



**SIEMENS**

# ISIS-SPB-PCR (IEEE 802.1Qca) Extensions for Path Control & Reservation

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# Structure of this Presentation

- 1. AVB Gen 1**  
**MSRP Role and Stream Properties for Reserved Traffic**  
**Task of MSRP Talker Advertise**  
**Task of MSRP Listener Ready**
- 2. AVB Gen 2**  
**Why there is a need for new MSRP / ISIS-SPB-PCR Mechanism?**  
**Extensions for MSRP and ISIS-SPB-PCR for Reserved- and Scheduled Traffic**
- 3. Proposal for MSRP Gen 2 / ISIS-SPB-PCR Mechanism**  
**Concerns about the proposed Solutions**
- 4. Proposal for new TLV's or Sub-TLV's used by ISIS-SPB-PC**

## AVB Gen1

### MSRP: Role and Stream Properties for Reserved- Traffic

#### Role:

- **Talker**
  - Advertisement & Transmission of Streams
- **Listener**
  - Initiation of reservation & receiving streams
- **AV-Bridges**
  - Reservation of resources
  - Control forwarding of Reserved-Traffic

#### Network:

- **RSTP** provides a **single** loop free path from Talker to Listener (s)  
(recovery time in case of network failures is not addressed)
  
- **MSRP** is used for **resource reservation** and **control forwarding** of Reserved-Traffic
  
- **MAC Address**
  - Unique stream destination MAC address per VLAN ID to control forwarding of streams in bridges
- **Priority**
  - Specifies traffic class for Reserved traffic (default: priority 3 for class A, priority 2 for class B)
- **VLAN ID**
  - VLAN's for streams

## AVB Gen1

### MSRP: Role and Stream Properties for Reserved- Traffic

#### Stream properties for reservation:

##### ▪ Stream ID

- Talker MAC address
- Unique talker specific ID

##### ▪ T-Spec

- Max. frame size
- Transmission period (frames / interval)
  - Reserved Traffic (125 $\mu$ s for class A, 250 $\mu$ s for class B)

##### ▪ Ranking

- AVB Gen 1: only one bit for ranking (default/emergency)

##### ▪ Latency

- Calculation for given communication path (Talker -> Listener)

##### ▪ Reservation status

- Resources in bridges and end stations available

# AVB Gen 1

## Information's used by MSRP in a MSRP PDU

### Listener Informations

|    |                  |                       |               |          |
|----|------------------|-----------------------|---------------|----------|
| 00 | DA               |                       |               |          |
| 04 |                  |                       |               |          |
| 08 | SA               |                       |               |          |
| 12 | EtherType        | Version               | AttributeType |          |
| 16 | Attribute Length | Attribute List Length | LA            | # Values |
| 20 | # Values         | Stream ID             |               |          |
| 24 |                  |                       |               |          |
| 28 |                  | 3 Pkd (1)             | 4 Pkd (1)     | END MARK |
| 32 | END MARK         | EndMark               |               |          |
| 36 |                  |                       |               |          |
| 40 |                  |                       |               |          |
| 44 |                  |                       |               |          |
| 48 |                  |                       |               |          |
| 52 |                  |                       |               |          |
| 56 |                  |                       |               |          |
| 60 |                  |                       |               |          |

### Talker Informations

|    |                       |                       |               |          |
|----|-----------------------|-----------------------|---------------|----------|
| 00 | DA                    |                       |               |          |
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| 08 | SA                    |                       |               |          |
| 12 | EtherType             | Version               | AttributeType |          |
| 16 | Attribute Length      | Attribute List Length | LA            | # Values |
| 20 | # Values              | Stream ID             |               |          |
| 24 |                       |                       |               |          |
| 28 |                       |                       |               |          |
| 32 | Data Frame Parameters |                       |               |          |
| 36 | TSpec                 |                       |               |          |
| 40 | Prio&Rank             |                       | Latency       |          |
| 44 | Latency               |                       | 3 Pkd         | END MARK |
| 48 | END MARK              | EndMark               |               |          |
| 52 |                       |                       |               |          |
| 56 |                       |                       |               |          |
| 60 |                       |                       |               |          |

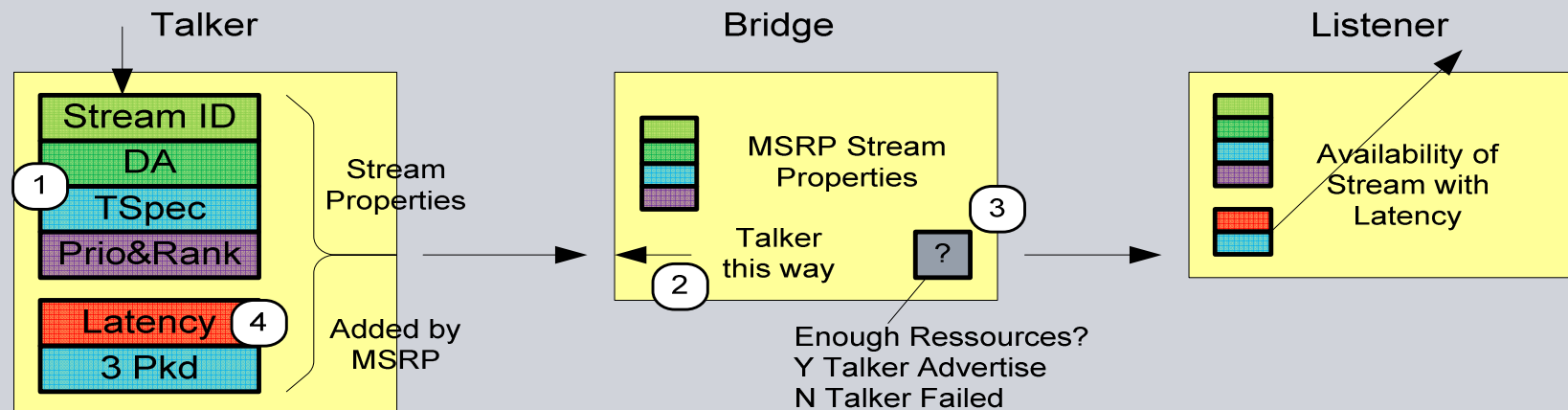
- Stream ID Unique Stream ID for Management
- DA Data send with this DA
- TSpec Needed Ressources from Stream
- Prio&Rank Priority and Ranking for Streams
- Latency Max. latency after which data arives by Listener
- 3 Pkd Synchronisation of MSRP data
- 4 Pkd Availability-Status of Listeners

# AVB Gen 1

## Task of MSRP Talker Advertise

**Talker advertise** is used by MSRP for:

1. Announcement of stream properties (Talker -> Bridge -> Listener)
2. Find path to Talker in the RSTP network
3. Check availability of resources on the path from Talker to Listener (s)
4. Accumulate latency on the path from Talker (T) to Listener (L)

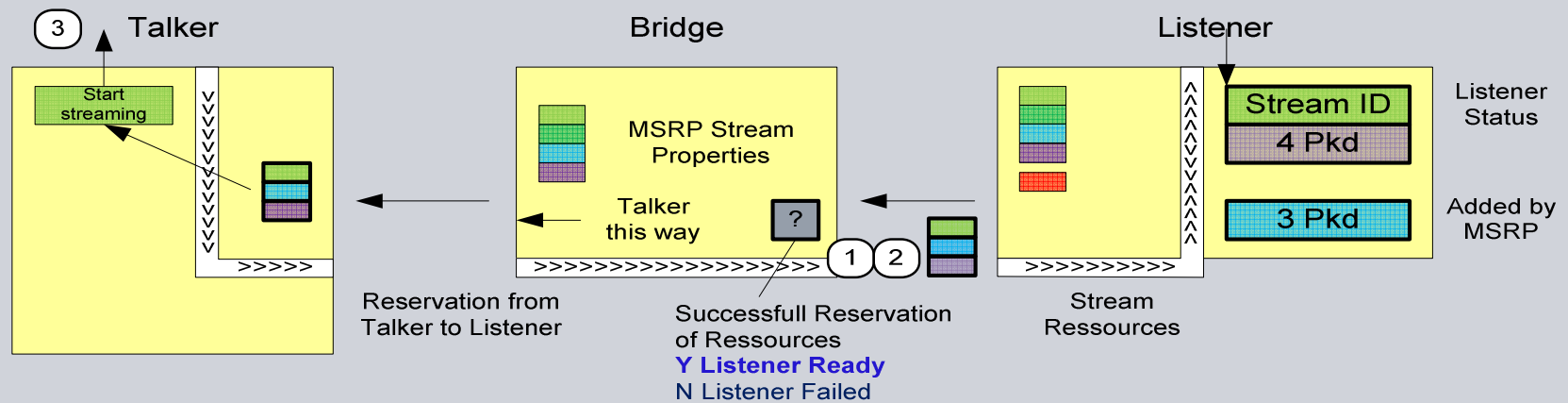


# AVB Gen 1

## Task of MSRP Listener Ready

The **MSRP Listener Ready** is used for:

1. Reservation of the resources
2. Control and set forwarding path (stop blocking)
3. Starting transmission of stream (after reservation of all resources)



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**Extensions for MSRP and ISIS-SPB-PCR for Reserved- and Scheduled Traffic**
3. **Proposal of different MSRP Gen 2 / ISIS-SPB-PCR Mechanism**  
**Concerns about the proposed Solutions**
4. **Proposal for new TLV's or Sub-TIV's used by ISIS-SPB-PCR**



## Why there is a need for new MSRP / ISIS-SPB-PCR Mechanisms?

Higher requirements from Industrial Automation and Automotive for

- Reserved- and
- **Scheduled- Traffic (new traffic class)**

**Need: Lower latency and high availability for Reserved- and Scheduled- Traffic**

Proposed Mechanism for:

### Low Latency:

- **ISIS-SPB-PCR** to find „shortest“ / **optimal** path for Reserved- and Scheduled- Traffic to **minimize** latency

### High Availability:

- **ISIS-SPB-PCR** shall be used to find “shortest” / **optimal redundant** paths for Reserved- and Scheduled Traffic to support **high availability** using topology information

## AVB Gen 2: Extensions for MSRP and ISIS-SPB-PCR for Reserved- and Scheduled- Traffic

### Role:

#### AV-Bridges

- Control forwarding of Reserved- and Scheduled- Traffic

### Network:

- **ISIS-SPB-PCR** is used to find “shortest”/optimal redundant paths
- **ISIS-SPB-PCR and / or MSRP** is used for resource reservation and control forwarding of Reserved- and Scheduled- Traffic
- **Priority**
  - Scheduled- Traffic (to define default priorities class A and class B)
- **VLAN ID**
  - Multiple VLAN ID's for multiple path to support high availability (to define)

## AVB Gen 2: Extensions for MSRP and ISIS-SPB-PCR for Reserved- and Scheduled- Traffic

### Stream properties for reservation

#### ▪ T-Spec

- Transmission period (frames / interval)
  - Scheduled- Traffic (range between 31,25 $\mu$ s and 1ms)

#### ▪ Ranking

- Ranking for reservation for repeatability (become independent of reservation order)

#### ▪ High Availability:

- Number of communication paths
  - Single path (with recovery)
  - Multiple path (with or without recovery)

#### ▪ Latency

- Calculation has consideration for scheduler, pre-emption, bridge delay, ..
- Min & Max latency on each communication path

## AVB Gen 2: Extensions for ISIS-SPB-PCR for Reserved- and Scheduled- Traffic

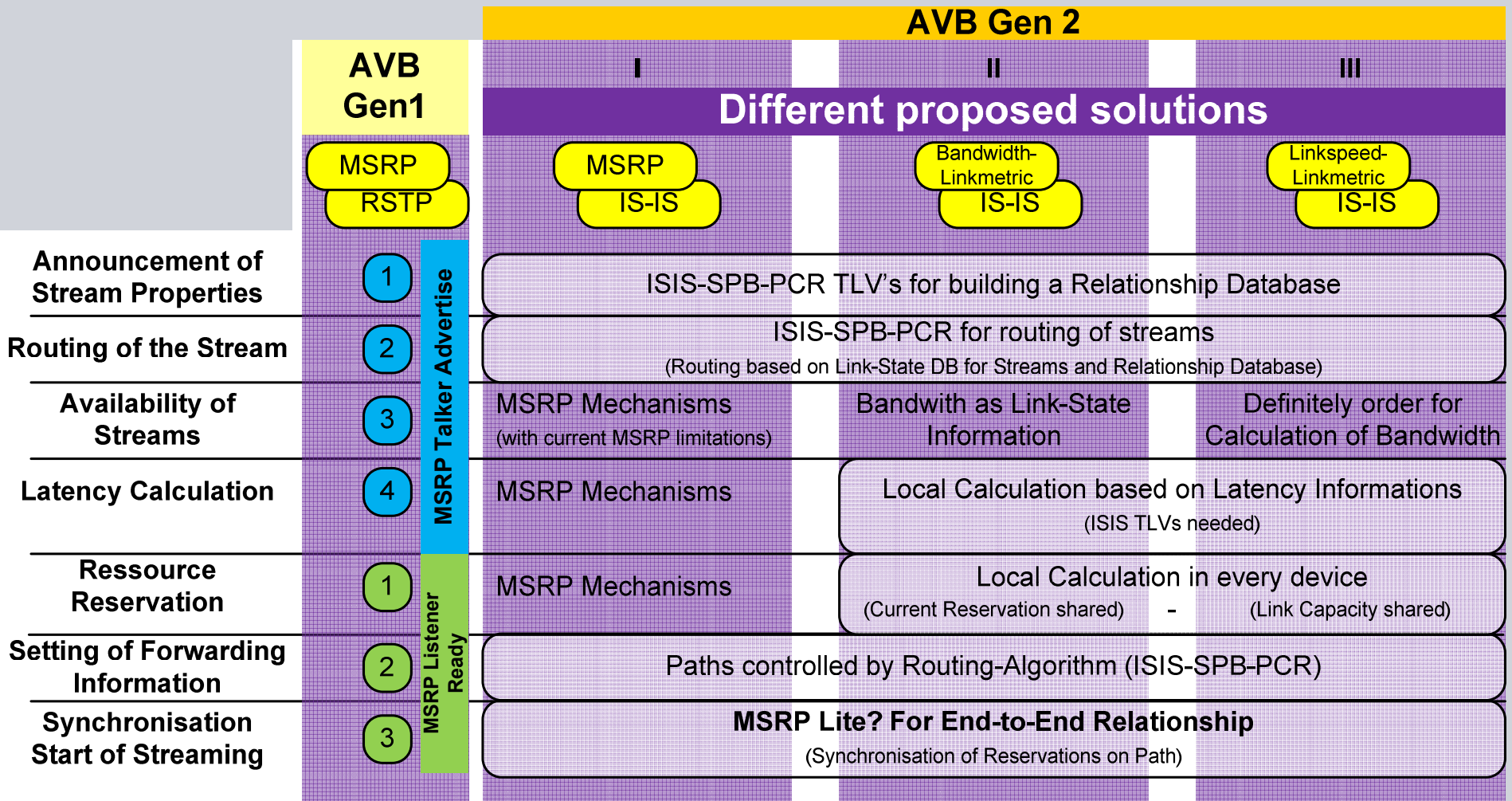
### Properties for routing

- **Topology (Link State Database)**
- **Relationship Talker->Listener (Relationship Database)**
- **Link Metric**
  - Available bandwidth
    - Available bandwidth for certain traffic class?
  - Latency
    - Traffic Shaper (CBSA, TAS, BLS, ...)
    - Bridge delay?
    - Link delay?
  - Link Speed?

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# Proposal of different MSRP Gen 2 / ISIS-SPB-PCR Mechanisms



# Concerns about the proposed Solutions

|                                   | AVB Gen 1                     | AVB Gen 2  |   |  |
|-----------------------------------|-------------------------------|--|---|--|
|                                   |                               | I  | II  | III  |
|                                   |                               | Different proposed solutions   |   |  |
|                                   | MSRP<br>RSTP                  | MSRP<br>IS-IS  | Bandwidth-Linkmetric<br>IS-IS   | Linkspeed-Linkmetric<br>IS-IS  |
| Distribution of Stream Properties | MRP Protocol Mechanisms       | ISIS-SPB-PCR mechanism (TLV's or Sub-TLVs) to distribute information       |   |  |
| Path of Streams                   | RSPT data tree                | ISIS-SPB-PCR for routing of single / multiple path streams                 |   |  |
| Calculation effort                | Low effort                    | ISIS-SPB-PCR algorithm for single / multiple Paths in every node           |   |  |
| Sharing of Reservationstatus      | By MRP Protocol<br>MSRP Gen 1 | MSRP Lite  | Local Calculation<br>Storage of Results needed for new Calculations   | Via ISIS Linkstate<br>instable ISIS behaviour because of fast changing values? |
| Latency Calculation               | By MRP Protocol<br>MSRP Gen 1 | MSRP Lite  | On ISIS basis = Information's about all Delays from all devices needed in every device -> huge synchronised database needed |  |
| Setting of Forwarding Information | MRP Protocol Mechanisms       | ISIS Mechanism   |   |  |
| Repeatable result of Reservation  | Depending on Starting-order   | Unique Priority for fixed result needed to get a stable, repeatable result |   |  |

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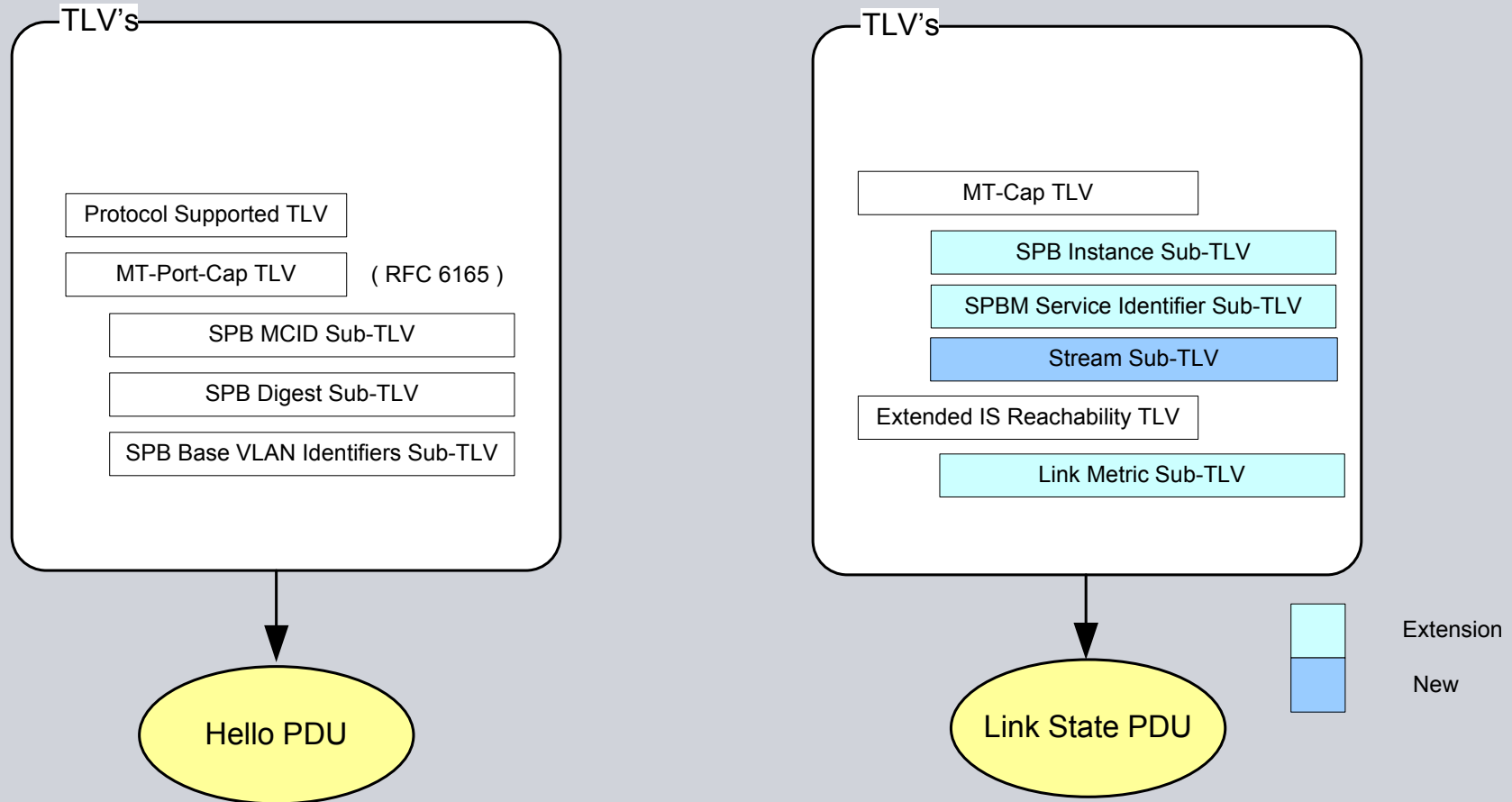


**Proposal for new TLV's or Sub-TLV's used by  
ISIS-SPB-PCR**

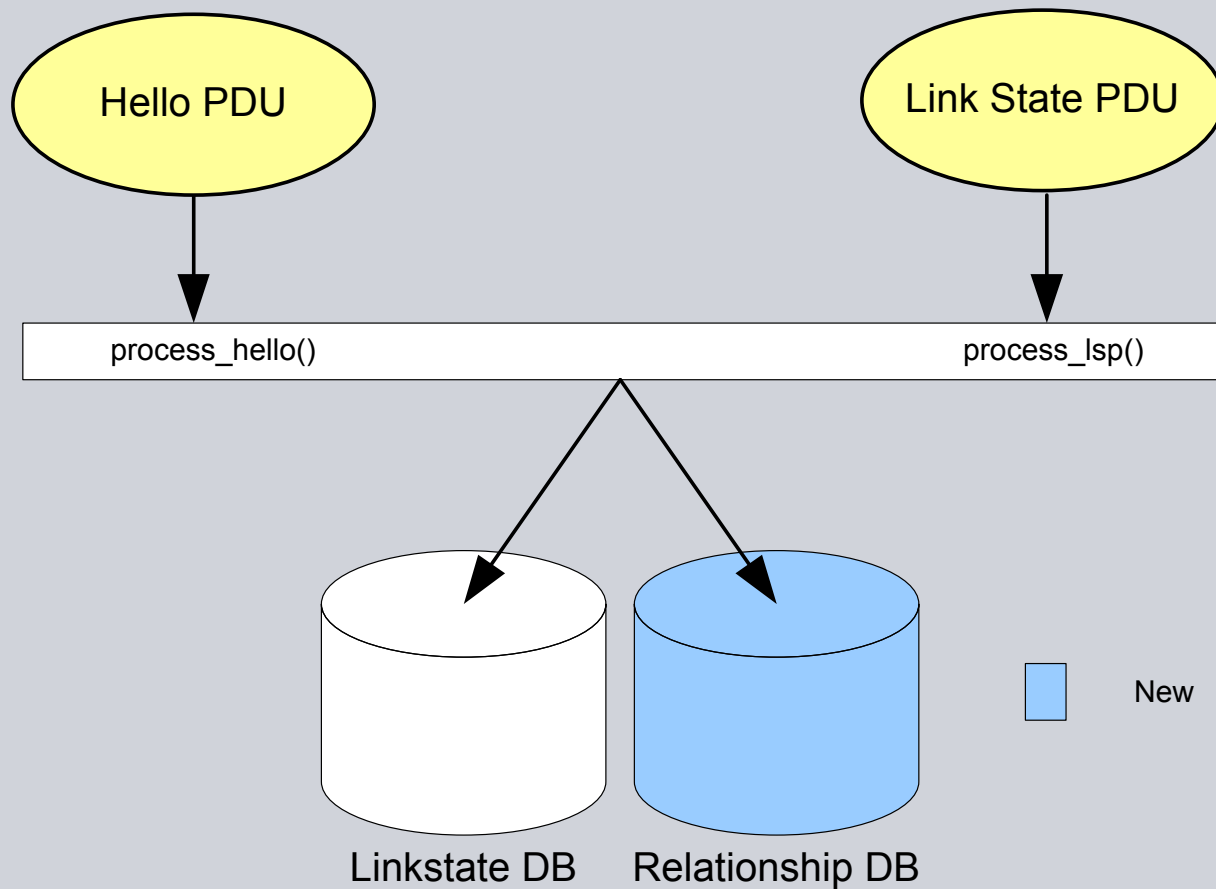
**Proposal to distribute Stream Properties for Reserved-  
and Scheduled- Traffic with ISIS-SPB-PCR**

# Proposal

## New TLVs or Sub-TLVs for ISIS-SPB-PCR



# Proposal Relationship Database for ISIS-SPB-PCR



# Proposal for ISIS-SPB-PCR

## New Instance Sub-TLV in Link-State-PDU

### 802.1aq ISIS-SPB Instance Sub-TLV

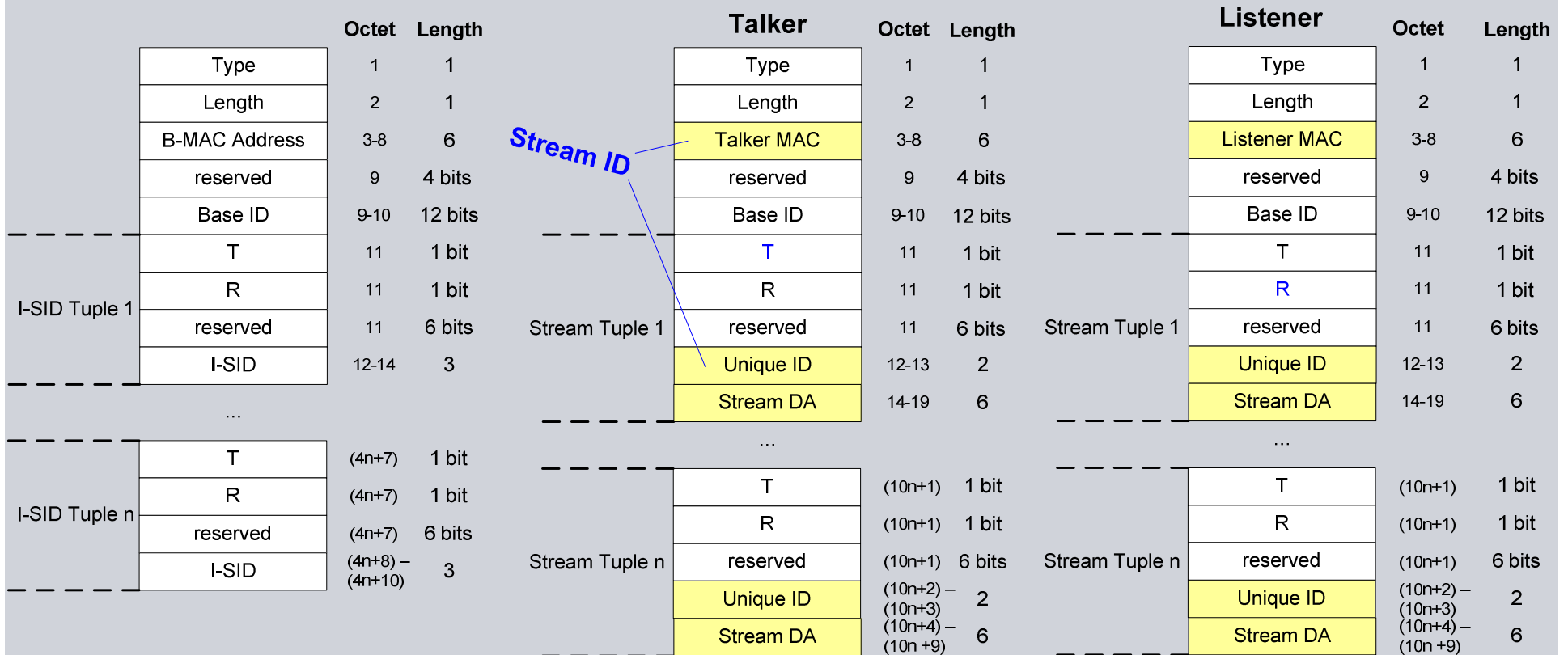
### ISIS-SPB-PCR Instance Sub-TLV

| 802.1aq ISIS-SPB Instance Sub-TLV |                          |                     | ISIS-SPB-PCR Instance Sub-TLV |                          |                       |         |                      |                                   |        |
|-----------------------------------|--------------------------|---------------------|-------------------------------|--------------------------|-----------------------|---------|----------------------|-----------------------------------|--------|
|                                   | Octet                    | Length              |                               | Octet                    | Length                |         | Octet                | Length                            |        |
|                                   | Type                     | 1                   | 1                             | Type                     | 1                     | 1       |                      |                                   |        |
|                                   | Length                   | 2                   | 1                             | Length                   | 2                     | 1       |                      |                                   |        |
|                                   | CIST Root ID             | 3-10                | 8                             | CIST Root ID             | 3-10                  | 8       |                      |                                   |        |
|                                   | CIST Ext. Root Path Cost | 11-14               | 4                             | CIST Ext. Root Path Cost | 11-14                 | 4       |                      |                                   |        |
|                                   | Bridge Priority          | 15-16               | 2                             | Bridge Priority          | 15-16                 | 2       |                      |                                   |        |
|                                   | Reserved                 | 17-18               | 11 bits                       | Reserved                 | 17-18                 | 11 bits |                      |                                   |        |
|                                   | V                        | 18                  | 1 bit                         | V                        | 18                    | 1 bit   |                      |                                   |        |
|                                   | SPSourceID               | 18-20               | 20 bits                       | SPSourceID               | 18-20                 | 20 bits |                      |                                   |        |
|                                   | Nr. of Tree              | 21                  | 1                             | Nr. of Tree              | 21                    | 1       |                      |                                   |        |
| VLAN Tuple 1                      | U                        | 22                  | 1 bit                         | U                        | 22                    | 1 bit   | U                    | $(7+2x)n+13-x$                    | 1 bit  |
|                                   | M                        | 22                  | 1 bit                         | M                        | 22                    | 1 bit   | M                    | $(7+2x)n+13-x$                    | 1 bit  |
|                                   | A                        | 22                  | 1 bit                         | A                        | 22                    | 1 bit   | A                    | $(7+2x)n+13-x$                    | 1 bit  |
|                                   | reserved                 | 22                  | 5 bits                        | Nr. of mult. Path        | 22                    | 5 bits  | Nr. of mult. Path    | $(7+2x)n+13-x$                    | 5 bits |
|                                   | ETC Algorithm            | 23-26               | 4                             | Mult. Path Algorithm     | 23-26                 | 4       | Mult. Path Algorithm | $((7+2x)n+14-x) - ((7+2x)n+17-x)$ | 4      |
|                                   | Base VID                 | 27-28               | 12 bits                       | Base VID (path#1)        | 27-28                 | 2       | Base VID (path#1)    | $((7+2x)n+18-x) - ((7+2x)n+19-x)$ | 2      |
|                                   | SPVID                    | 28-29               | 12 bits                       | Base VID (path#2)        | 29-30                 | 2       | Base VID (path#2)    | $((7+2x)n+20-x) - ((7+2x)n+21-x)$ | 2      |
|                                   | ...                      |                     |                               | ...                      |                       |         | ...                  |                                   |        |
| VLAN Tuple n                      | U                        | $8n+14$             | 1 bit                         | Base VID (path#x)        | $27+(x+1) - 27+(x+2)$ | 2       | Base VID (path#x)    | $((7+2x)n+18+1) - ((7+2x)n+18+2)$ | 2      |
|                                   | M                        | $8n+14$             | 1 bit                         | SPVID                    | $27+(x+3) - 27+(x+4)$ | 2       | SPVID                | $((7+2x)n+18+3) - ((7+2x)n+18+4)$ | 2      |
|                                   | A                        | $8n+14$             | 1 bit                         |                          |                       |         |                      |                                   |        |
|                                   | reserved                 | $8n+14$             | 5 bits                        |                          |                       |         |                      |                                   |        |
|                                   | ETC Algorithm            | $(8n+15) - (8n+18)$ | 4                             |                          |                       |         |                      |                                   |        |
|                                   | Base VID                 | $(8n+19) - (8n+20)$ | 12 bits                       |                          |                       |         |                      |                                   |        |
|                                   | SPVID                    | $(8n+20) - (8n+21)$ | 12 bits                       |                          |                       |         |                      |                                   |        |

# Proposal for ISIS-SPB-PCR New Relationship Sub-TLV in Link-State-PDU

ISIS-SPB (IEEE 802.1aq)  
Service Identifier

ISIS-SPB-PCR (IEEE 802.1ca)  
Relationship Sub-TLV



# Proposal for ISIS-SPB-PCR New Stream Sub-TLV in Link-State-PDU

## ISIS-SPB-PCR (IEEE 802.1ca) Stream Sub-TLV

|                |              | Octet                   | Length |
|----------------|--------------|-------------------------|--------|
| Stream Tuple 1 | Type         | 1                       | 1      |
|                | Length       | 2                       | 1      |
|                | Stream DA    | 3-8                     | 6      |
|                | TSpec        | 9-12                    | 4      |
|                | Prio         | 13                      | 4 bits |
|                | Rank         | 13                      | 4 bits |
|                | Latency      | 14                      | 1      |
|                | Stream Class | 15                      | 1      |
|                | Redundancy   | 16                      | 1      |
|                | Status       | 16                      | 1      |
|                | ...          |                         |        |
| Stream Tuple n | Stream DA    | 14(n-1)+3<br>14(n-1)+8  | 6      |
|                | TSpec        | 14(n-1)+9<br>14(n-1)+12 | 4      |
|                | Prio         | 14(n-1)+13              | 4 bits |
|                | Rank         | 14(n-1)+13              | 4 bits |
|                | Latency      | 14(n-1)+14              | 1      |
|                | Stream Class | 14(n-1)+15              | 1      |
|                | Redundancy   | 14(n-1)+16              | 1      |
|                | Status       | 14(n-1)+16              | 1      |

*Usage depends  
selected solution*

# Proposal for ISIS-SPB-PCR

## New Link Metric Sub-TLV in Link-State-PDU

802.1aq ISIS-SPB  
Link Metric Sub-TLV

|             | Octet | Length |
|-------------|-------|--------|
| Type        | 1     | 1      |
| Length      | 2     | 1      |
| Link Metric | 3-5   | 3      |
| Nr Ports    | 6     | 1      |
| Port ID     | 7-8   | 2      |

ISIS-SPB-PCR  
Link Metric Sub-TLV

|               | Octet | Length |
|---------------|-------|--------|
| Type          | 1     | 1      |
| Length        | 2     | 1      |
| Link Metric   | 3-5   | 3      |
| Bandwidth     | 6     | 1      |
| Link Speed    | 7-8   | 2      |
| Bridge Delay  | 9-10  | 2      |
| Traffic Class | 11    | 1      |
| Nr Ports      | 12    | 1      |
| Port ID       | 13-14 | 2      |

**Next Steps?**

**Thank You!**