SRP in Automotive

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Editor IEEE 802.1Qat-2010 (SRP)
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SRP Overview

SRP Technical Details

SRP in the Future

What does SRP do for you?

SRP automatically creates a path with guaranteed bandwidth from a Talker to one or more Listeners. It also assures that non-compliant devices are not allowed to corrupt those streams.

If a stream cannot be established SRP will give you the reason why and the exact location where the reservation is failing.

Emergency stream reservations override non-emergency streams without requiring Talkers to shutdown the non-emergency streams first.

How does SRP create a path?

- Establish a "protected cloud" for AVB devices

- Discovers path from Talker to Listener(s)

- Configures switches from Listener(s) back to Talker

  - Protocol abstracts H/W specific configuration

  - Forwarding/filtering tables

  - Shaper configuration

  - Dynamic VLAN setup

  - H/W queue assignments

Additional SRP features

- Supports up to seven SR classes (A, B, …, G)

- Error report (i.e. why <u>can't</u> a stream be created)

- Emergency stream support

- Single protocol supports wired, wireless, etc.

- Calculates latency along path

- Efficient Stream-ID packing

VLAN protection still works

- SRP supports all VLAN registration types:
  - Static Fixed – Port is always a member of VLAN
  - Static Forbidden – VLAN is blocked on port
  - Dynamic – Membership configured by MVRP
- Management can block streams from certain ports

SRP Design Constraints

- Only one Talker per stream (one-at-a-time or time-sliced)

- No link aggregation

- No automatic redundancy

- Cannot modify reservation size

- Doesn't support variable bit rate reservations

- No built-in support for two-way reservations (VOIP)

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SRP Protocol Suite

The Stream Reservation Protocol (SRP) is a combination of three MRP based protocols all running together to create reservations:

- Multiple Registration Protocol (MRP)

- Multiple Stream Registration Protocol (MSRP)

- Multiple VLAN Registration Protocol (MVRP)

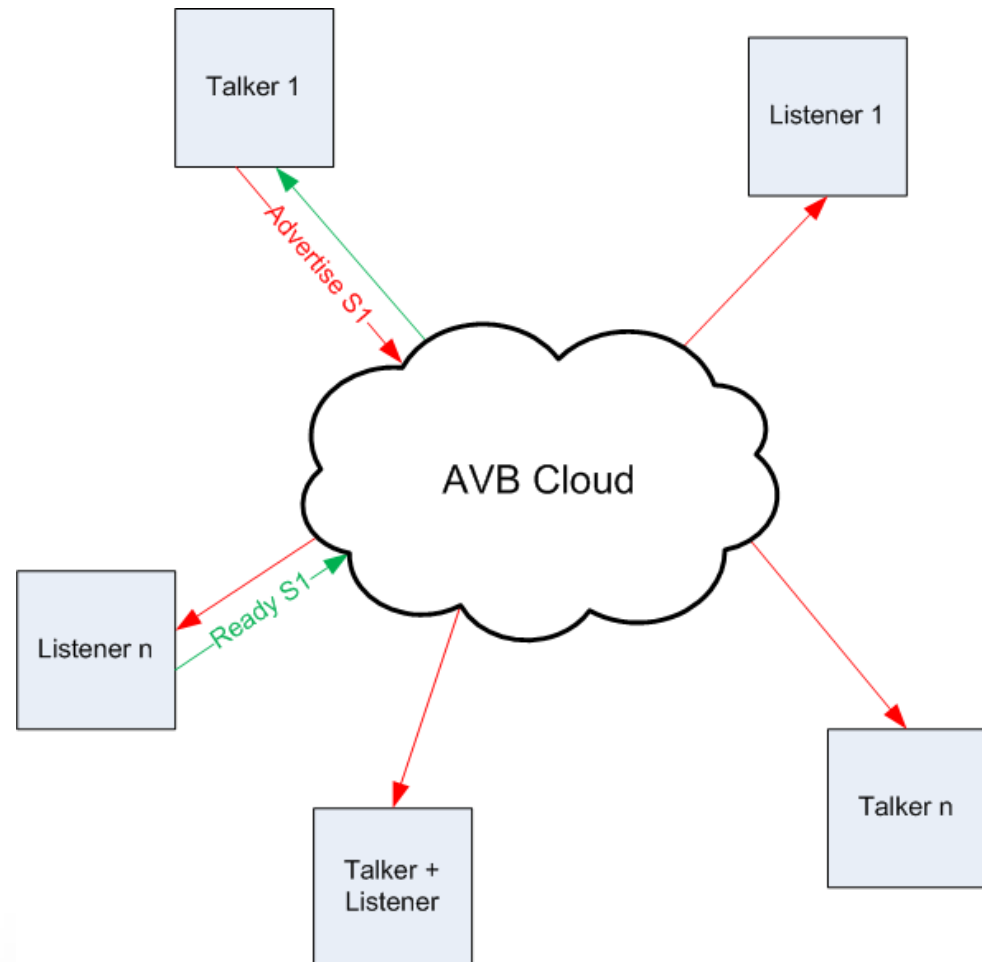- Multiple MAC Registration Protocol (MMRP)

MSRP Attribute Interaction

Talker Advertise (TA) goes everywhere by default

Listener Ready (LR) only goes to Talker

Notes:
1. No ACKs
2. MSRP ties TA & LR together to create the stream

MSRP Attribute Types

Domain

• Negotiate SR Class Priority and default SR Class VID with peer.

Talker Advertise

• Path back to Talker has sufficient resources to support a reservation.

Talker Failed

• Path back to Talker has insufficient resources to support the reservation. Failure Information is related to Bridge with failure that is nearest the Talker.

Listener

• **Ready:** A reservation has been established along the path to every downstream Listener.

• **Ready Failed:** At least one path to a downstream Listener has a reservation and at least one path to another downstream Listener has insufficient resources to establish a reservation.

• **Asking Failed:** There are insufficient resources to all downstream Listeners and no reservation has been established.

MSRP Attribute Propagation

Listener attribute combinations and propagation:
- Listener Ready + Listener Asking Failed -> Listener Ready Failed
- Listener Ready + Listener Ready Failed -> Listener Ready Failed
- Listener Ready Failed + Listener Asking Failed -> Listener Ready Failed

Reservation creation:
- Talker Advertise + Listener Ready = Reservation
- Talker Advertise + Listener Ready Failed = Reservation

No Reservation:
- Talker Advertise + Listener Asking Failed = No Reservation
- Talker Failed + Listener (Ready, Ready Failed, Asking Failed) = No Rsrv

Defining Stream Requirements

Streams are uniquely defined by their StreamID:
• 48-bit Talker MAC address
• 16-bit Unique ID allows for 65,536 Streams from a single Talker

Other components:
• Stream Destination Address (multicast, no unicast)
• Class priority (associated with SR class A or B)
• Maximum frame size
• Maximum number of frames per class measurement interval
• Emergency or non-emergency ranking
• Failure information: Bridge ID + failure code

SRP Behavior

SRP cannot detect "buggered repeaters":
• MSRP uses gPTP (802.1AS) for this
• Reservations not allowed across non-gPTP links

SRP boundary:
• Hearing no Domain message => boundary
• Reservations not allowed across boundaries
• Non-MRP bridges will not forward MSRP
• Remaps interfering Class A/B priorities at boundary

SRP Configuration & Control

Some configuration parameters:
- **Traffic Class percent of bandwidth (Qav)**

Status/feedback

- **Stream Age (How long has the reservation been active?)**
- **Dropped frame counts**
- **Accumulated latency**
- Boundary Port yes/no
- Talkers and Listeners by port
- Failure codes

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IEEE is always looking for guidance

AVnu Alliance is a superb organization for gathering requirements of users of the AVB protocols.

As such they have provided input to the IEEE 802.1 AVB/TSN (Time-Sensitive Networking) Work Group in the past and we look forward to their input in the future.

The following slides list some of the features we are considering for SRP in future releases.

SRP Gen 2 – more SR classes

Here is a specific example that is currently being discussed in AVnu:

AVB as designed specifies two classes of traffic. SR class A generates 8,000 packets per second and guarantees a maximum of 2msec of latency across seven AVB devices.

SR class B generates 4,000 packets per second with a maximum latency of 50msec.

Less packets per second would reduce the load on the CPU in the device at the expense of increased latency.

SRP Generation 2

- Gen 1 and Gen 2 devices can interoperate
- Redundant links in the network (goal: seamless)
- Dynamic bandwidth (modify on the fly)
- Variable bit rate reservations
- Lock down latency based on current reservations
- Tear-down rank bit
- Two-way reservations
- Link aggregation w/explicit path reservation
- Multiple Talkers per stream

Thank you