Extensions to MPLS for Temporal LSP

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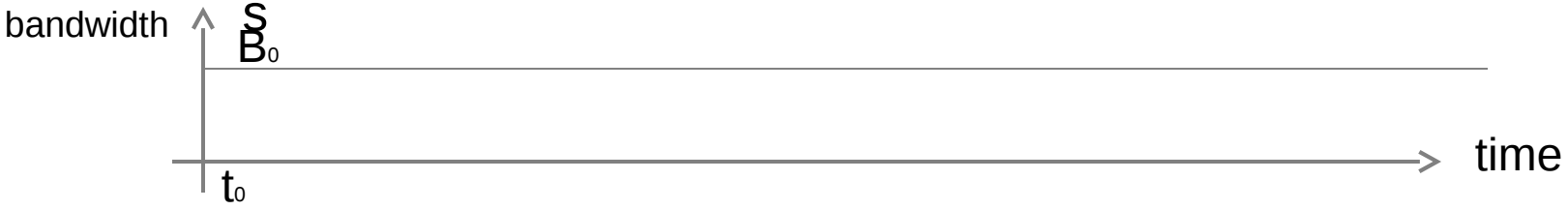
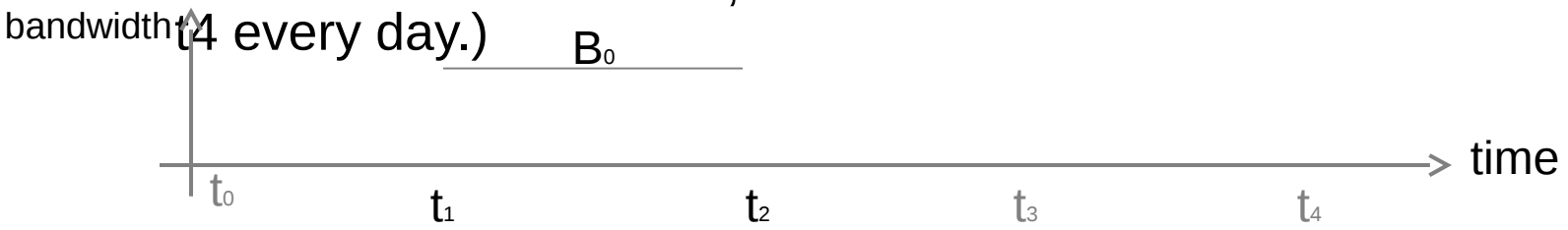
Introduction

- Existing RSVP-TE
  - Establishes an LSP tunnel, assumes it up forever until tor n down
  - Reserves bandwidth for it forever on every link it traverse s



- Extensions to RSVP-TE

  Creates an LSP in a sequence of time intervals (e.g., a TE LSP from A to B from t1 to t2, another TE LSP from C to D from t3 to t4 every day.)



Temporal LSP: LSP

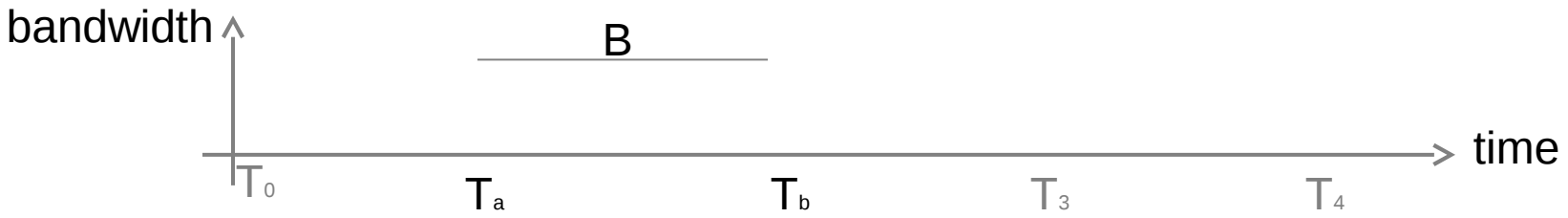
with a sequence of time intervals,

carrying traffic in each of intervals

Operations Overview

Simple time interval [Ta, Tb]: time period from Ta to Tb

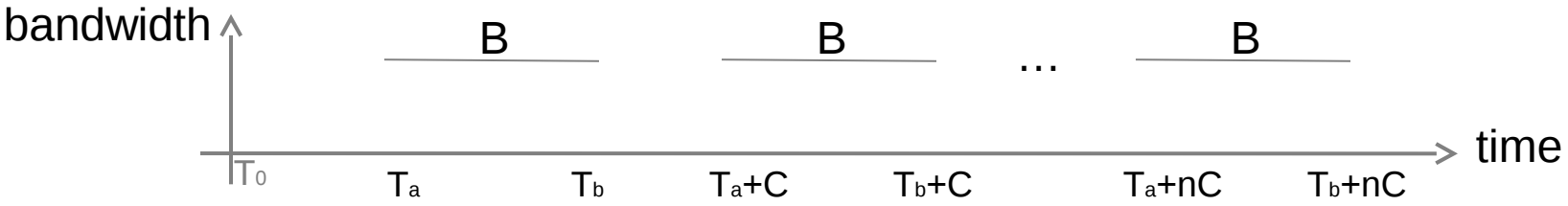
- LSP with [Ta, Tb]
  - path satisfying the constraints from Ta to Tb is computed
  - LSP is set up to carry traffic from Ta to Tb



Recurrent time interval [Ta, Tb] repeats n times with repeat cycle C

[Ta, Tb], [Ta+C, Tb+C], [Ta+2C, Tb+2C], . . ., [Ta+nC, Tb+nC]

- LSP with "[Ta, Tb] repeats n times with repeat cycle C"
  - path satisfying the constraints in each of (n+1) time intervals
  - LSP is set up to carry traffic in each of (n+1) intervals



Operations Overview - Continue

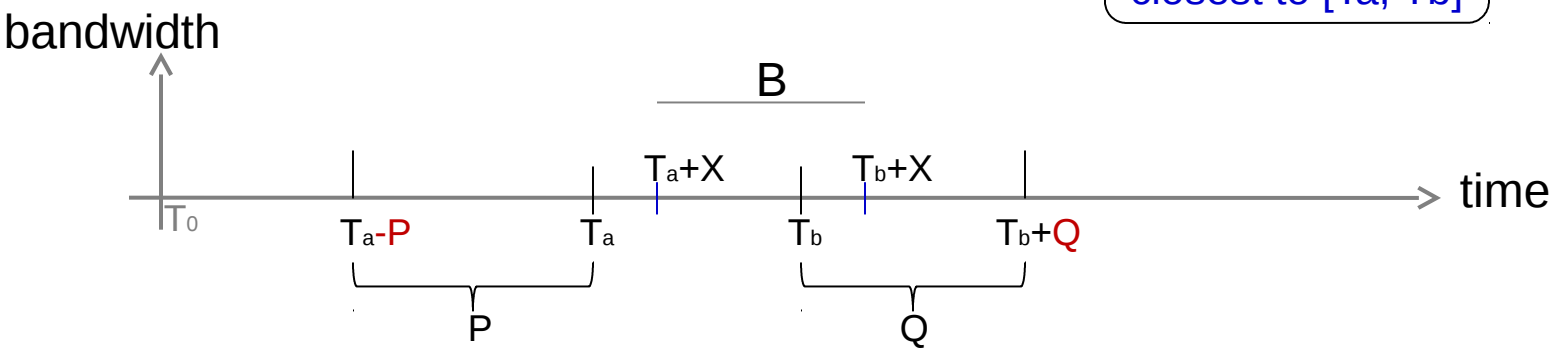
Elastic time interval [Ta, Tb] within -P and Q

[Ta+X, Tb+X], where -P <= X <= Q, P/Q is an amount of time

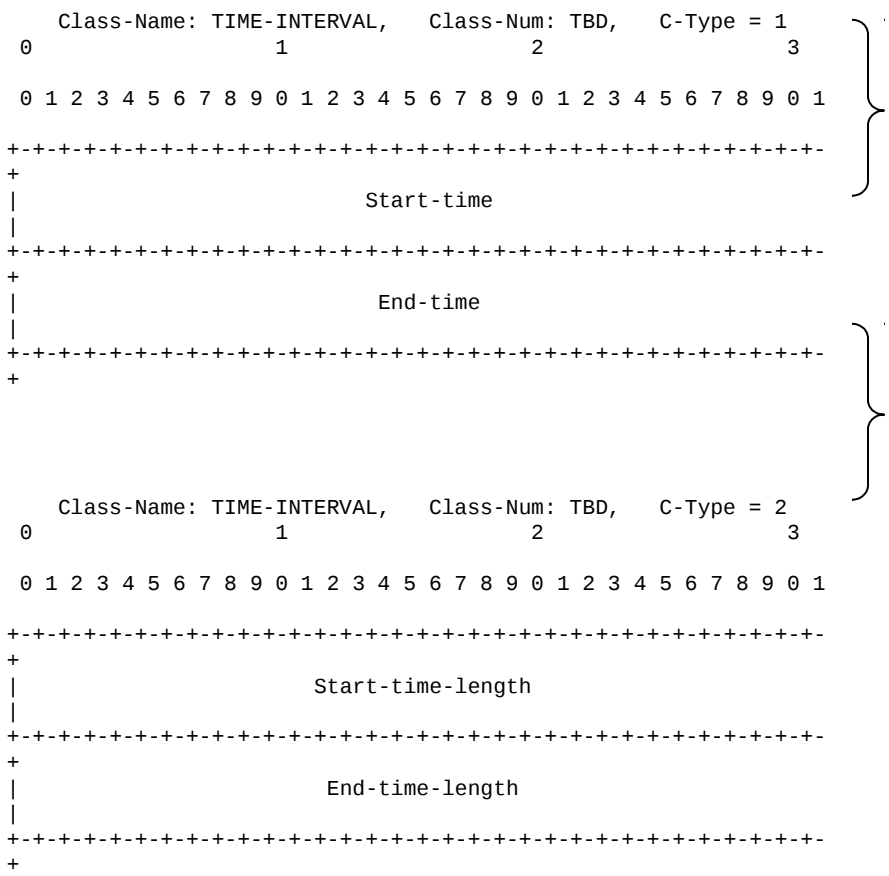
No path for LSP in [Ta, Tb] is OK

- LSP with “[Ta, Tb] within -P and Q”
  - path satisfying constraints in [Ta+X, Tb+X] and |X| is the minimum from -P to Q
  - LSP set up to carry traffic from Ta+X to Tb+X

Time interval closest to [Ta, Tb]



Time Interval Object



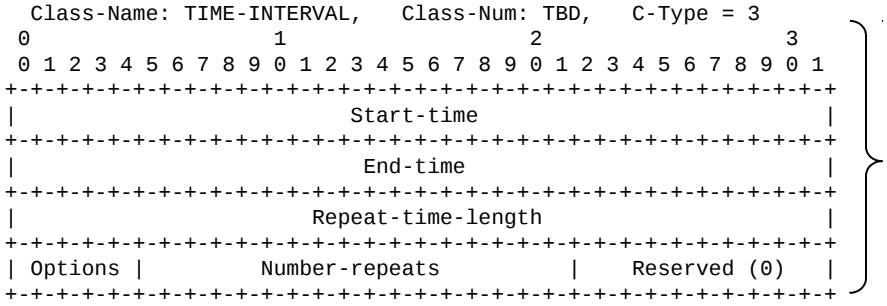
Start-time: The time LSP starts to carry traffic.
End-time: The time LSP ends carrying traffic.
Time interval [Start-time, End-time]

Times must be synchronized among all nodes.

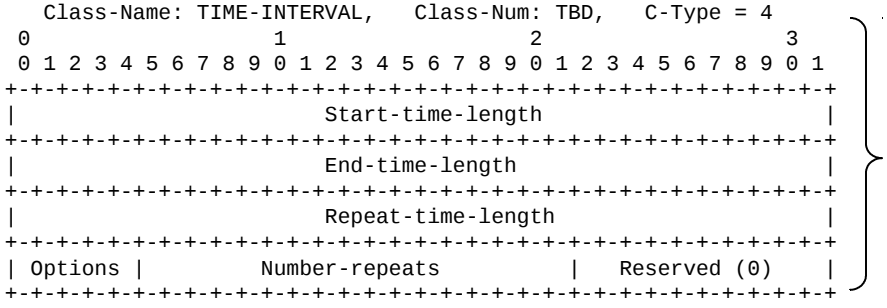
Start-time-length: Time length in seconds from current to time LSP starts to carry traffic.
End-time-length: Time length in seconds from current to time LSP ends carrying traffic.
Time interval
[CT+ Start-time-length, CT+ End-time-length]
CT means Current Time

Clocks/times on all the nodes can be different.

Time Interval Object: Recurrent



Recurrent Absolute Time Interval Object



Recurrent Relative Time Interval Object

Start-time: The time LSP starts to carry traffic.
End-time: The time LSP ends carrying traffic.
Repeat-time-length: The time length in seconds after which LSP starts to carry traffic again for (End-time – Start-time). This field is valid when Options indicates “repeat every Repeat-time-length.
Options: Indicates a way to repeat. Options=1: repeat every day; Options=2: repeat every week; Options=3: repeat every month; Options=4: repeat every year; Options=5: repeat every Repeat-time-length.
Number-repeats: The number of repeats in each repeat, LSP carries traffic.

Start-time-length: The time length in seconds from current to time LSP starts to carry traffic.
End-time-length: The time length in seconds from current to time LSP ends carrying traffic.
Other fields are the same as above.

Creating a Temporal LSP

On ingress:

- It processes the configurations of time intervals.
- It computes a path for the LSP, satisfying constraints in every time interval
- It puts TIME-INTERVAL objects and ERO into PATH messages

Processing a PATH with TIME-INTERVAL objects on ingress/transit node

- It gets the time intervals and the link to its next hop.
- Is bandwidth available in every time interval?
- It updates state with time intervals and sends PATH to the next hop if yes; otherwise, it returns a PATH-ERR to its upstream node.

Creating a Temporal LSP - Continue

On egress:

- After receiving PATH, it allocates a label, writes a forwarding entry for the LSP and sends a RESV to its upstream.

Processing a RESV on a transit:

- After receiving RESV, it allocates a label, reserves the bandwidth on the li nk in every time interval, and writes a forwarding entry for the LSP.
- It sends a RESV with the label to its upstream.

Processing a RESV on ingress:

- After receiving RESV, it reserves the bandwidth on the link for the LSP in every time interval, and writes a forwarding entry for the LSP.

Next Step

- Welcome comments