802.1Qcc UNI: Multi Port End Systems

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Agenda

• Use cases
  • Show that Qcc (D0.5) can address multi port end systems

• Potential changes to Qcc
  • Including proposal to replace UNI's Interface Capabilities / Configuration with remote management of end system
Refresh of Qcc UNI (1 of 2)

• User → Network
  • EndStationInterfaces: List of ports (MAC address for each)
  • InterfaceCapabilities (for all ports):
    • VlanTag: Boolean (support add/remove of VLAN tags per port?)
    • 802-1CB: Boolean (support end system requirements?)
    • 802-1CB-StreamIdenTypeList: List of uint32 (0 or more .1CB types)
    • 802-1CB-SequenceTypeList: List of uint32 (0 or more .1CB types)
Refresh of Qcc UNI (2 of 2)

- Network $\rightarrow$ User
  - InterfaceConfig: List of 0 or more port configurations; Each config is MAC address (ID of port), then 0 or more of:
    - IEEE802-VlanTag: 12-bit VID and 3-bit PCP
    - IEEE802-MacAddresses: Source and Dest MAC addresses
    - IPv4-5tuple: Same encoding as 802.1CB
    - IPv6-5tuple: Same encoding as 802.1CB
    - ScheduledOffset: Uint32 nanosecs; Offset for scheduled talker
## Use Cases for Two Port End System

1. **Independent ports:**
   - No .1CB, No .1AX

2. **Redundant only:**
   - Yes .1CB, No .1AX

3. **Independent plus .1AX:**
   - No .1CB, Yes .1AX

4. **Redundant plus .1AX:**
   - Yes .1CB, Yes .1AX

5. **Bridged:**
   - Bridge is 802.1Q
   - Qcc 5.4.1.8 requires remote management;
   - Internal end station ports can apply use cases 1-4
Use Case 1: Independent Ports

- For independent networks, or to optimize bandwidth
  - Historically, user selects the port by traffic (i.e. above 802)
  - For TSN, if user selects port, effectively two end systems
    - Bandwidth optimization requires manual config (e.g. port-based VLAN)
- For TSN, we want network to select the port
  - "I can act as a talker of this stream on either port... I want network to tell me which to use"
- Qcc supports network selection of port
  - EndStationInterfaces with two ports (but no .1CB or .1AX)
  - InterfaceCapabilities returns config for only one port
    - Can include a VLAN tag
Use Case 2: Redundancy Only

- Let's assume that .1CB needs distinct VID per port
- Qcc supports distinct VID per port
  - InterfaceCapabilities: VlanTag TRUE, 802-1CB TRUE
    - No need for optional 802.1CB types (uses MAC/VLAN and CB tag)
  - InterfaceConfig: CNC returns distinct VID per port
- Non-TSN traffic (e.g. best effort) continues to use independent ports
802.1AX Background (1 of 2)

- For LAG/DRNI, .1AX selects port for each frame
- .1AX-2014 per-service frame distribution avoids this
  - Assigns specific traffic to one link
  - Optional feature of .1AX-2014 (5.3.1 item g)
    - Aka conversation-sensitive
  - Uses 12-bit Conversation ID
    - For C-tagged, maps 1-1 to the C-VID
    - For S-tagged and B-tagged, mapping table is used
- Ideally, use per-service for TSN traffic, and use .1AX distribution for all others (e.g. best effort)
802.1AX Background (2 of 2)

• Can Qcc's CNC detect when .1AX is in use on a link?
  • .1AX-2014 doesn't require remote management, but Qcc 5.4.1.8 requires it for bridge (that supports CNC)
    • Remote management not required for end station
  • Successful 'read' of .1AX aAggOperState of 'up' → in use

• Can Qcc's CNC detect when per-service is supported?
  • aAggPortAlgorithm provides the per-service algorithm
    • E.g. "Distribution based on C-VIDs"
  • Successful 'read' of .1AX aAggPortAlgorithm → supported
Use Case 3: Independent plus .1AX

- As with use case 1, network selects port for TSN
- Qcc supports network selection of port
  - InterfaceCapabilities: VlanTag TRUE, 802-1CB FALSE
  - CNC detects .1AX, including per-service
  - InterfaceConfig: CNC returns config for only one port
    - Includes VID for per-service
    - TSN layers are not aware of .1AX... talker just adds the tag
    - .1AX config of per-service VID uses its mechanisms (e.g. LACP)
Use Case 4: Redundant plus .1AX

• Similar to use case 2: Distinct VID per port
• Qcc supports distinct VID per port
  • InterfaceCapabilities: VlanTag TRUE, 802-1CB TRUE
  • CNC detects .1AX, including per-service
  • InterfaceConfig: CNC returns distinct VID per port
    • Used for both: .1AX per-service, and .1CB
Potential Changes to Qcc
Management of End Stations in .1Q

- Remote mgmt of end stations not specified in .1Q
  - Intro text for clause 12 refers to Bridge only
  - PICS entry for Bridge only, not End Station (Annex B)

A.5 Major capabilities

<table>
<thead>
<tr>
<th>RMGT</th>
<th>Is a remote management protocol supported?</th>
<th>MGT:O PBBTE OR TPMR: M</th>
<th>5, A.15</th>
<th>Yes [ ] No [ ]</th>
</tr>
</thead>
</table>

- PICS RMGT A.15 lists protocols (e.g. SNMP, RESTCONF) and encodings (e.g. MIBs, YANGs)

- NETCONF and RESTCONF introductions
  - "configuration of network devices"
  - End station (host) is **not** a network device (bridge/router)
Qcc IntfCap/Conf in Remote Mgmt

• Summary of equivalents in managed objects

<table>
<thead>
<tr>
<th>IntfCap/Conf Element</th>
<th>In managed object?</th>
<th>Mgmt protocol failure?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap: VlanTag</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Cap: 802-1CB</td>
<td>N</td>
<td>Y (successful .1CB read)</td>
</tr>
<tr>
<td>Cap: .1CB Types</td>
<td>N</td>
<td>Y (successful .1CB write)</td>
</tr>
<tr>
<td>Conf: VlanTag</td>
<td>N in .1Q, Y in .1CB</td>
<td>-</td>
</tr>
<tr>
<td>Conf: Stream MacAddr</td>
<td>Y (.1CB)</td>
<td>-</td>
</tr>
<tr>
<td>Conf: Stream IP tuple</td>
<td>Y (.1CB)</td>
<td>-</td>
</tr>
<tr>
<td>Conf: Stream Scheduled Offset</td>
<td>N</td>
<td>-</td>
</tr>
</tbody>
</table>

• Only the .1CB elements can be managed remotely
How Does Qcc Reference CB Mgmt?

• YANG snippet from InterfaceConfiguration:

```yang
leaf-list CB-StreamIdenTypeList {
  type uint32;
  description
    "This provides a list of the optional Stream Identification Types as specified in IEEE Std 802.1CB."

  Each stream identification type is provided as a 32-bit unsigned integer. The upper three octets contain the OUI, and the lowest octet contains the Type Number."
}
```

• Reference by formal name in 802.1CB, with brief summary
  • Avoids duplication of 802.1CB text
Add End Station Remote Mgmt?

- “Todo” list if we do it in 802.1Q
  - Add to conformance (clause 5, annex B, etc)
    - Require for TSN remote management feature
    - Question: Not specific to Qcc… is it in scope?
  - Add concept of managed config of Streams
    - Currently ‘Idle’ in Annex Z due to many open issues
    - Specify managed objects for Stream’s VLAN tag
    - Specify managed objects for Talker’s ScheduledOffset

- Editor’s preference: No (new idea)
  - If desired, address in a future 802.1Q PAR
Remove Interface Cap/Config?

• Some verbal comments have implied that we should remove Interface Capabilities/Config from Qcc, and replace it with remote mgmt of end station
  • Breaks MSRP
    • Even MSRPv0 does interface config (e.g. VID)
  • Prevents integration of TLVs into non-mgmt protocols
    • 802.1: LLDP, LACP, …
    • 1722.1
    • Other automotive protocols
    • Other industrial protocols
• Editor’s preference: No
Other Potential Qcc Changes

- Add an Annex (informative) to describe uses cases 1-5
  - Can help to clarify .1AX usage
- Add text to IntfConfig to clarify use case 1
  - Not only configuration, but "here is the port to use"
- Add text to IntfCap to clarify that when 802-1CB is FALSE, VlanTag TRUE means the capability to apply a distinct VID per port
- Editor proposes to submit comments to Qcc D0.6
Thank you