Tips for Successfully Commissioning and Monitoring an ST 2059/PTP System

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Imagine Communications

PTP/ST 2059 Systems – Facts and Fiction

Myth: PTP/2059 Systems are black magic or mystical

Fact: They are more complex than legacy analog black systems
PTP/ST 2059 Systems – Facts and Fiction

Myth: PTP/2059 Systems never work well and always have issues

Fact: If designed, implemented and commissioned POORLY, they do NOT work well

Fact: If designed, implemented and commissioned PROPERLY, they work very well

The Problem To Solve

• Now that you have designed and built your system, you need to verify that it is working properly
• PTP can seem to be working however it may not be working as designed/expected
• Issues can be
  – Design
  – Configuration
  – Device features or implementation bug
Examples of Not Working As Expected

• GM actual announce rate varies from 1 to 3 seconds

• Delay Request rates incorrectly configured on the switch

• Delay Request not being received because of unicast configuration issue

Design Sign-off

• Get Design sign-off from
  – GM vendor
  – Switches vendor
  – Media Nodes vendors
Example Design

Recommended Values

- AES-R16 defaults
  - Will be the defaults in the new ST 2059-2 revision

- Announce Interval: 0 or 1 message per sec
- Announce Timeout: 3
- Sync rate: -3 or 8 messages per sec
Commissioning

• Need to understand the expected behavior
• Need to verify
  – GM
  – Switches
  – Media Nodes
• Checklist
• Tests

Commissioning Checklist

• Items to verify
  – There will be a lot

• Pass Criteria
Commissioning Checklist – GM

- Verify Master parameters configuration
  - Announce and Sync intervals
  - Priorities
  - Communication modes
  - Delay Request rate

- Verify Actual message rates

<table>
<thead>
<tr>
<th>Test #</th>
<th>Pass Criteria</th>
<th>Pass (P)/Fail (F)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PTP Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>PTP Domain (defaultDS.domainNumber)</td>
<td>Matches customer design Recommended not 0 or 128 E.g. 1</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Announce Receipt Timeout (portDS.announceReceiptTimeout)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Announce Interval (portDS.logAnnounceInterval)</td>
<td>0 (1 Message per second)</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Sync Interval (portDS.logSyncInterval)</td>
<td>-3 (8 Messages per second)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Parameter restore after power cycle</td>
<td>All parameters in section 1 are correct after power cycle.</td>
<td></td>
</tr>
</tbody>
</table>
Commissioning Checklist – Switch

- Boundary clock mode

- Global settings
- Per port settings

- PTP state on each Slave interface
  - E.g. Counters
- PTP state on each Master interface

### Commissioning Checklist – Switch

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<tr>
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<th>Fail (F)</th>
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<tr>
<td>1</td>
<td>PTP Parameters - Global</td>
<td>Matches customer design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>PTP Domain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>PTP Source IP address</td>
<td>Matches customer design E.g. 192.168.2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>PTP mode</td>
<td>Boundary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>PTP Priority 1</td>
<td>Greater than the GM E.g. 128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PTP Parameters - on each interface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>PTP Enable</td>
<td>Enable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Announce Receipt Timeout</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Announce Interval</td>
<td>0 (1 Message per second)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Sync Interval</td>
<td>3 (8 Messages per second)</td>
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<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Master mode</td>
<td>For Media Node interfaces, “Master Only” For interfaces towards the GM, “Master/Slave”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Delay Request interval</td>
<td>3 (8 Messages per second)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Commissioning Checklist – Media Node

- Verify PTP Parameters
- Verify PTP Locking
- PTP Packets at the Media Node Interface

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
<th>Pass Criteria</th>
<th>Pass (P)/Fail (F)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Verify PTP Parameters – Common and Slave</td>
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<td></td>
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<tr>
<td>1.1</td>
<td>PTP Mode (defaultDS.slaveOnly)</td>
<td>“Slave Only”</td>
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</tr>
<tr>
<td>1.3</td>
<td>Manual PTP Domain (defaultDS.domainNumber)</td>
<td>Matches customer design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Manual Announce Receipt Timeout (portDS.announceReceiptTimeout)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Manual PTP Slave Communication Model</td>
<td>Multicast</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>PTP Locking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>PTP State</td>
<td>Locked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>UTC Time</td>
<td>Matches correct UTC time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Grandmaster ID</td>
<td>E.g. 08 00 11 FF FE 22 0F 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Grandmaster Traceable</td>
<td>Yes if the GM is GPS locked No if the GM is freerunning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Sync/Follow-up Processing</td>
<td>Master Offset &lt; 5us and is non-zero</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>One Way Delay Processing</td>
<td>Master Delay &lt; 1us and is non-zero. It should be slowly changing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tools for Verifying

- Device GUI/API
  - Counters

- WireShark .pcap capture
  - Verify fields in the packets

- PTP TrackHound

WireShark Packet Analysis
How to Check Actual Message Rates

• WireShark .pcap capture
  – Port mirror
  – Unused boundary clock port

• In WireShark
  – Filter on packet type
  – Set time to delta from previous packet
  – Sort by time
Commissioning Period

• Monitor for 24-48 hours

• pcap for monitoring period

Redundancy/Failover

• Understand expected behavior
  – Detailed transient behavior. This includes
    • Port state change
    • Timing of the changes

• Change of GM should not impact the Media Node output
  – Check for glitches at the Media Nodes
Monitoring

• Monitor critical parameters
  – GM ID
  – Locked status

• Detect changes in the system

• SMPTE has DG working on PTP Monitoring
  – Coming up with standardize parameters to monitor

Conclusions

• PTP may seem like it is working however it may not

• Need to understand the expected behavior

• Commissioning Checklists

• Need to thoroughly test
  – GM, Switches and Media Nodes

• Need to test Redundancy/Failover

• If designed, implemented and commissioned PROPERLY, PTP works very well
Thank you
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