



SMPTE ST 2059/PTP Systems Over an ST 2022-7 Network, How to Design and Troubleshoot

Leigh Whitcomb, Architect
Imagine Communications



IP SHOWCASE THEATRE AT IBC – SEPT. 14-18, 2018



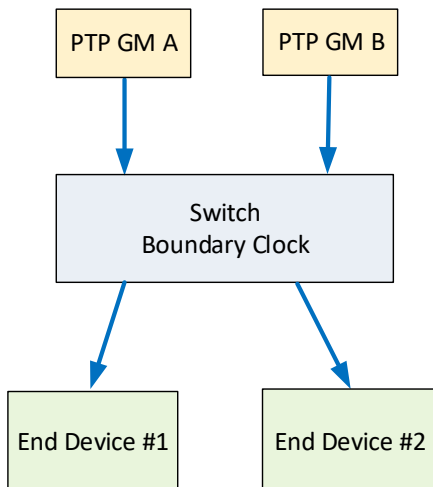
Agenda

- ST 2059 Systems
- ST 2022-7 Networks
- Challenges of ST 2059 Systems over ST 2022-7 Network
- Good Practices
- Trouble Shooting

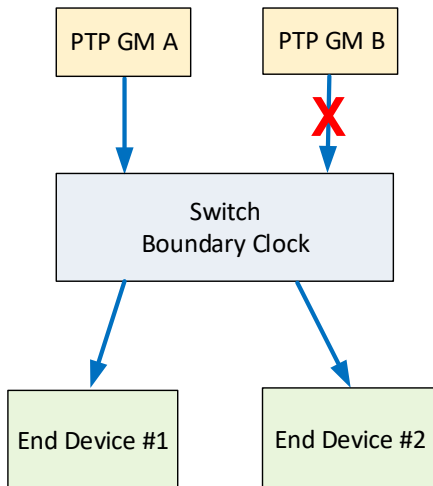




Basic PTP Network



Redundancy with Basic PTP Network

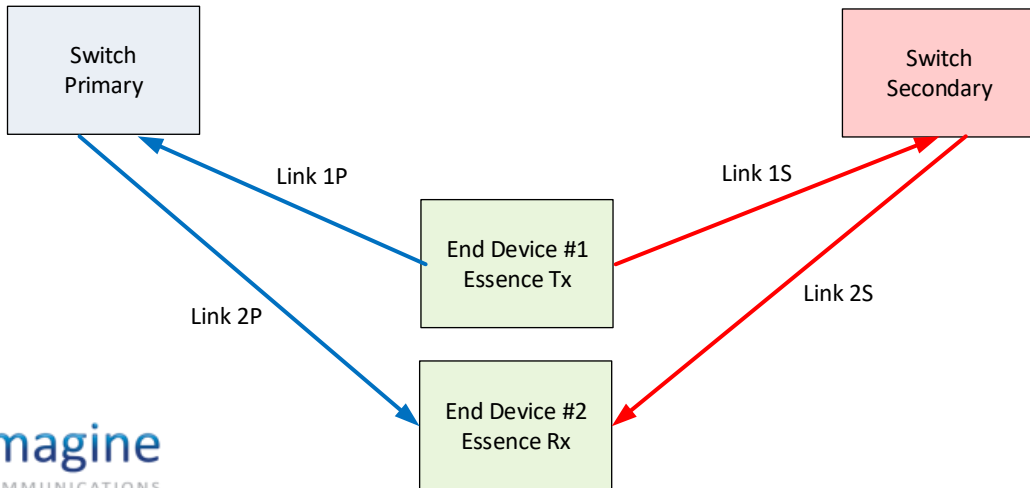


- BCMA to select GM
- Doesn't guard against failures of switches or link to end device

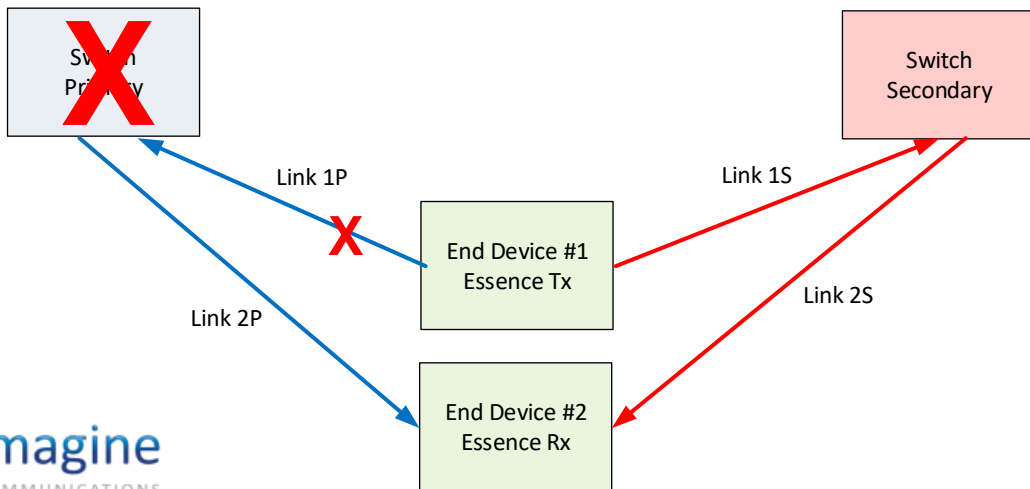




ST 2022-7 Networks



Redundancy with ST 2022-7 Networks





ST 2022-7 Networks

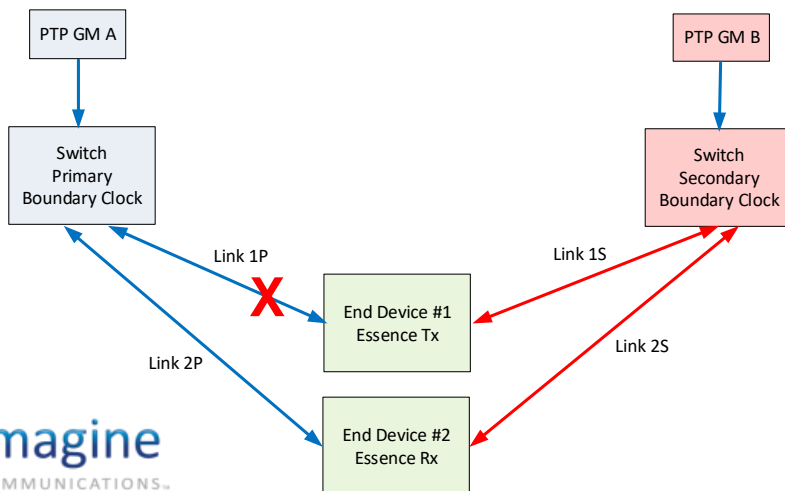
- Handles single failure of
 - Any switch
 - Any link
 - Any packet
- End devices have 2 network interfaces
- Allows maintenance on 1 of the switches



7



ST 2059 Over an ST 2022-7



- Which GM does an end device select?



8



ST 2059 Over an ST 2022-7 – Bad News

- Exact behaviour of PTP over an ST 2022-7 is not defined in the IEEE or SMPTE standards
- ST 2110 uses RTP timestamps that rely on ST 2059/PTP time
- Not all network topologies work
 - Different vendors are giving inconsistent recommendations



9



ST 2059 Over an ST 2022-7 – Good News

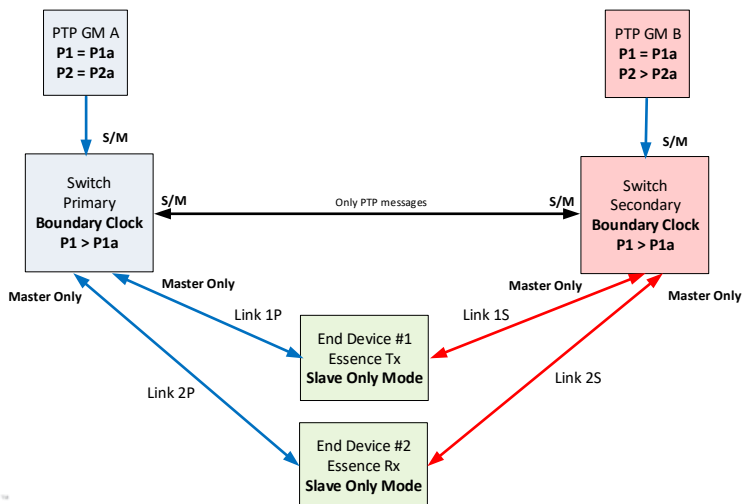
- Vendors are starting to agree on some common recommendations
 - All devices must lock to same GM-ID
- Work is starting in SMPTE to define
 - the behavior of essence Tx devices
 - the behavior of essence Rx devices
 - the behavior of PTP GMs if they have multiple interfaces
 - a method for analyzing network topologies



10



Leigh's Good Practices



Good Practices

- PTP Parameters
 - Sync Interval = -3 (8 Hz)
 - Announce Interval = 0 (1 Hz)
 - Announce Receipt Timeout = 3
 - PTP Domain = What ever you want but not 0 or 127
- Based on AES R16





Checking a new device

- Through check of new devices before adding it to a network
- Use PTP message load expected in the network
- Reaction to PTP Management messages



13



Monitor Network

- Each of the end devices
- Each of the switches
- Tools to monitor PTP messages in the network
 - WireShark
- Watching for time discontinuities

- Next version of IEEE-1588 will have additional monitor features



14



Trouble Shooting

- System is healthy if
 - All end-devices are locked to the correct GM
 - No discontinuities in the time
- If not, what went wrong



15



What is Wrong?

Status

PTP State Locked

PTP Master Present Yes

PTP Master IP Address 192.168.110.192

PTP Master Interface IP Address 192.168.109.186

PTP Master UUID 00 04 B3 FF FE F0 12 3C

PTP Master Delay 0.000 us

PTP Master Offset 0.093 us

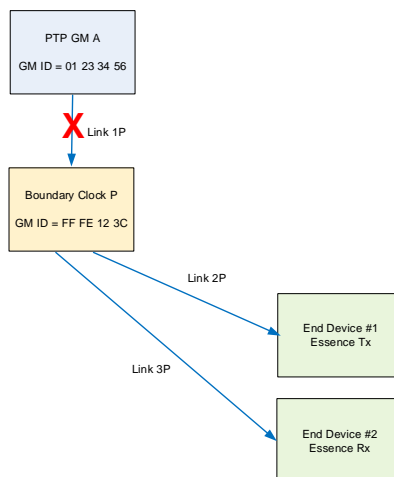
UTC Time Sun Apr 8 00:25:18 2018



16



What is Wrong?



What is Wrong?

Status

PTP State Locked

PTP Master Present Yes

PTP Master IP Address 192.168.110.192

PTP Master Interface IP Address 192.168.109.186

PTP Master UUID 00 04 B3 FF FE F0 12 3C

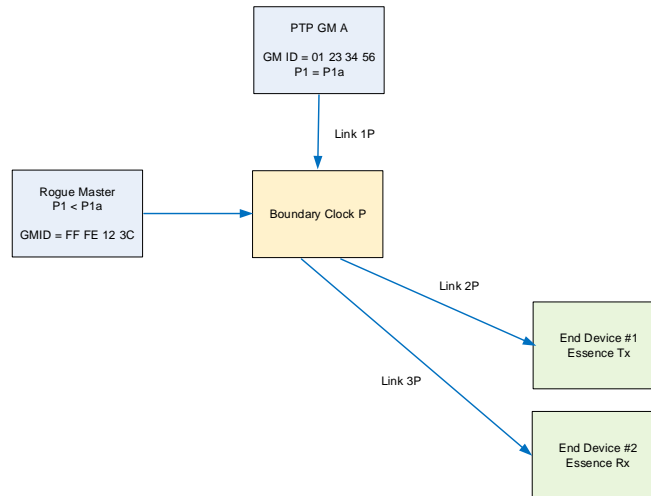
PTP Master Delay 0.000 us

PTP Master Offset 0.093 us

UTC Time Sun Apr 8 00:25:18 2018



What is Wrong?



Other Issues

- GM changing
- Wrong Announcement Interval



Key Take Aways

- ST 2059 and ST 2022-7 have different redundancy models
- Current standards do not define to exact behaviour
- SMPTE is working on the problem
- All devices must lock to same GM-ID with a single switch or link failure
- System design recommendations
 - Link between Primary and Secondary networks
 - Boundary clocks with Master only ports
 - End devices in Slave Only Mode
 - R16 parameters



21



Thank You

Leigh Whitcomb, Imagine Communications
Leigh.Whitcomb@imaginecommunications.com



IP SHOWCASE THEATRE AT IBC – SEPT. 14-18, 2018