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Generalized Shortest Path Bridging

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Background

- The IEEE 802.1aq Shortest Path Bridging (SPB) standard specifies two operation modes for SPB:
- SPBM: SPB MAC
  - Bound to PBB data plane
  - B-MAC identified SPTs
  - Source specific Group MAC = SPSourceID + I-SID
  - No B-MAC learning
    - unknown is dropped
- SPBV: SPB VID
  - Although, not bound to a specific data plane, envisioned for non-PBBN
  - VID identified SPTs
  - Source specific VID = SPVID
  - MAC learning
- More on SPB e.g.:
  - http://standards.ieee.org/getieee802/download/802.1aq-2012.pdf
  - http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1118148665.html
  - http://en.wikipedia.org/wiki/IEEE_802.1aq

Disclaimer

- From now on, this presentation is only a mental exercise of the author
- The operation investigated here is based on IEEE 802.1aq;
- However, this operation is not part either of the 802.1Q-REV drafts or the 802.1aq standard

- Generalization to 802.1aq are indicated by blue as much as possible

A Generic Approach

- The VID → MSTID allocation determines the control mode for the VID

1. IS-IS control
   - If a VID is allocated either to the SPBM MSTID or to the SPBV MSTID, then the VID is under IS-IS control
2. SPBV MSTID (0xFFD)
   - If a VID is allocated to the SPBV MSTID, then it is a learning VID, i.e. MAC addresses are learnt from the data frames

     → consequently, forwarding is based on VID (until station location is learnt)
3. SPBM MSTID (0xFFC)
   - If a VID is allocated to the SPBM MSTID, then it is a non-learning VID, i.e. MAC addresses are not learnt from the data frames

     → consequently, forwarding is based on MAC (within the VLAN's scope)

- AND **THAT IS ALL**, no restriction on data plane
  - Note that items 1 – 3 are all valid for 802.1aq, which however makes further restrictions
- In other words, SPBM is not bound to PBB
  - In fact we are talking about a generalization of SPBM

Use of ISIS-SPB TLVs

- The good news is that the TLVs specified by 802.1aq cover the generalized approach too
- No change or renaming of TLVs or TLV fields is proposed here!
- All that considered is a more generic use than described in 802.1aq
  - The terms used may be less straightforward though
  - Or unnecessary fields are carried around
- Key question: Which sub-TLV to use in order to propagate MAC for non-learning VIDs, i.e. VIDs allocated to the SPBM MSTID in a non-PBBN?
- Let's see the options

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Option 1

SPBV MAC Address sub-TLV

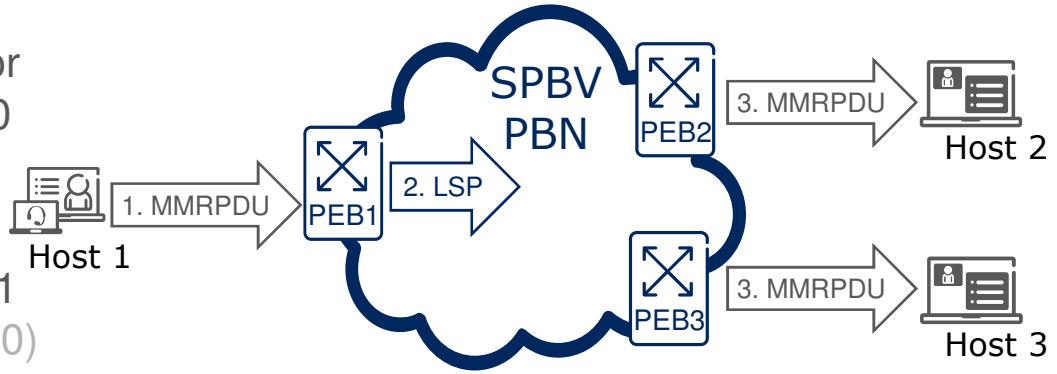
SPBV MAC Address sub-TLV

- Associates a MAC to an SPVID
- Prepared for MMRP ⇔ ISIS-SPB interworking

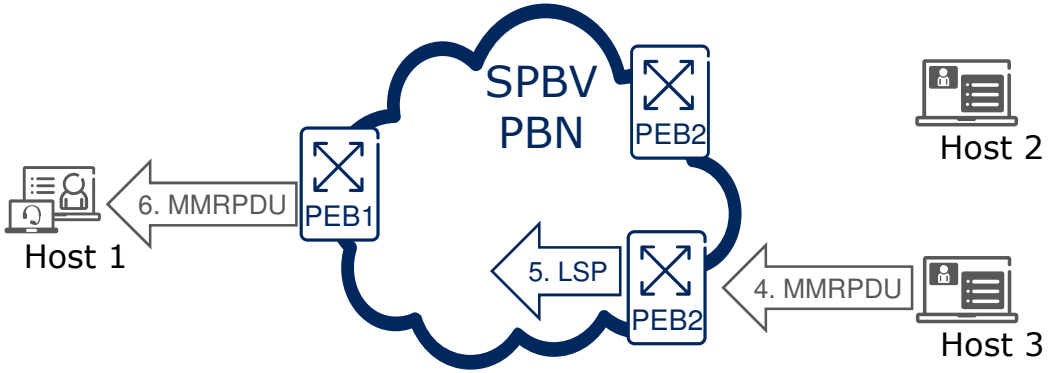
		Octet	Length
	Type (4)	1	1
	Length	2	1
	reserved	3	2 bits
	S-R	3	2 bits
	SPVID	3-4	12 bits
MAC Address Tuple 1	T	5	1 bit
	R	5	1 bit
	reserved	5	6 bits
	MAC Address	6-11	6
	...		
MAC Address Tuple n	T	(7n-2)	1 bit
	R	(7n-2)	1 bit
	reserved	(7n-2)	6 bits
	MAC Address	(7n-1)-(7n+4)	6

MAC Registration Example subclause 28.10

- Declaration
  1. MMRPDU carries declaration for Group MAC G on Base VID 100
  2. PEB1 sends LSP with SPBV MAC Address sub-TLV
     - Group MAC G → SPVID 4001 (SPVID 4001 → Base VID 100)
     - T flag is set for Group MAC G
  3. MMRPDU with declaration for Group MAC G on Base VID 100



- Registration
  4. MMRPDU with registration for Group MAC G on Base VID 100
  5. PEB1 sends LSP with SPBV MAC Address sub-TLV
     - Group MAC G → SPVID 4001 R flag is set for Group MAC G
  6. MMRPDU with registration for Group MAC G on Base VID 100



Generalized SPBV MAC Address sub-TLV

- SPVID could be generalized to VID
- It would be then a MAC → VID sub-TLV; generic to SPB; i.e. applicable to non-learning VIDs allocated to the SPBM MSTID

		Octet	Length
	Type (4)	1	1
	Length	2	1
	reserved	3	2 bits
	S-R	3	2 bits
	SPVID	3-4	12 bits
MAC Address Tuple 1	T	5	1 bit
	R	5	1 bit
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	MAC Address	6-11	6
	...		
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Generalized MAC Registration Example

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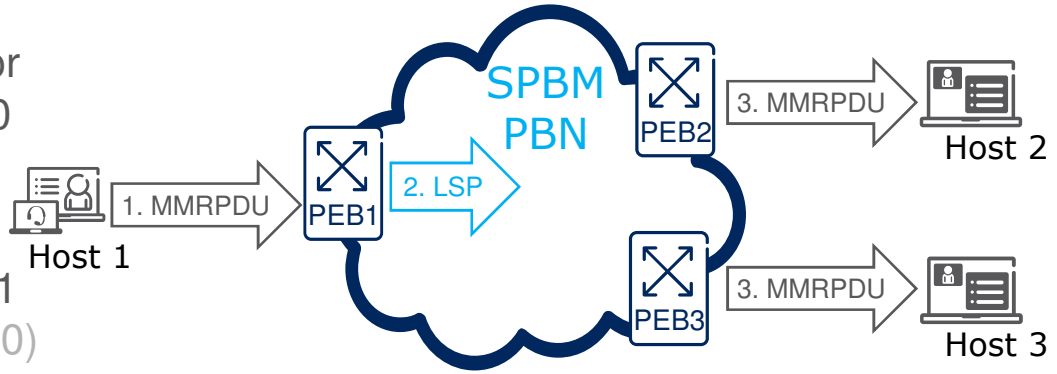

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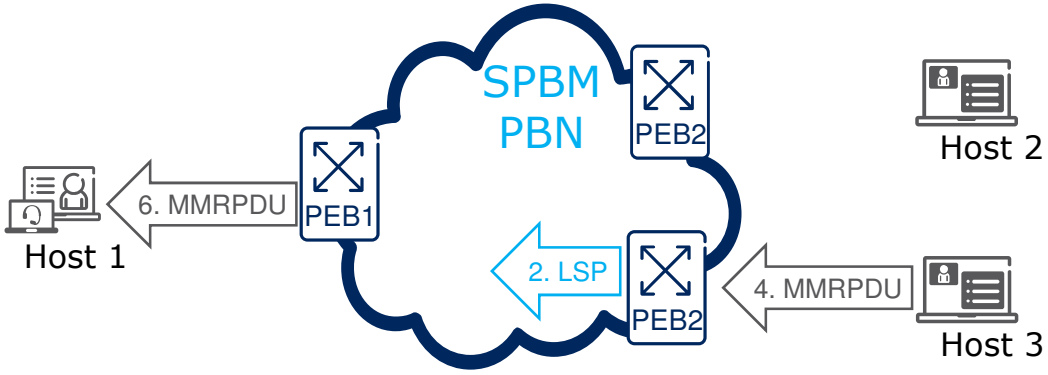

Option 1 – Summary

- SPBV MAC Address sub-TLV can be used for non-learning VLANs as is, with no additional specification
- That is, SPBV MAC Address sub-TLV can be used for VIDs allocated to the SPBM MSTID in non-PBB networks
- The operation for MMRP interworking is already specified (subclause 28.10)
- The only downside is that naming may confuse people because:
  - A sub-TLV having SPBV in its name is used for a VID allocated to the SPBM MSTID
  - Octets 3-4 convey a non-learning VID, not an SPVID

- Note that the use of SPBV MAC Address sub-TLV for MAC → VID association in case of non-learning VIDs (VIDs allocated to the SPBM MSTID) is included in 45.1.3 of P802.1Qca D0.5

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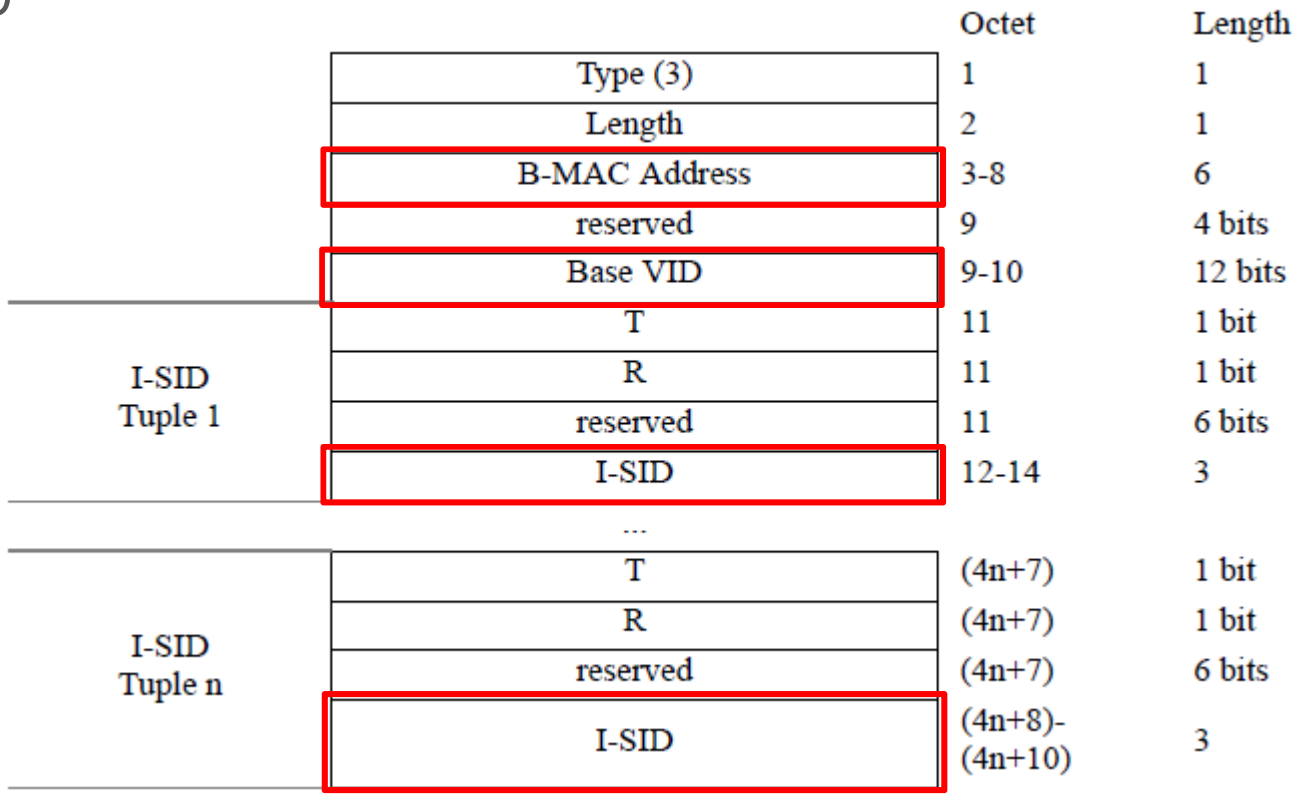
Option 2

SPBM Service Identifier and Unicast Address sub-TLV

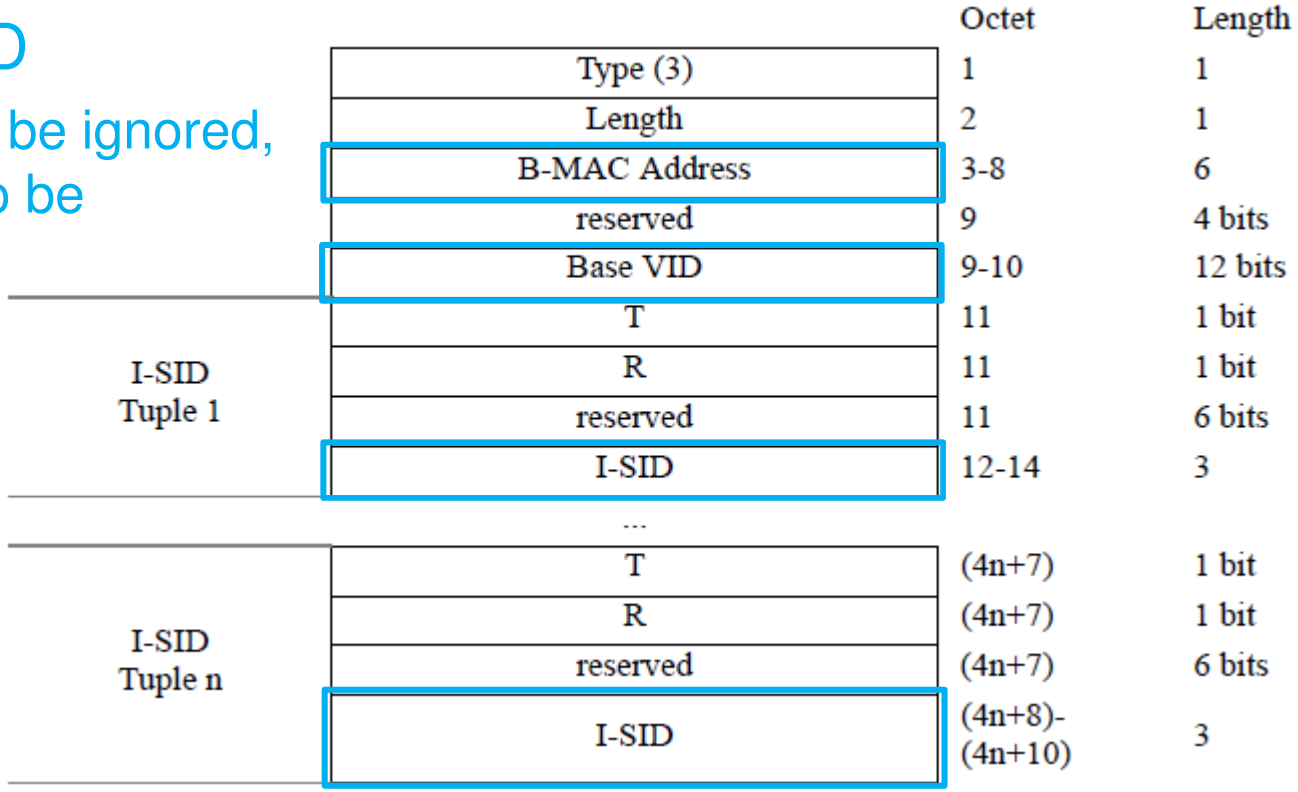
SPBM Service Identifier and Unicast Address sub-TLV

- Associations provided
  - I-SID → B-VID
  - B-MAC → I-SID



SPBM Service Identifier and Unicast Address sub-TLV for a non-B-VID

- Base VID is not a B-VID
- Octets 3-8 convey a C-MAC not a B-MAC, which is not necessarily a unicast address
- There is no I-SID
  - An I-SID should be ignored, a value needs to be defined for that

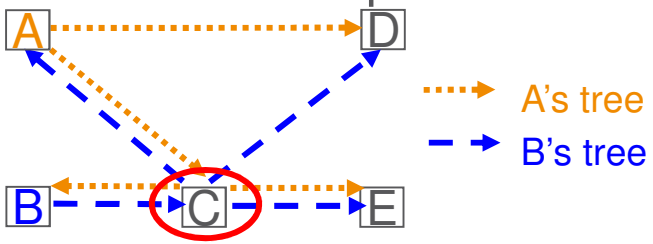


Option 2 – Summary

- SPBM Service Identifier and Unicast Address sub-TLV can be used in a non-PBBN too
- The name of the TLV does not cause confusion as the VID is allocated to the SPBM MSTID
- BUT
- There may be naming confusion here too
  - The Base VID is not a B-VID
  - The MAC is not a B-MAC (it may be a Group MAC, not unicast)
- Above all,
  - There is no I-SID (no service identifier)
  - It is a 3-byte unnecessary overhead
  - An I-SID value encoding “ignore” is to be specified
  - The interworking with MMRP based on the SPBM Service Identifier and Unicast Address sub-TLV is to be specified

An Observation
Valid for Both Options

- Source specific multicast (S,G) has to be used in an SPB network as each source uses its own SPT
  - Let's assume that A and B are Sources in the same Group
  - C should ONLY forward B's frames to D but NOT A's frames
  - (*,G) does not work, (S,G) is needed
  - (S,G) of SPBM in a PBBN is implemented by source specific Group MAC = SPSourceID + I-SID (subclause 27.15)



- Multicast for SPBM in a non-PBB network
  - It has to be still ensured that there is a single multicast source for each Group MAC, VID tuple
  - For example, have a single source within a VID for a Universally Administered Group MAC

Further Generalization Possibilities

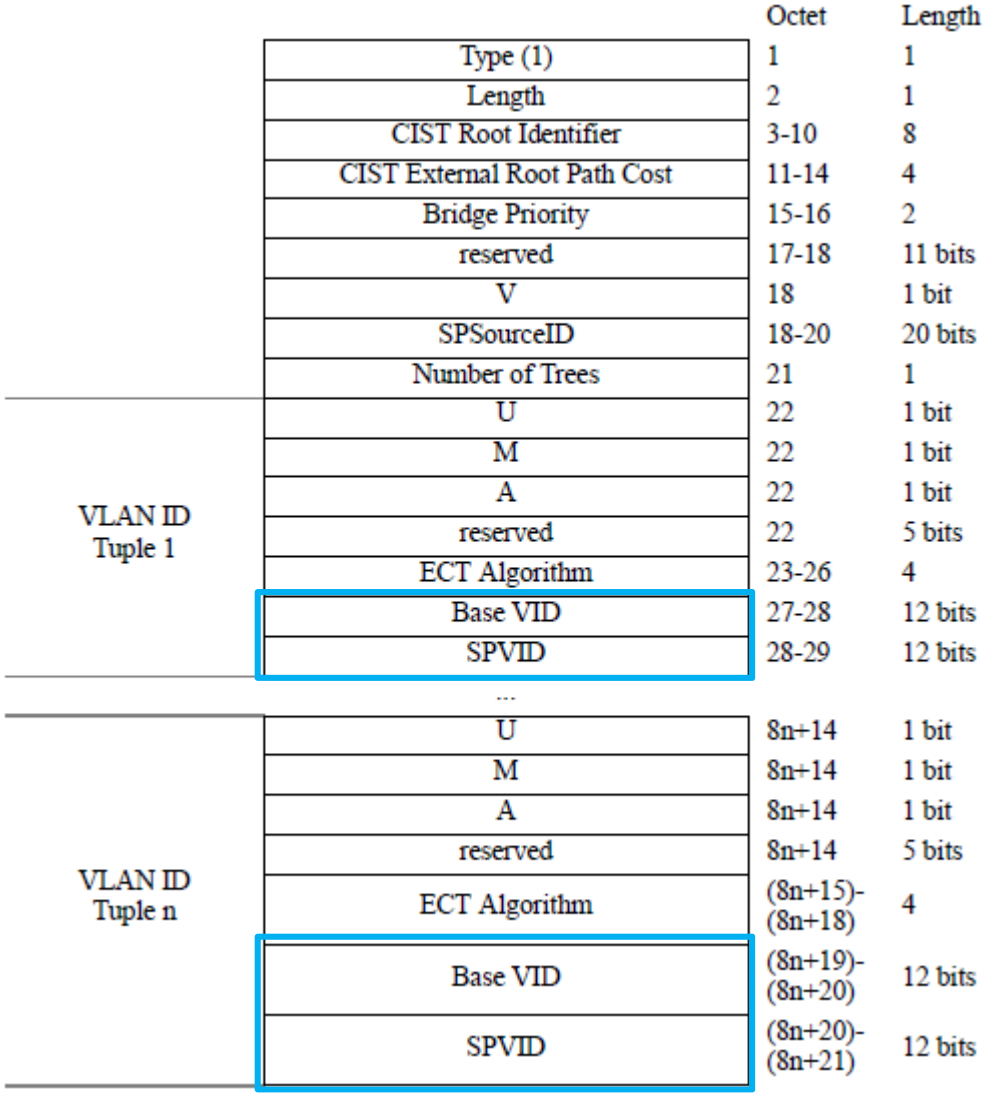
SPBM Service Identifier and Unicast Address sub-TLV

- B-MAC can be generalized allowing Group MAC for shared trees
- It has been included in P802.1Qca D0.5, see e.g.
  - 28.12.10
  - 45.1.3

		Octet	Length
	Type (3)	1	1
	Length	2	1
	B-MAC Address	3-8	6
	reserved	9	4 bits
	Base VID	9-10	12 bits
I-SID Tuple 1	T	11	1 bit
	R	11	1 bit
	reserved	11	6 bits
	I-SID	12-14	3
	...		
I-SID Tuple n	T	(4n+7)	1 bit
	R	(4n+7)	1 bit
	reserved	(4n+7)	6 bits
	I-SID	(4n+8)-(4n+10)	3

SPB Instance sub-TLV

- Provides bridge parameters, e.g.
  - SPSourceID
- Associations provided:
  - Base VID → ECT Algorithm
  - SPVID → Base VID
    - This could be generalized to **VID → Base VID** to cover cases when it is another type of VID, not an SPVID to be associated with the Base VID



Summary

- The standard 802.1aq TLVs support a more generic approach than described in 802.1aq
- The simplest way forward seems to
  - Keep the TLV formats and names as specified by 802.1aq
  - Leverage the operations already specified
  - Allow a more generic use than the name of some sub-TLVs and fields suggest, which has to be clearly documented when used that way
- What we get is
  - SPBM for non-PBB networks
  - Tools for explicit trees/paths