802.1Qbp – ECMP
Multicast Mode Selection
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ECMP Behavior

- Default should spread both unicast and multicast traffic
- Random spreading should not require configuration
- Configuration knobs should be provided for additional control
  - Operator’s choice whether or not to exercise this control
- Each SPB ECMP VLAN should be separately controllable
- Each BSI should be separately controllable
Unicast ECMP

- Random spreading hop-by-hop using hash of Flow ID, System ID
- Allows all possible equal cost paths to be used
- Does not guarantee particular distribution; but is deterministic
Multicast ECMP

- Each BSI endpoint must have a multicast mode
  - Source tree (unique group address per BSI endpoint)
  - Shared tree (one group address for all BSI endpoints)
  - Head end replication (no group address)

- Source tree calculation
  - Symmetry with unicast is no longer required
  - Randomize using per hop ECT tie-breaker or hash function

- Shared tree calculation
  - Single tree per root or multiple trees per root?

- How are BSI endpoints assigned to a shared tree
  - Random
  - Provisioned
  - Calculated
ECMP Multicast Attributes

• **Granularity of SPT selection?**
  – One (per region)
  – One per source node
  – N per source node
  – One per address

• **How many SPTs in selection set?**
  – One tie-breaker subset
  – N tie-breaker subsets
  – All SPTs

• **How many group addresses?**
  – One per I-SID endpoint
  – One per I-SID (requires shared tree)

• **Selection of SPT**
  – Automatic (requires standard hash)
  – Provisioned (may require ISIS-SPB extension)

• **Assignment of I-SID to SPT**
  – Automatic (requires standard hash)
  – Provisioned (may require ISIS-SPB extension)
Combinations in Draft 0.1

- **802.1aq** (first 16 ECT-ALGORITHMs)
  - One ECT tie-breaker, one SPT per source node
  - One address per I-SID endpoint
  - Fully automatic

- **Hash based source tree** (00-80-C2-21)
  - All SPTs possible, one SPT selected per source node (hash selects hop toward root)
  - One address per I-SID endpoint
  - Fully automatic

- **All ECT tie-breakers** (00-80-C2-22)
  - 16 ECT tie-breakers, 16 SPTs per source node
  - One address per I-SID endpoint
  - Fully automatic with provisioned override

- **Shared tree** (00-80-C2-22)
  - All SPTs possible, one selected per shared tree root node
  - One address per I-SID
  - Provisioned (or Automatic?)
Combination in “One Slide”

- **bp-ashwood-one-slide-1215-v3.pdf**
  - One ECT-ALGORITHM
  - 16 ECT tie-breakers
  - Source tree and shared tree supported
  - Source tree
    - 16 SPTs per source node possible
    - One SPT per source node by default (ECT tie-breaker 0)
    - One address per I-SID endpoint
    - Fully automatic with provisioned override
  - Shared tree
    - 16 shared tree roots (selected using 16 ECT tie-breakers)
    - One SPT per root, using same ECT tie-breaker
    - One address per I-SID
    - Automatic shared tree root selection with provisioned override
    - Provisioned I-SID assignment to shared tree (management automation possible)

- **Includes aspects of:**
  - 802.1aq (but all ECT tie-breakers available in one VLAN)
  - All ECT tie-breakers
  - Shared tree
### Multicast Mode Selection using ISIS-ADDR sub-TLV

<table>
<thead>
<tr>
<th>Octet</th>
<th>Length</th>
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<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>
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<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)-10</td>
<td>3</td>
</tr>
</tbody>
</table>

- Use reserved bits to select multicast mode option (if desired)
  - Ts (shared tree multicast source), ECT tie-breaker (4 bits)
- All zeros selects default behavior