Evaluation of 1588v2 for Deployment.

Presenter: Tommy Cook, CEO Calnex Solutions Ltd
Presentation overview

- Items for evaluation.
  - Protocol Behaviour
  - Performance in Network Congestion
- Evaluation Plan.
  - Current methodology.
  - Enhanced methodology and Goal for the Future.

I want to deploy 1588v2 to transfer timing across my network.

Want aspects and behaviours do I need to evaluate?

How do I prove equipment is fit for deployment?
Proving 1588v2 clock transfer

Clock Output must comply with the relevant ITU-T clock specification (MTIE & TDEV specification);

- G.81x series of specifications
- (G.823/4 for TDM delivery.)
Protocol Behaviour
Session Management Problems

- Are the Session Management protocol stacks robust to unexpected events?
- Will they always recover and continue as expected?
Handshake Sequence problems.

- Are the protocol stacks robust to unexpected events?
- Will they always recover and continue as expected?

Missing Sync message.

Missing Delay_Response.
Network Delay & PDV
Network Impact of 1588v2 clock transfer

Sync PDV (1-step or 2-step)

Does Master > Slave PDV impact clock recovery?
Network Impact of 1588v2 clock transfer

Does Slave > Master PDV impact clock recovery?
Network Impact of 1588v2 clock transfer

Round Trip Delay

Will the in RTD variation impact the Slave clock?
Network Impact of 1588v2 clock transfer

Asymmetry in Path Delay

Will the Delay Symmetry impact the Slave clock?
Network Impact of 1588v2 clock transfer

![Diagram showing network impact of 1588v2 clock transfer]

- **Sync IPG**
  - Monitor variation in arrival time of Sync messages at Slave Clock

- **Does Slave need regular Sync messages?**
Network Impact of 1588v2 clock transfer

Follow_Up PDV

- Arrival time of the Follow_Up message with respect to the Sync message

Will the variation impact the Slave clock?
Network Impact of 1588v2 clock transfer

Delay_Resp Response Time
- Launch time of the Delay_Req to the arrival of the Delay_Resp message

Will the variation impact the Slave clock?
Network Impact of 1588v2 clock transfer

To fully understand the impact of the Network on the Slave clock recovery, the impact of variation and congestion on the following parameters needs to be understood:

- Sync PDV
- Delay_Req PDV
- Round Trip Delay
- Path Asymmetry
- Sync IPG
- Follow-up PDV
- Delay RESP Response Time
Evaluation Plan
Evaluation Plan
– Approach to date

1. **Evaluate Session Management protocol.**
   - Introduce PDV into Sync & Del_Req.
   - G.8261 Test Cases.
   - Replay Live captures from active network.
   - Vary the Round-trip-delay & path asymmetry.
     - Vary the latency in each path.
     - Introduce asymmetry between up-stream & down-stream path latency.
     - Emulate IPG variation on Sync, Follow-up & Delay-response.
     - Emulate varying Master Response times.

2. **Evaluate Time Transfer protocol.**
   - Evaluate Time Transfer message sequence.
     - Sync, Follow-up, Del_req, Del_resp
   - Introduce Network Impairments to each type of message;
     - Drop, Repeat, Delay, Mis-ordered.

3. **Stress Test impact of Network Congestion and PDV.**
   - Evaluate Session Start-up and Status Management.
     - Signalling and Announce messages.
   - Introduce Network Impairments to each type of message;
     - Drop, Repeat, Delay, Mis-ordered.
Evaluation Plan – Enhanced

Characterise & compare Slave performance with controlled behaviours.

- Emulate recognised network PDV behaviours.
  - Step Noisefloor.
  - Ramp, 24hr varying Noisefloor.
  - PDV amplitude.
  - Deplete Noisefloor.
Estimate Performance Limits of Slave

- **Master Clock**
- **Slave Clock**
- **Clock Output**

Timeline:
- **t1**
- **Sync**
- **t2**
- **Follow_Up**
- **t3**
- **Delay_Req**
- **t4**
- **Delay_Resp**

Results:
- **Pass**
- **Fail**

Graphs indicate performance metrics with green lines representing successful outcomes and possibly red lines indicating failures.
Evaluation for mass deployment – The Goal

Engineer Network to agreed Performance Limits.
• Test network prior to deployment against Performance Limits.
• Manage network to Performance Limits.

What’s required to achieve this Goal;
• Agreement on recognised PDV behaviours.
• Establish PDV Limits.
• Tools to emulate and measure network to not exceed Performance Limits.
www.calnexsol.com

Tommy Cook
tommy.cook@calnexsol.com
Tel.: +44 (0) 1506-671-416

Calnex Paragon

- IEEE 1588v2
- CES
- Sync-E
- NTP
- Ethernet OAM