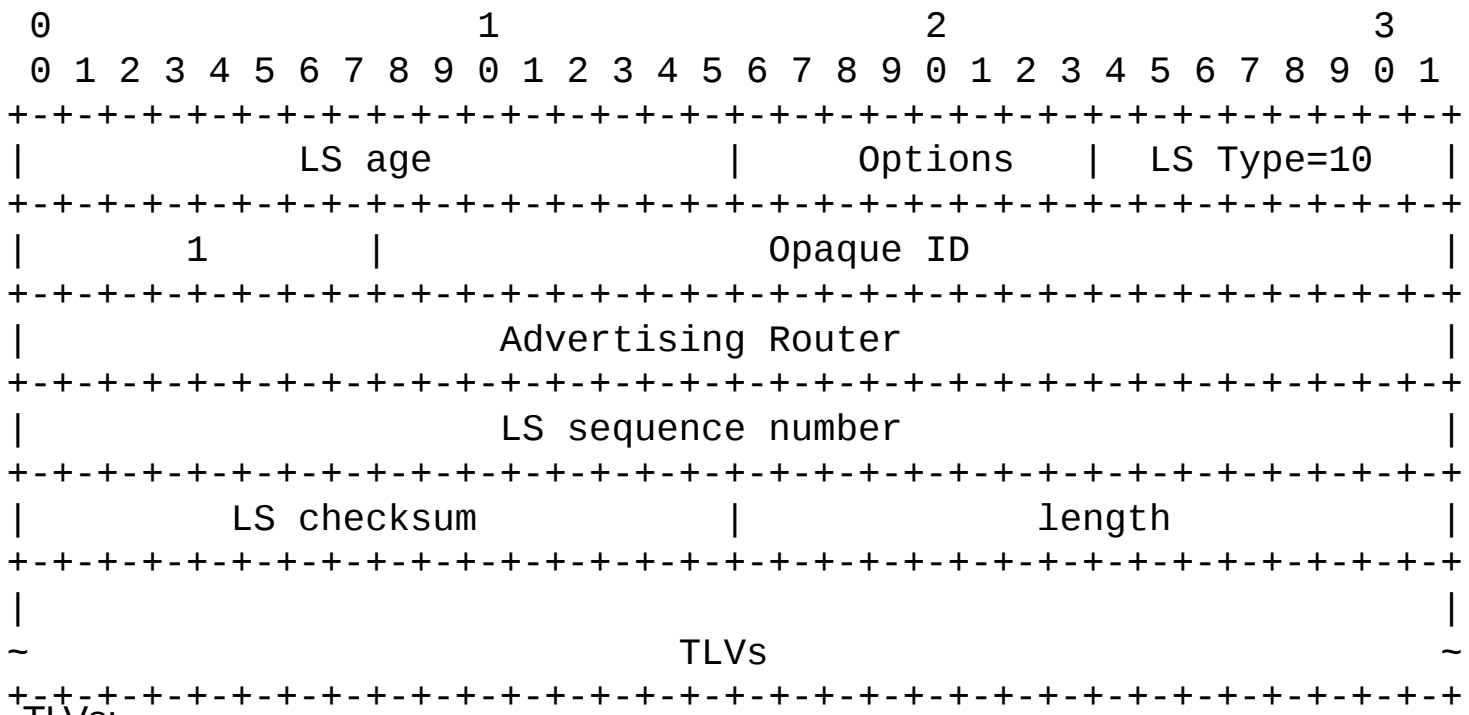
- $[P_0, B_0]$, $[P_1, B_1]$, $[P_2, B_2]$, $[P_3, B_3]$, . . . where $P_j = t_{j+1} - t_j$ and j = 0, 1, 2, 3, …
- A timer expires every time unit (e.g., every second), triggers P_0-- ; when P_0== 0, P_1 becomes P_0, P_2 becomes P_1, and so on.
- If an LSP is deleted/down at time t and uses bandwidth B, then for every time interval/period (after time t) during which bandwidth B is reserved for the LSP on a link attached to a node, the node adds B to the link for that period.
- If an LSP is set up at time t and uses bandwidth B, then for every time interval /period (after time t) during which bandwidth B is reserved for the LSP on a lin k attached to a node, the node subtracts bandwidth B from the link for that pe riod.
- If there are significant changes on the bandwidths on a link attached to a nod e, the node distributes the bandwidths on the link to other nodes. That is that $[P_0, B_0]$, $[P_1, B_1]$, $[P_2, B_2]$, $[P_3, B_3]$, . . . are distributed to other nodes in the network. On each of the other nodes, a timer expires every time unit and trigg ers P_0– when it expires; when P_0==0, P_1 becomes P_0, P_2 becomes P_1, and so on.

Advantages of this representation: The times on all the nodes can be different.

Link Bandwidth Distribution

Add TTS Link TLV into Existing TE LSA

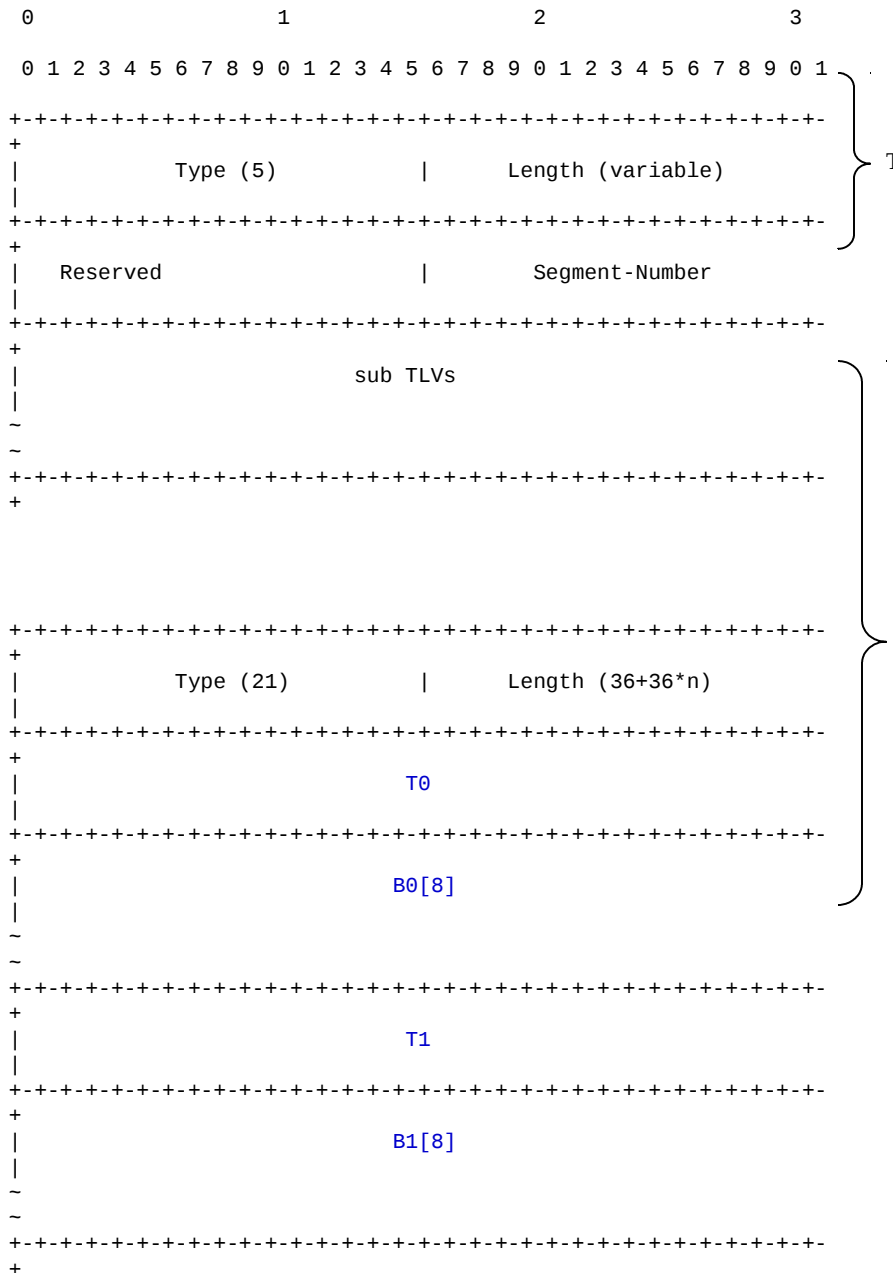
Format of Opaque LSA for TE LSA



TLVs:

- Router Address TLV (Existing)
- Link TLV (Existing)
- TTS Link TLV (New) for bandwidths of a link to support TTS

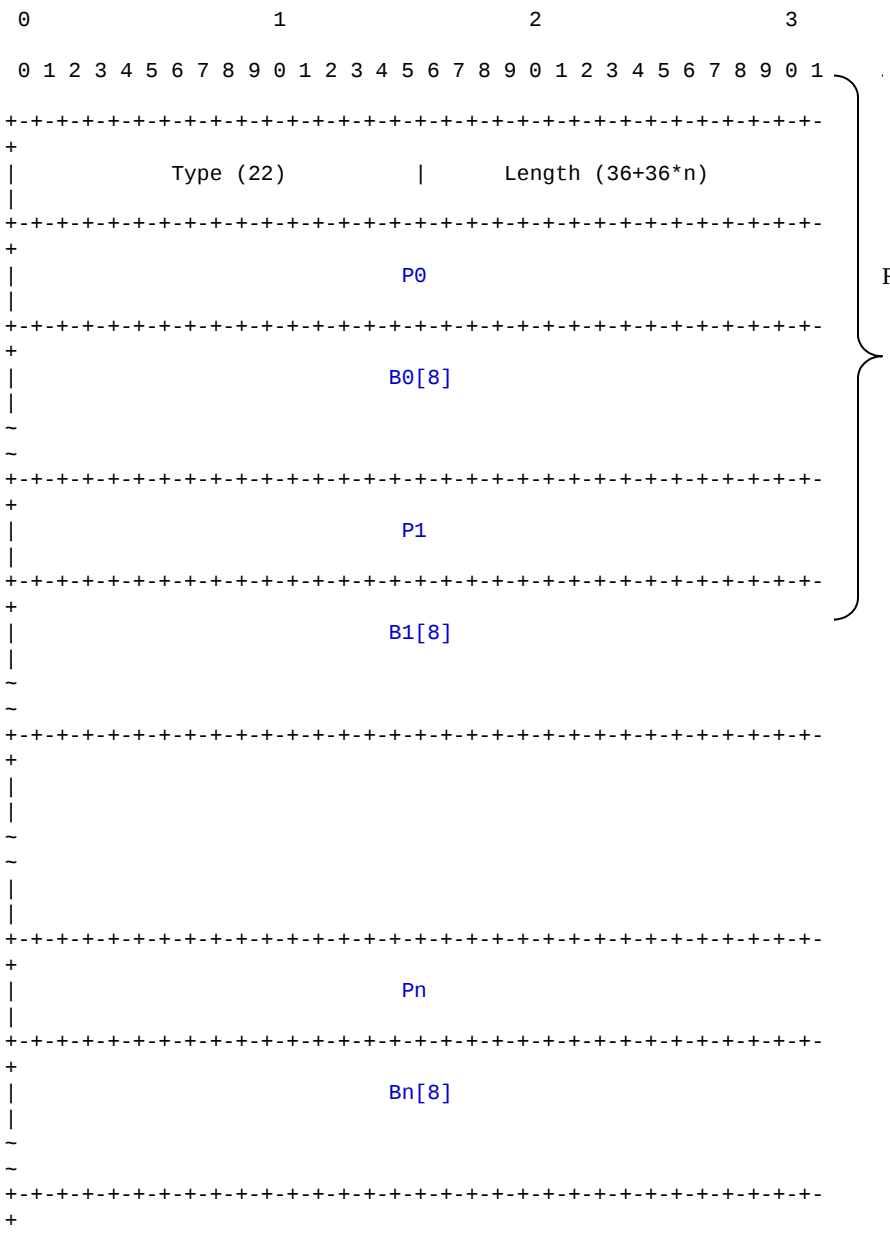
Link Bandwidth Distribution: TTS Link TLV



TTS Link TLV has type of 5 (exact number is to be assigned by IANA), Segment Number and must contain Link Type sub-TLV and Link ID sub-TLV. It may include Local Address sub-TLV, Remote Address sub-TLV, TE metric sub-TLV, Maximum Bandwidth TLV, Maximum Reservable Bandwidth sub-TLV, Unreserved Bandwidth sub-TLV, Administrator Group sub-TLV, and so on. It may also contain a Relative TTS Unreserved Bandwidth sub-TLV or Absolute TTS Unreserved Bandwidth sub-TLV.

An Absolute TTS Unreserved Bandwidth sub-TLV may have a type of 21 (the exact number is to be assigned by IANA) and contains
[T0, B0[8]], [T1, B1[8]], ... , [Tn, Bn[8]],
where T0, T1, ..., Tn are absolute time; Bj[8] (j=0, 1, ..., n) are the amount of unreserved bandwidth at 8 priority levels for the time period from Tj to Tj+1.

Link Bandwidth Distribution: TTS Link TLV (Cont)



A Relative TTS Unreserved Bandwidth sub-TLV has a type of 22 (the exact number is to be assigned by IANA) and contains [P0, B0[8]], [P1, B1[8]], … , [Pn, Bn[8]], where Pj(j=0, 1, …, n) is the time period during which the unreserved bandwidth is Bj[8], containing the amount of unreserved bandwidth at 8 priority levels.

Next Step

- Welcome comments