Scheduling Function One (SF1) for hop-by-hop Scheduling in 6tisch Networks

draft-satish-6tisch-6top-sf1-01

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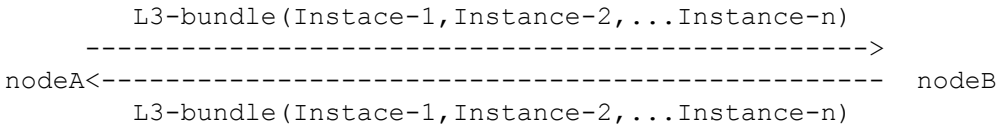
The need for SF1

SF0 :

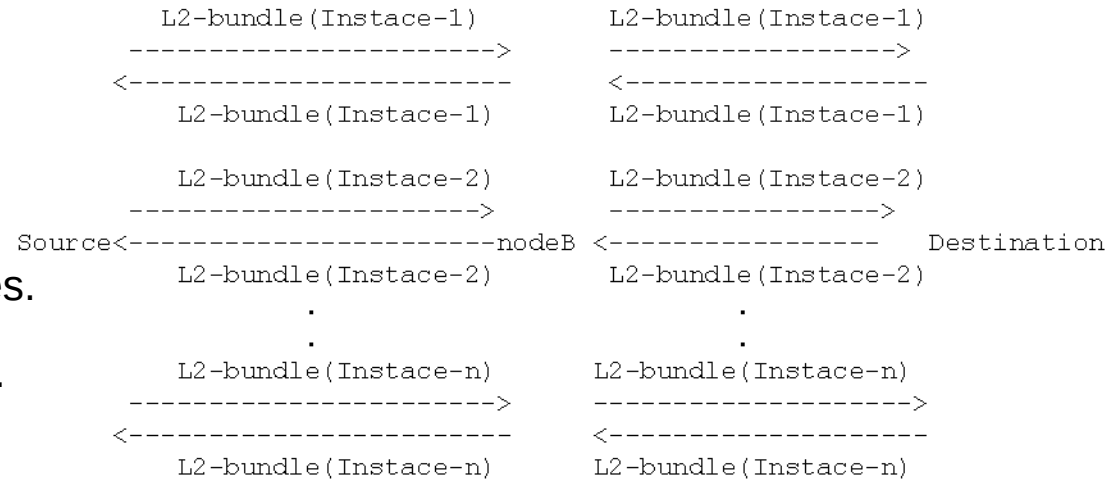


- 1-Hop scheduling protocol.
- Schedule for aggregate traffic flows (L3-bundle).
- Dynamic cell adaptation (OTF Scheduling).
- Support best effort-traffic flows.

But, applications (Industrial-M2M, Medical-IoT) need Time critical traffic flows.

SF1 :

- End-to-end scheduling protocol.
- Schedule isolated traffic flows.
- Dedicated end-to-end L2-bundles.
- Support time-critical traffic flows.



Label Distribution Protocol

RSVP-MPLS

- Explicit label mechanism.
- Packet Switching Capability.
- PATH message with “Label Request”.
- RESV message with “Label Object”.
- Per-hop labels (4 Bytes) are created by downstream node.

RSVP-GMPLS

- Implicit label mechanism.
  - Timeslot Switching Capability (TSC).
  - Lambda Switching Capability (LSC).
  - Fiber Switching Capability (FSC).
- “Cell Switching Capability (CSC)” for 6tisch Networks.

Scheduling Function One (SF1)

Objective of SF1

- When to reserve end-to-end resources.
- How to provide implicit labels for the reserved resources.
- When to schedule end-to-end L2-bundles.
- How to associate the TrackID for each L2-bundle.

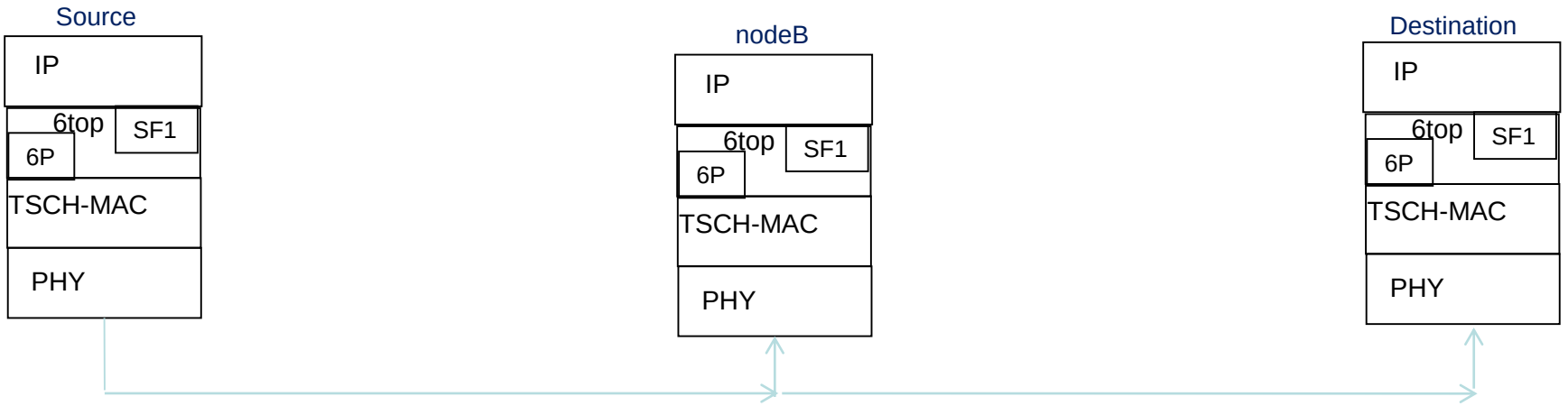
Resource Reservation Protocol

- Extension of GMPLS-RSVP-TE[RFC3473].
- Treat other protocol as “object " in RSVP.
- Each cell(ChannelOffset+SlotOffset) is used as an “implicit label”.

Assumption

- End-to-end route path is available [storing or non-storing mode].

End to End Scheduling with SF1 : RSVP-PATH



RFC3473

<Path Message> ::=

<SESSION> <…….>
<…….....>
<LABEL_REQUEST> : CSC
[……]
[<LABEL_SET>]
[<SF1 OPERATION REQUEST>]
[<6P OPERATION REQUEST>]
[……..]
[……]
[……]
[……..]
<sender descriptor>

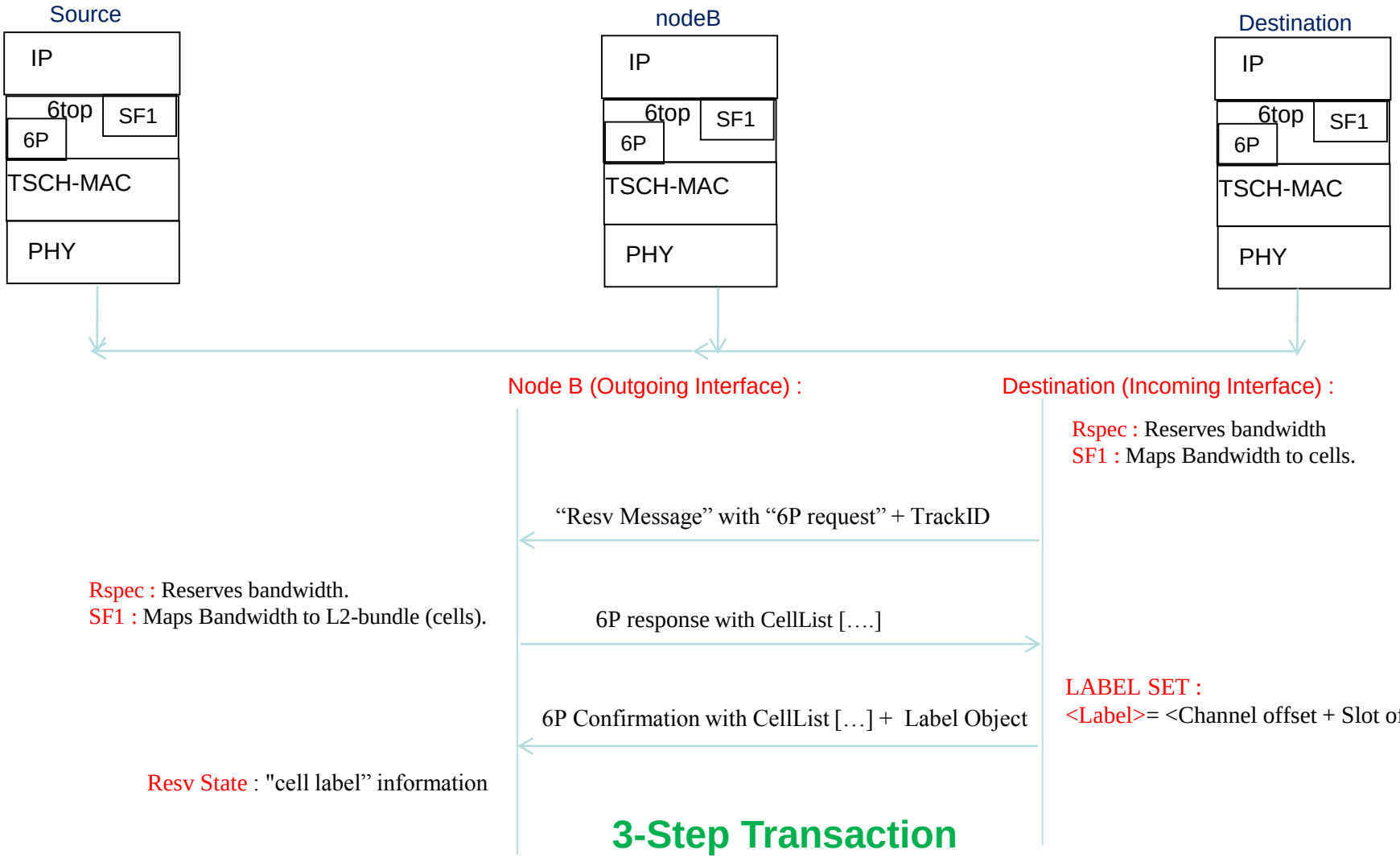
<Path Message> ::=

<SESSION> <…….>
<…….....>
<LABEL_REQUEST> : CSC
[……]
[<LABEL_SET>]
[<SF1 OPERATION REQUEST>]
[<6P OPERATION REQUEST>]
[……..]
[……]
[……]
[……..]
<sender descriptor>

CSC : Cell Switching Capability

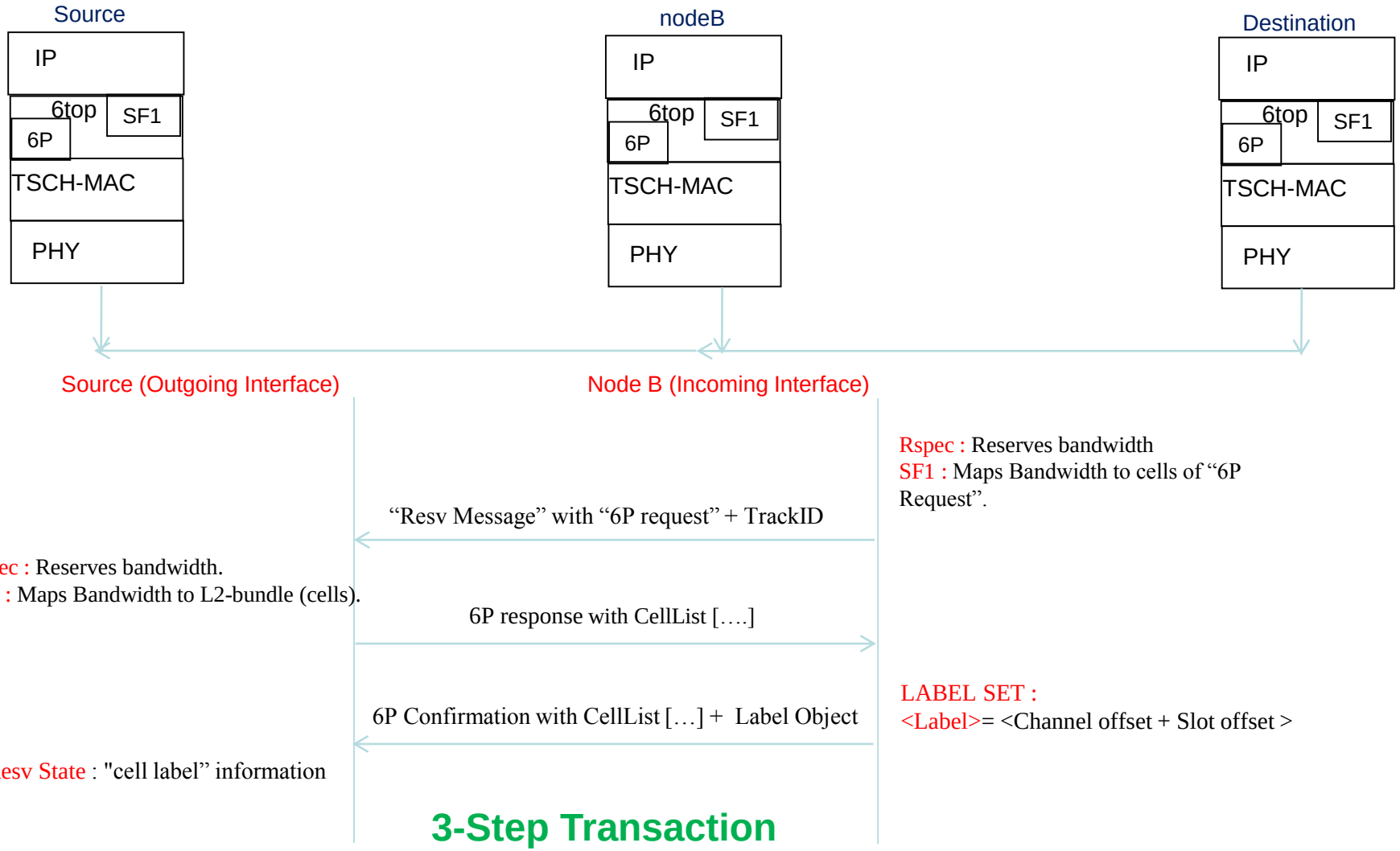
"RPLInstanceID" is in "SENDER_TEMPLATE" and "FLOW_SPEC".

End to End Scheduling with SF1 : RSVP-RESV



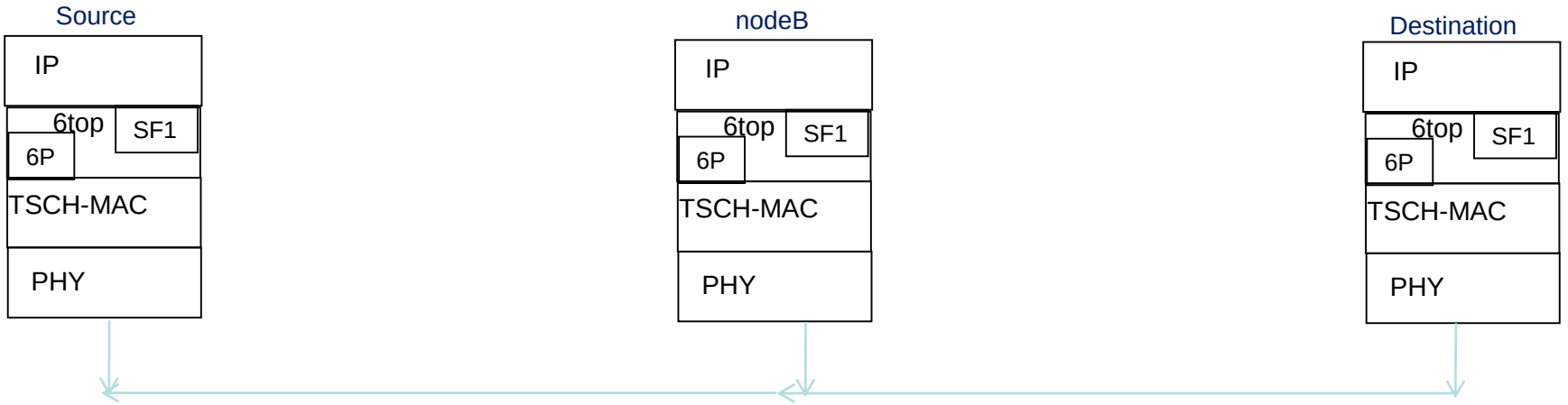
TrackID = Sender/Destination IP address + RPLInstanceID
SENDER_TEMPLATE / FLOW_SPEC has "Sender IP address" and "RPLInstanceID".
SESSION has "Destination IP address".

End to End Scheduling with SF1 : RSVP-RESV



6P Confirmation(Source to node B) -> "Source cell label" is mapped to "node B cell label".

End to End Scheduling with SF1 : RSVP-RESV



Node B (Outgoing Interface) :

< Resv Message > ::=
Rspec : Reserves bandwidth
SF1 : Maps Bandwidth to cells.
6P Response(Transmit cells):

2-Step Transaction

Destination (Incoming Interface) :

< Resv Message > ::=
Rspec : Reserves bandwidth.
SF1 : Maps Bandwidth to L2-bundle (cells).
LABEL SET :
<Label>= <Channel offset + Slot offset >
6P Request(Receive cells):

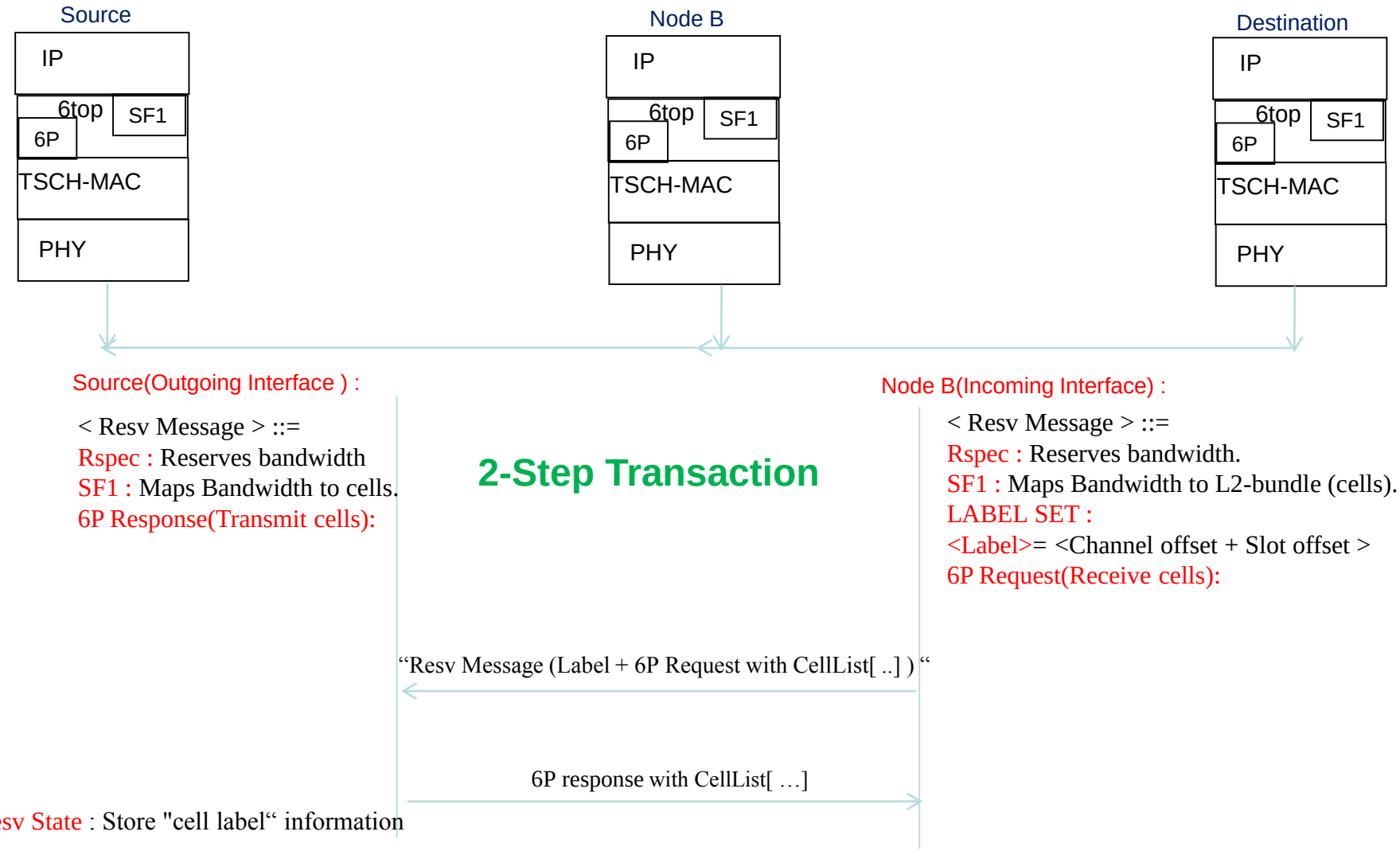
"Resv Message"
(Label + 6P Request with CellList […])

6P response with CellList [….]

Resv State : Store "cell label" information

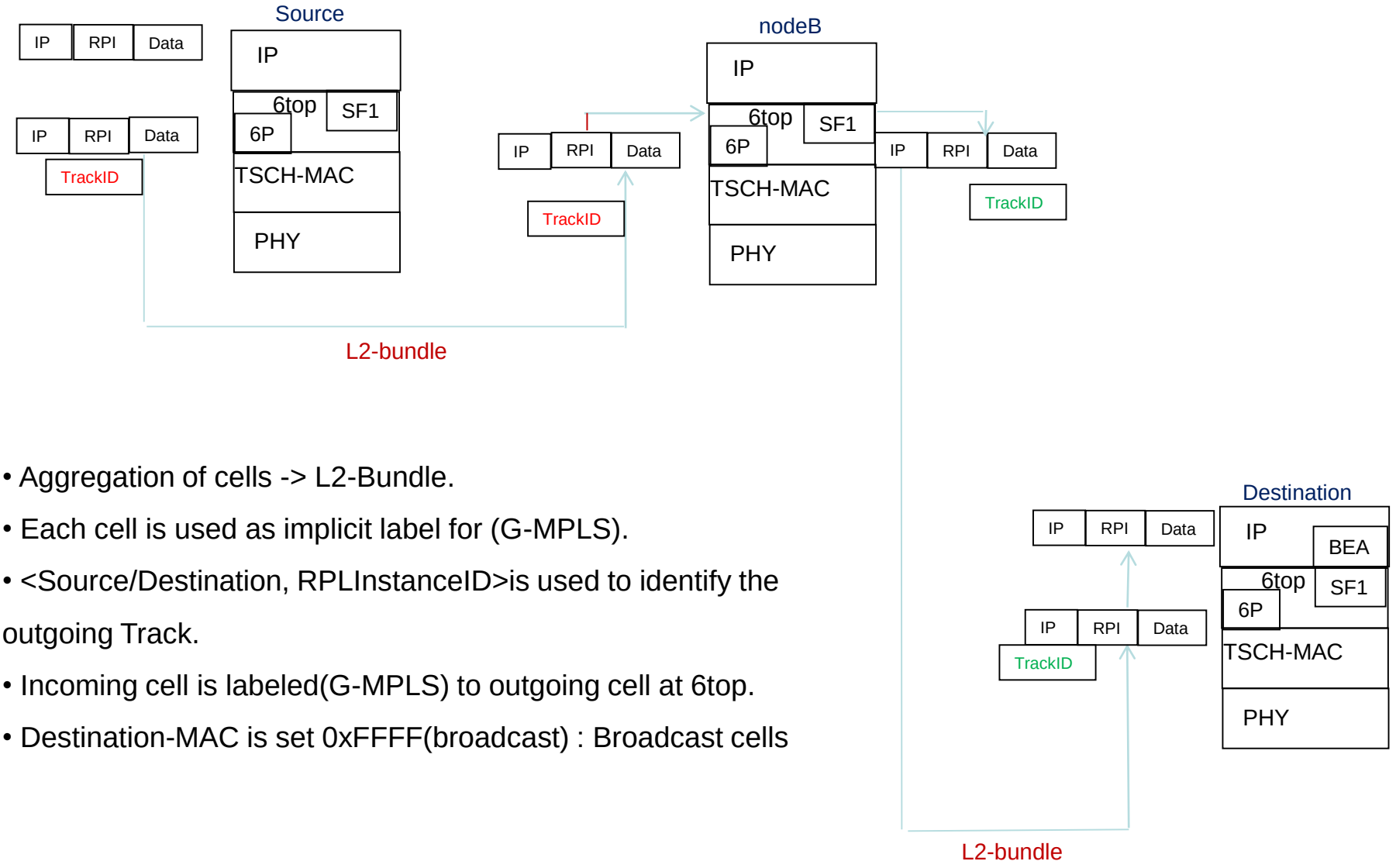
TrackID = Sender/Destination IP address + RPLInstanceID
SENDER_TEMPLATE / FLOW_SPEC has "Sender IP address" and "RPLInstanceID".
SESSION has "Destination IP address".

End to End Scheduling with SF1 : RSVP-RESV



6P Response (Source to node B) -> “Source cell label” is mapped to “node B cell label”.

End-to-end data transmission with Track forwarding



- Aggregation of cells -> L2-Bundle.
- Each cell is used as implicit label for (G-MPLS).
- <Source/Destination, RPLInstanceID>is used to identify the outgoing Track.
- Incoming cell is labeled(G-MPLS) to outgoing cell at 6top.
- Destination-MAC is set 0xFFFF(broadcast) : Broadcast cells

Next Steps

- Comments and Questions

Thanks!