Spatial Aware Sublayer
Interop via Extended Frame Header

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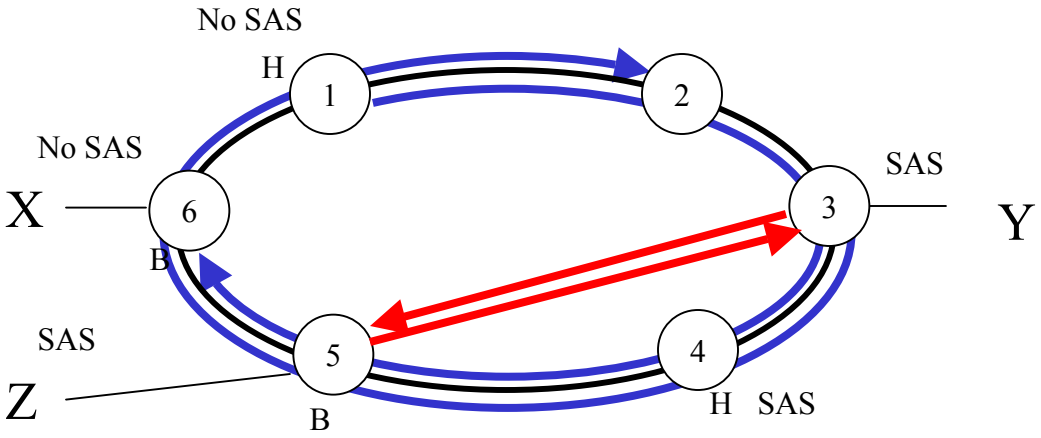
Introduction

- Spatially Aware Sublayer performs spatial reuse enhancements by selectively directing (not flooding) remote unicast and multicast traffic. Remote unicast and multicast traffic are flooded in 802.17 per current transmission rules.

- Spatially Aware Sublayer needs to be backwards compatible with 802.17 implementations which do not implement SAS

Backward Compatibility Requirements

- When SAS transmits to non-SAS, SAS must flood all remote and multicast traffic.
- Example below
  - Station 1 and 6 are non-SAS. Station 3, 4 and 5 have SAS.
  - Station 3 must flood all remote unicast traffic (either remote SA or DA) that is not transmitted to a remote SAS.
  - If station 3 does not flood remote frames to station 1 then persistent flooding on the extended L2 network occurs.



SAS Interoperability

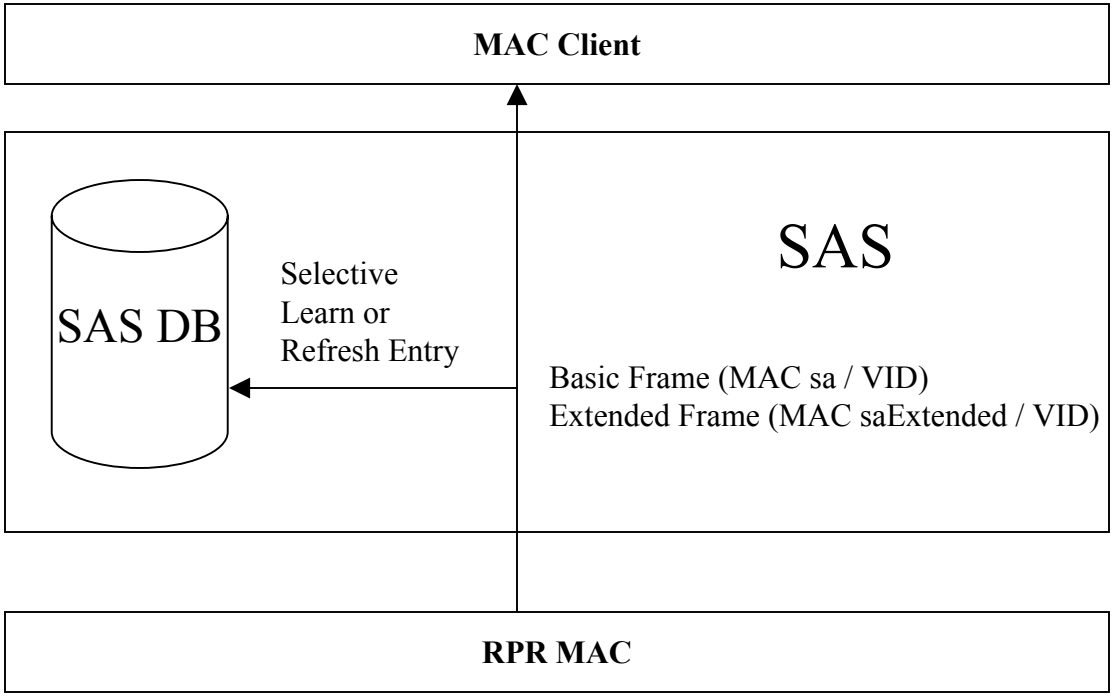
- SAS needs to know when it is sending unicast frames to a SAS entity vs. a non-SAS entity.
  - Current thinking is SAS will make this determination via SAS_DB during transmission.
  - Addresses not in SAS_DB are treated as non_SAS entries until the source is identified as SAS capable.
  - SAS_DB entries are selectively populated (learned) during reception based on whether the sending station is SAS capable or not. Frames from SAS capable sources are learned into SAS_DB. Frames from non-SAS sources are not learned into SAS_DB.
  - Local stations on ring that are not SAS capable should not reside in SAS_DB, hence should not be statically entered by default.
  - SAS should follow normal MAC tx rules for local only frames (local SA & local DA).

Selective SAS_DB entry learning

- SAS_DB selective entry learning triggered by one of three methods:
  - MAC Address Method
  - Topology Discovery Method
  - Bit in the Extended Frame Header Method

- Implications on where local-local and local-remote are handled. Is this determination and handling performed by SAS or by MAC?

Selective SAS Learning



MAC Address Method / 1

- Selective Learning Rules

```
(DA == RPR_reserved_group_address)              /* Learn saExtended / VID */
|| (EF == 1 && unicast(DA) && FI==FI_NONE) /* Learn saExtended /VID */
|| (EF == 0 && DA != local && FI==FI_NONE) /* Learn SA / VID */
```

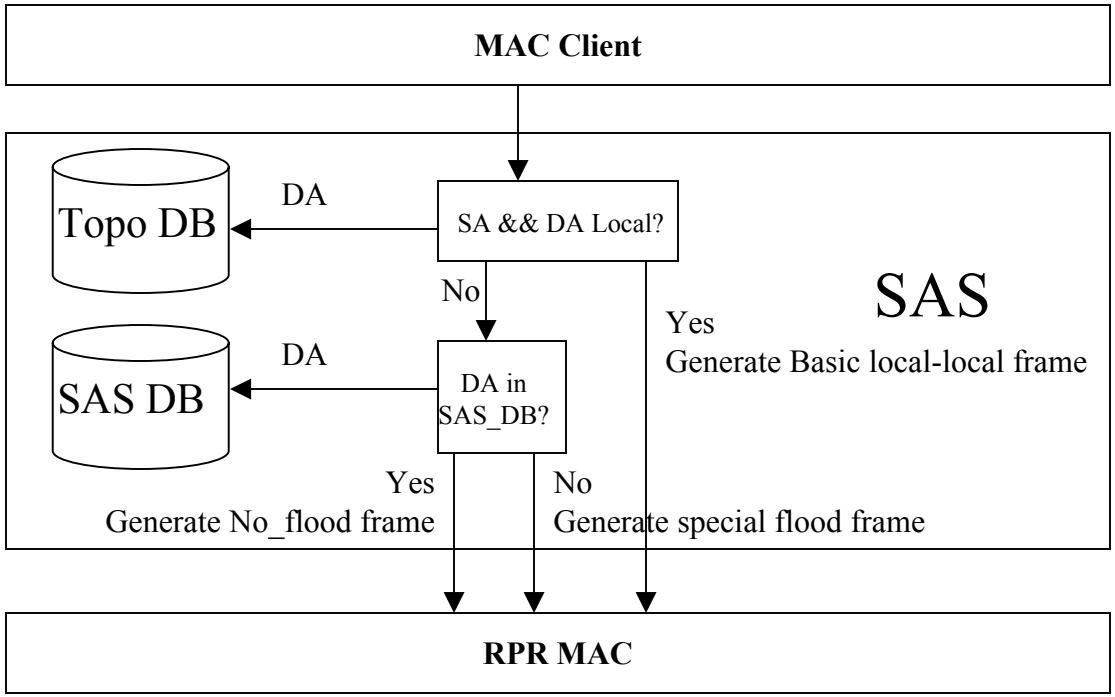
- Determining SAS layer support in local-local frames is ambiguous.
- SAS selective learning in a local SA to remote DA frame reception situation is difficult to make. Learning algorithm needs to determine whether frame DA is local or remote which is an additional lookup.
- To only learn for the first simple rule (DA == RPR_reserved_address) will result in SAS MAC addresses never being learned in certain network situations, producing persistent network flooding conditions.
  - A remote SAS MAC address will not be learned if it starts sending extended frames to a remote MAC address if SAS learning algorithm does not use rule 2.
  - A local SAS MAC address will not be learned if it sends frames using basic frame format if SAS learning algorithm does not use rule 3.

MAC Address Method) / 2

- Address look up on *saExtended / VID* (*SA / VID*) should be done for reception of every frame in order to compare associated SA with frame.SA. If associative SA does not match frame.SA, then the entry must either be updated or purged. Frame is entry is updated with new associative SA if learning is permitted, and entry is purged if it is not.

MAC Address Method / 3

– SAS needs to determine when to format transmit frames with a (DA == RPR_group_address) vs. basic frame format for local-local transmissions.



Topology Discovery Method

- Selective Learning Rules

  /* Support of SAS by each station is exchanged during topology discovery and populated into the SAS DB */

  SAS(SA) && EF==1 /* Learn saExtended / VID */

  || SAS(SA) && EF==0 /* Learn SA / VID */

- Requires extra associative lookup on SA to determine whether an entry should/should not be learned.
- In transmit direction, frames not in SAS_DB (may be??) directly sent to the MAC where the MAC determines whether the frame is unicast or flooded. This simplifies the SAS layer by relieving it from having to identify and format local-local frames.
- Address look up on *saExtended / VID* (*SA / VID*) should be done for reception of every frame in order to compare associated SA with frame.SA. If associative SA does not match frame.SA, then the entry must either be updated or purged.

Bit in extended header method / 1

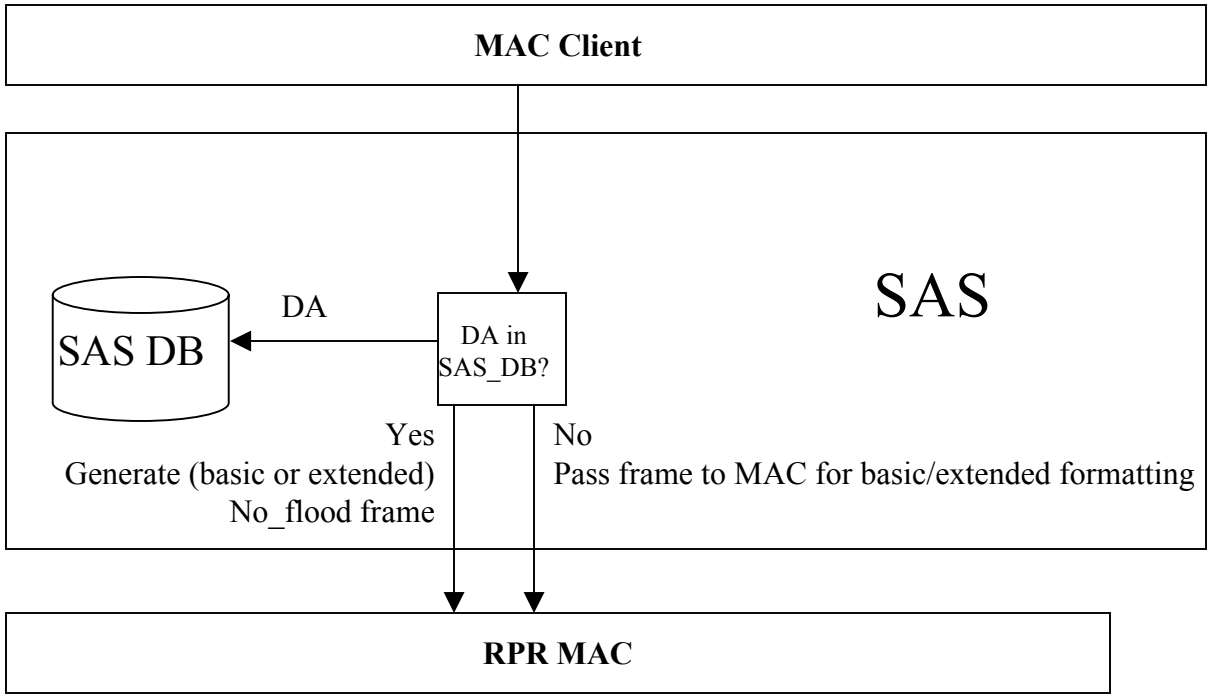
- Define SAS bit as one of the reserved extended frame bits.
  - Frame.SAS bit set to 1 if SAS layer is implemented above 802.17 MAC else SAS bit set to 0.
  - The setting of this bit is hard coded by the MAC.
- Learn Address

  (frame.SAS==1 && EF==1 /* Learn saExtended / VID */
  || (frame.SAS==1 && EF==0 /* Learn SA / VID */

- In transmit direction, frames not in SAS_DB (may be??) directly sent to the MAC where the MAC determines whether the frame is unicast or flooded. This simplifies the SAS layer by relieving it from having to identify and format local-local frames.
- Address look up on *saExtended / VID* (*SA / VID*) should be done for reception of every frame in order to compare associated SA with frame.SA. If associative SA does not match frame.SA, then the entry must either be updated or purged.

Bit in extended header method / 1

– Local-Local / Local-Remote identification and handling performed by RPR MAC.



Conclusion

- Identification of remote SAS entity via extended frame header has following benefits
  - Eliminates need for additional associative lookups during selective learning process
  - No ambiguity as to whether an incoming frame is from an SAS or non-SAS capable client. Local-Local frames clearly defined as coming from SAS capable or SAS non-capable.
  - Allows the RPR MAC to handle the local-local and local-remote frame format identification and formatting for transmitted frames.