Control Plane Changes for 802.1Qbp

Ali Sajassi

May 17, 2011
**Issue: I-SIDs to B-VID mapping**

- Currently in clause 6.11, I-SIDs are groups into different B-VIDs bins

- In 802.1aq, for a given I-SID, the same B-VID is used for both unicast and mcast frames because both share the same ECT tree

- For ECMP operation, unicast and multicast frames need to use different trees and different load sharing algorithms
  - Unicast frames need to use ECMP algorithm
  - Multicast frames need to use ECT algorithm

- **Question:** How should we do I-SID to B-VID mapping for ECMP?
Requirements:

- Use the same I-SID to B-VID mapping mechanism as currently specified in clause 6.11 – e.g., don’t change the table (because it has hardware ramification)
- Allow for different B-VIDs to represent different ECT algorithms as done currently with 802.1aq
- Allow for a single B-VID to represent different ECT algorithms in order to support untagged ECMP frames
- Allow for full ECMP operation of unicast frames regardless of weather multiple B-VIDs or a single B-VID is used
- Automatic distribution of I-SIDs among ECT algorithms is desirable
- Explicit distribution of I-SIDs among ECT algorithm (as done currently in 802.1aq) is mandatory
- Backward compatibility with existing 802.1aq specification is highly desirable
- Minimum changes to the spec. is highly desirable
Possible Options:

Options for I-SIDs to B-VIDs mapping:

a) Use multiple B-VIDs to designate different ECTs as before for multicast frames and use the same set of B-VIDs for unicast ECMP frames

b) Use a single B-VID to designate different ECT algorithms for multicast frames and use this B-VID for unicast ECMP frames

c) Use multiple B-VIDs for multicast frames and use a single B-VID for unicast frames
Option A) Multiple B-VIDs for Both

- In this option different B-VID represent different ECT algorithm but all these B-VIDs are mapped to the same ECMP algorithm

- All B-VIDs are mapped to the same bridge domain (VLAN) – e.g., analogous to SVL
  - Same filtering DB is used for unicast (and multicast) addresses with different B-VIDs
  - SVL-like operation can be used because I-SIDs are unique across B-VIDs – e.g., same I-SID cannot be used under two different B-VIDs

- Pros
  - No modification to either control or data planes are needed

- Cons
  - We lose the option of not using B-tag for unicast ECMP because for a given I-SID, we need to use the same B-tag for unicast data as for multicast data
Option B)

- In this option a single B-VID is used to represent different ECT algorithms for multicast frames as well as the ECMP algorithm for unicast frames

- **Pros**
  - Use of B-tag can be optional for both unicast and multicast data
  - No additional changes in data plane is required

- **Cons**
  - It requires changes to the control plane – e.g., it requires decoupling of B-VID to ECT algorithm in SPBM I-SID sub TLV so that I-SIDs can be directly associated with ECT algorithm
**Option C)**

- In this option multiple B-VIDs are used to designate different ECT algorithms for multicast frames but a single B-VID is used to designate ECMP for unicast frames.

- **Pros**
  - No changes to control plane is required
  - Use of B-tag can be optional for unicast frames

- **Cons**
  - B-tag must always be used for multicast frames
  - It requires changes to data-plane to associate two B-VIDs for the same I-SID (one for unicast and the other for multicast)
Changes Needed for Option (b)

- Option (b) requires no changes to data-plane and minor changes to control plane
  - SPBM ISID-ADDR TLV should be modified to replace base VID with ECT Algorithm ID so that I-ISIDs are directly associated with the algorithm ID

- It is highly desirable to ensure backward compatibility and to avoid introduction of any new TLV/sub-TLV or modification of existing TLV/sub-TLV for ECMP operation

- In order to do this:
  - We will use the same Base VID field in SPBM ISID-ADDR TLV for ECT Algorithm ID
  - We use one bit of 4-bit reserved field to indicate whether the next 12 bits is a “Base VID” or is a “ECT Algorithm ID” (0 = base vid, 1 = alg ID). The usage of the reserved field in this way, guarantees backward compatibility
  - In order to fit the ECT algorithm ID in a 12-bit field, we use the 8-bit index part of the “ECT algorithm ID” and assume that OUI is the standard one
### Association of I-SIDs to a ECT Algorithm (indirectly via Base VID)

<table>
<thead>
<tr>
<th>Octet</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-8</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>4 bits</td>
</tr>
<tr>
<td>9-10</td>
<td>12 bits</td>
</tr>
<tr>
<td>11</td>
<td>1 bit</td>
</tr>
<tr>
<td>11</td>
<td>1 bit</td>
</tr>
<tr>
<td>11</td>
<td>6 bits</td>
</tr>
<tr>
<td>12-14</td>
<td>3</td>
</tr>
<tr>
<td>(4n+7)</td>
<td>1 bit</td>
</tr>
<tr>
<td>(4n+7)</td>
<td>1 bit</td>
</tr>
<tr>
<td>(4n+7)</td>
<td>6 bits</td>
</tr>
<tr>
<td>(4n+8)-(4n+10)</td>
<td>3</td>
</tr>
</tbody>
</table>

1-bit flag
0 = Base VID
1 = Algorithm ID

V/A (1 bit)
ECT Algorithm sub-TLV

No Changes is required to this TLV

<table>
<thead>
<tr>
<th></th>
<th>Octet</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (TBD)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Length</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ECT ALGORITHM</td>
<td>3-6</td>
<td>4</td>
</tr>
<tr>
<td>ECT Information</td>
<td>7-(Length+2)</td>
<td>variable</td>
</tr>
</tbody>
</table>

a) Type (8-bit) Value TBD
b) Length (8-bits)
   Total number of bytes contained in the value field.
c) ECT-ALGORITHM (4-bytes)
   ECT-ALGORITHM is advertised when the bridge supports a given ECT-ALGORITHM (by OUI/Index) on a given VID.
d) ECT Information (variable)
   ECT-ALGORITHM Information of variable length.
Mapping between ECT Algorithm & Base VID

No Changes is required to this TLV

<table>
<thead>
<tr>
<th>ECT-VID Tuple 1</th>
<th>ECT-VID Tuple n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECT Algorithm</td>
</tr>
<tr>
<td>Type (TBD)</td>
<td>(6n-3)-6n</td>
</tr>
<tr>
<td>Length (6n)</td>
<td>(6n+1)-6n</td>
</tr>
<tr>
<td>ECT Algorithm</td>
<td>(6n+2)</td>
</tr>
<tr>
<td>Base VID</td>
<td>6n+2</td>
</tr>
<tr>
<td>U</td>
<td>6n+2</td>
</tr>
<tr>
<td>M</td>
<td>6n+2</td>
</tr>
<tr>
<td>reserved</td>
<td>reserved</td>
</tr>
</tbody>
</table>

Octet | Length
--- | ---
1     | 1
2     | 1
3-6   | 4
7-8   | 12 bits
8     | 1 bit
8     | 1 bit
8     | 2 bits
(6n-3)-6n | 4
(6n+1)-6n | 12 bits
6n+2 | 1 bit
6n+2 | 1 bit
6n+2 | 2 bits

Figure 28-5—SPB Base VLAN-Identifiers sub-TLV
### Example: 802.1aq & .1Qbp option (a)

<table>
<thead>
<tr>
<th>ECTs</th>
<th>Algorithm</th>
<th>B-VID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tie—break 1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Tie—break 2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Tie—break 3</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Tie—break 4</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>Tie—break 5</td>
<td>15</td>
</tr>
</tbody>
</table>

**In Control Plane**
- No changes to control plane – operate as before
- Use different tie-breaking algorithm for different ECTs
- Assign a base VID for each of these algorithms
  - SPB base VID sub-TLV
- Load share I-SIDs among different ECTs and associated I-SID to B-VID
  - use SPBM I-SID sub-TLV as is w/o any changes
  - I-SID to B-VID association is derived directly by getting I-SID -> B-VID association from SPBM I-SID sub-TVL

**In Data Plane**
- Program Filtering DB for each mcast group address based on the above I-SID to B-VID association
### Example: .1Qbp option (b)

<table>
<thead>
<tr>
<th>ECTs</th>
<th>Algorithm</th>
<th>B-VID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tie—break 1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Tie—break 2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Tie—break 3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>Tie—break 4</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Tie—break 5</td>
<td>11</td>
</tr>
</tbody>
</table>

### In Control Plane
- Minor change in control plane: set V/A flag in SPBM I-SID sub-TLV to 1 & copy the algorithm index in the base VID filed
- Use different tie-breaking algorithm for different ECTs
- Assign a single base VID for all of these ECTs algorithms in SPB base VID sub-TLV
- Load share I-SIDs among different ECTs and associated I-SID to B-VID
  - I-SID to B-VID association is derived indirectly by first getting I-SID -> Alg-ID association from SPBM I-SID sub-TVL and then getting Alg-ID to B-VID association from SPB Base VID sub-TLV

### In Data Plane
- Program Filtering DB for each mcast group address based on the above I-SID to B-VID association
Recommendation

- Use option (b) whenever it is required to use a single B-VID for all ECT algorithms designation of multicast data.

- Use option (a) whenever it is required to use multiple B-VIDs for ECT algorithms designation of multicast data (one B-VID per ECT algorithm).

- The choice between option (a) and option (b) needs to be done network wide for 802.1Qbp operation:
  - They should be mutually exclusive for a given 802.1Qbp network.

- Multi-topology still uses different B-VIDs – e.g., in case of option (b), different B-VIDs can designate different MT instances.