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

CSC : Cell Switching Capability

“RPLInstanceID” is in “SENDER_TEMPLATE” and “FLOW_SPEC”.

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End to End Scheduling with SF1 : RSVP-RESV

**3-Step Transaction**

**TrackID = Sender/Destination IP address + RPLInstanceID**

- **SENDERS** _TEMPLATE / _FLOW_SPEC_ has “Sender IP address” and “RPLInstanceID”.
- **SESSION** has “Destination IP address”.

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**Source**

- **IP**
- **6top**
- **SF1**
- **6P**
- **TSCH-MAC**
- **PHY**

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**nodeB**

- **IP**
- **6top**
- **SF1**
- **6P**
- **TSCH-MAC**
- **PHY**

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**Destination**

- **IP**
- **6top**
- **SF1**
- **6P**
- **TSCH-MAC**
- **PHY**

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**Node B (Outgoing Interface)**:
- “Resv Message” with “6P request” + TrackID
- 6P response with CellList […]
- 6P Confirmation with CellList […] + Label Object

**Destination (Incoming Interface)**:
- Rspec : Reserves bandwidth
- SF1 : Maps Bandwidth to cells.

LABEL SET :
<Label> = <Channel offset + Slot offset>

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Rspec : Reserves bandwidth.
SF1 : Maps Bandwidth to L2-bundle (cells).

**Resv State** : "cell label" information
End to End Scheduling with SF1: RSVP-RESV

**3-Step Transaction**

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

Rspec: Reserves bandwidth.
SF1: Maps Bandwidth to L2-bundle (cells).

6P Confirmation with CellList […] + Label Object

6P response with CellList […]

“Resv Message” with “6P request” + TrackID

Source (Outgoing Interface)

nodeB (Incoming Interface)

Destination

Resv State: "cell label" information

-label set: 
<Label> = <Channel offset + Slot offset>

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2-Step Transaction

Source

Node B (Outgoing Interface) :

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

Resv State : Store "cell label" information

Destination

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):

Tracker = Sender/Destination IP address + RPLInstanceID
SENDANCE TEMPLATE / FLOW SPEC has “Sender IP address” and “RPLInstanceID”. 
SESSION has “Destination IP address”.

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2-Step Transaction

Source (Outgoing Interface):
- `<Resv Message> ::= Rspec : Reserves bandwidth
  SF1 : Maps Bandwidth to L2-bundle (cells).
  6P Response (Transmit cells):

Node B (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):

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Resv State: Store "cell label" information
```

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!