

PTP Best Practices for the Broadcast and Professional Media Industries

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Nov. 2021

Introduction

Imagine Communications

Broadcast equipment E.g. IP -> SDI Gateway, MV

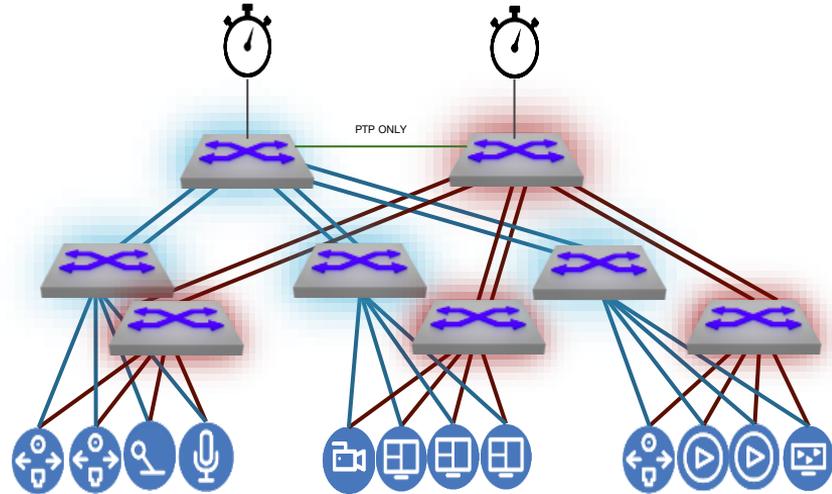
Arista

Switches

Telestream (Formally Tektronix Video)

GM and Test Equipment

- We have a lot of experience in PTP/ST 2059 deployments
- We are here to help you be successful
- Learn from other's mistakes and from successful deployments



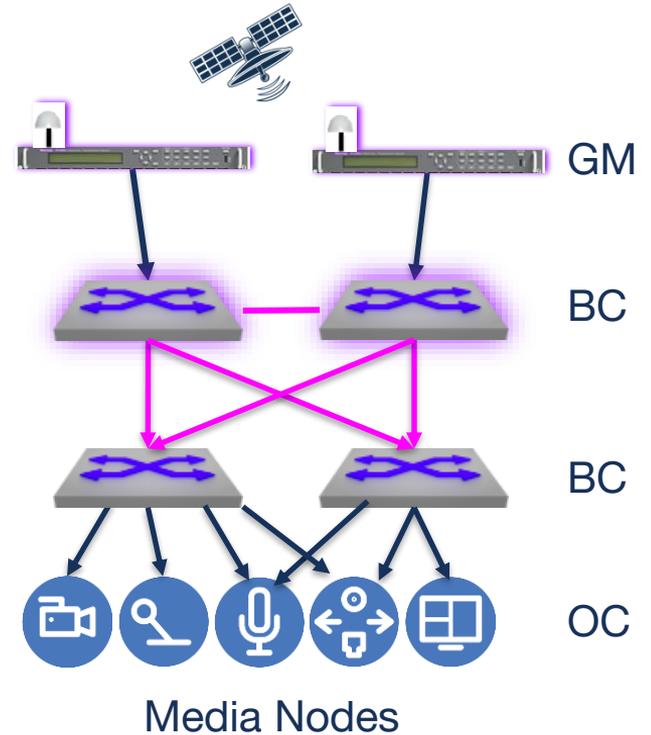
Agenda

- Best Practices for
 - Network Architecture/Topology
 - PTP Network Architecture/Topology
 - PTP Configuration
 - Commissioning and Operation
- Cover the “What” and the “Why”

Best Practices for Network Architecture/Topology

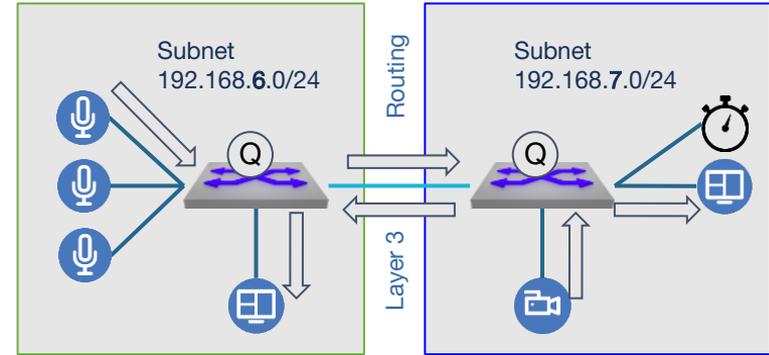
BP#1 - Solid Network and PTP Foundation

- Endpoint Planning comes first
 - The Network serves the Design
- Choose switches that support PTP BC at scale
- Avoid switches where enabling PTP disables other key features
- Avoid non-PTP aware switches
- Ensure that all switches have a network path to all GMs
- Design redundancy and resilience in at the start
 - At the PTP distribution layer
 - In the physical cabling
 - With the routing (and other) protocols you use
- **PTP is THE most important multicast flow on your network!**



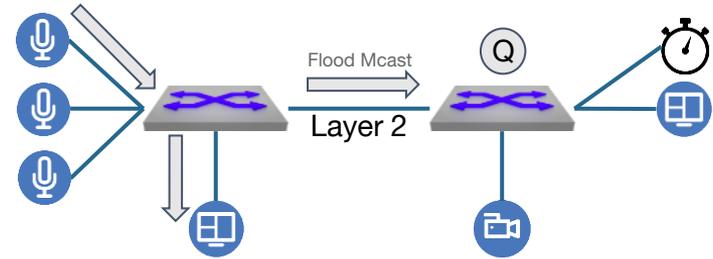
BP#2 - Network Architectural Considerations - Choose a Routed Network

- Routed networks reduces the Broadcast Domain size, which increases Stability
- Routed networks enable Resiliency and Scalability
- All Links Active, no Spanning Tree Blocking
- JT-NM TR-1001 leverages DHCP and DNS-SD for Discovery to assist with deployment, Media Node identity, connection point, and essence streams

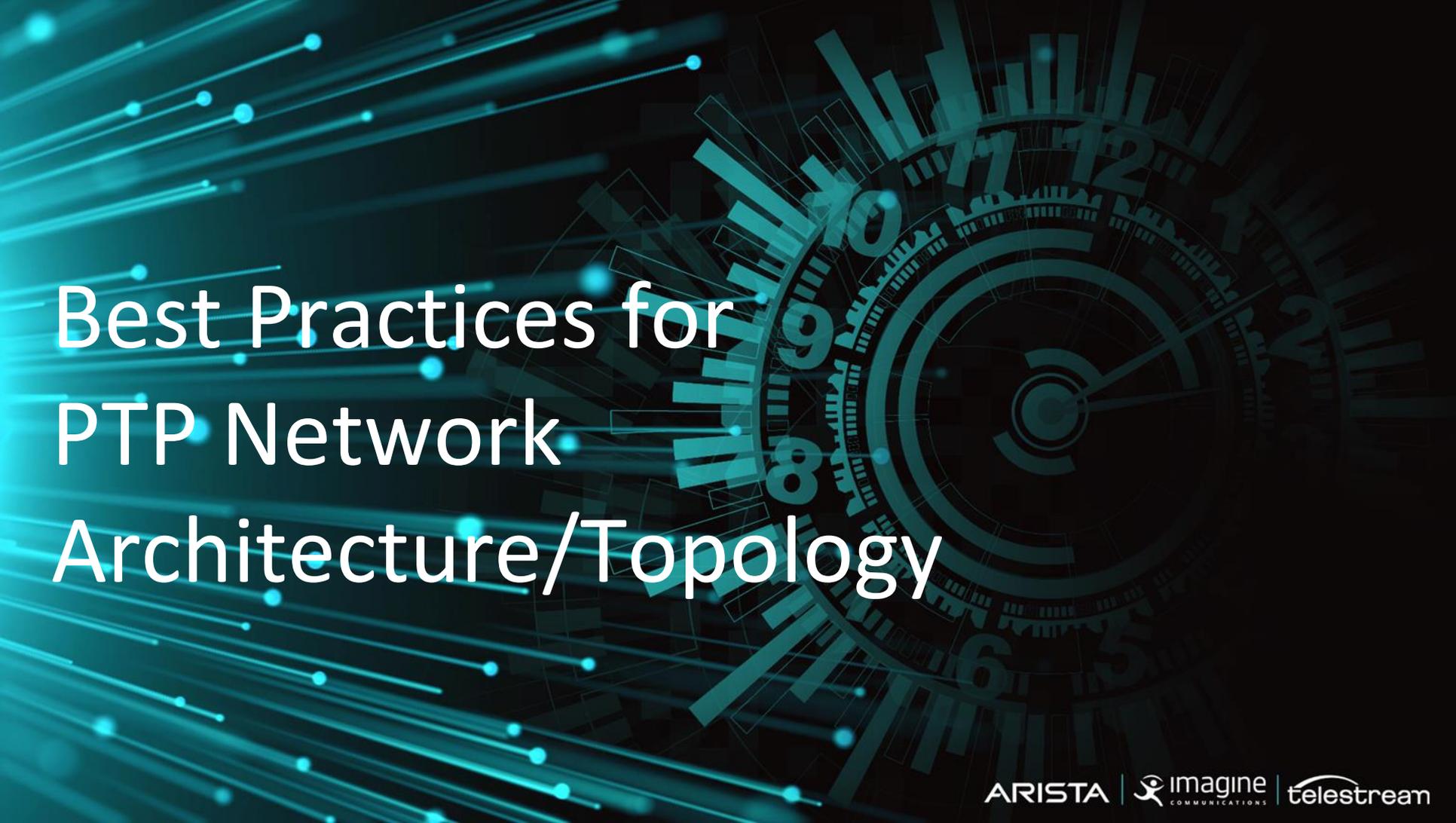


BP#3 - Network Architectural Considerations - Working with Layer 2

- **IGMP Snooping and a Querier**- Disables Flooding to all ports on the Switch per VLAN (Otherwise mcast = broadcast)
- **All Multicast Traffic is Flooded to the Snooping Querier** so that it knows of all Multicast Flows
- Configure Multiple Switches with Snooping Querier for Redundancy
- Best Practice is to have Snooping Querier on Every VLAN (Bonjour and other Multicast Traffic)



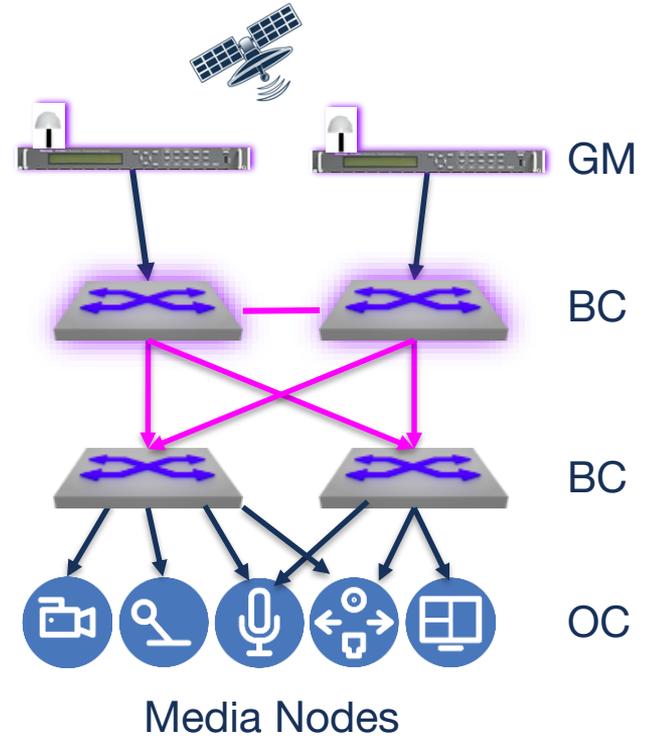
```
ARISTA#show ip igmp snooping group
Vlan  Group                Type      Version      Port-List
-----
21     224.0.1.129             Dynamic   -            Et16, Eth21, Et49/1, Cpu
21     239.6.6.7               Dynamic   -            Et49/1, Cpu
21     239.6.6.163            Dynamic   -            Et49/1, Cpu
21     239.7.7.7               Dynamic   -            Et49/1, Cpu
21     239.7.7.8               Dynamic   -            Et49/1, Cpu
21     239.20.30.142           Dynamic   -            Et21, Et49/1, Cpu
```

The background features a dark teal color with numerous glowing blue lines of varying lengths and directions, creating a sense of motion and data flow. On the right side, there is a large, semi-transparent clock face with numbers from 1 to 12, rendered in a similar teal color. The overall aesthetic is high-tech and futuristic.

Best Practices for PTP Network Architecture/Topology

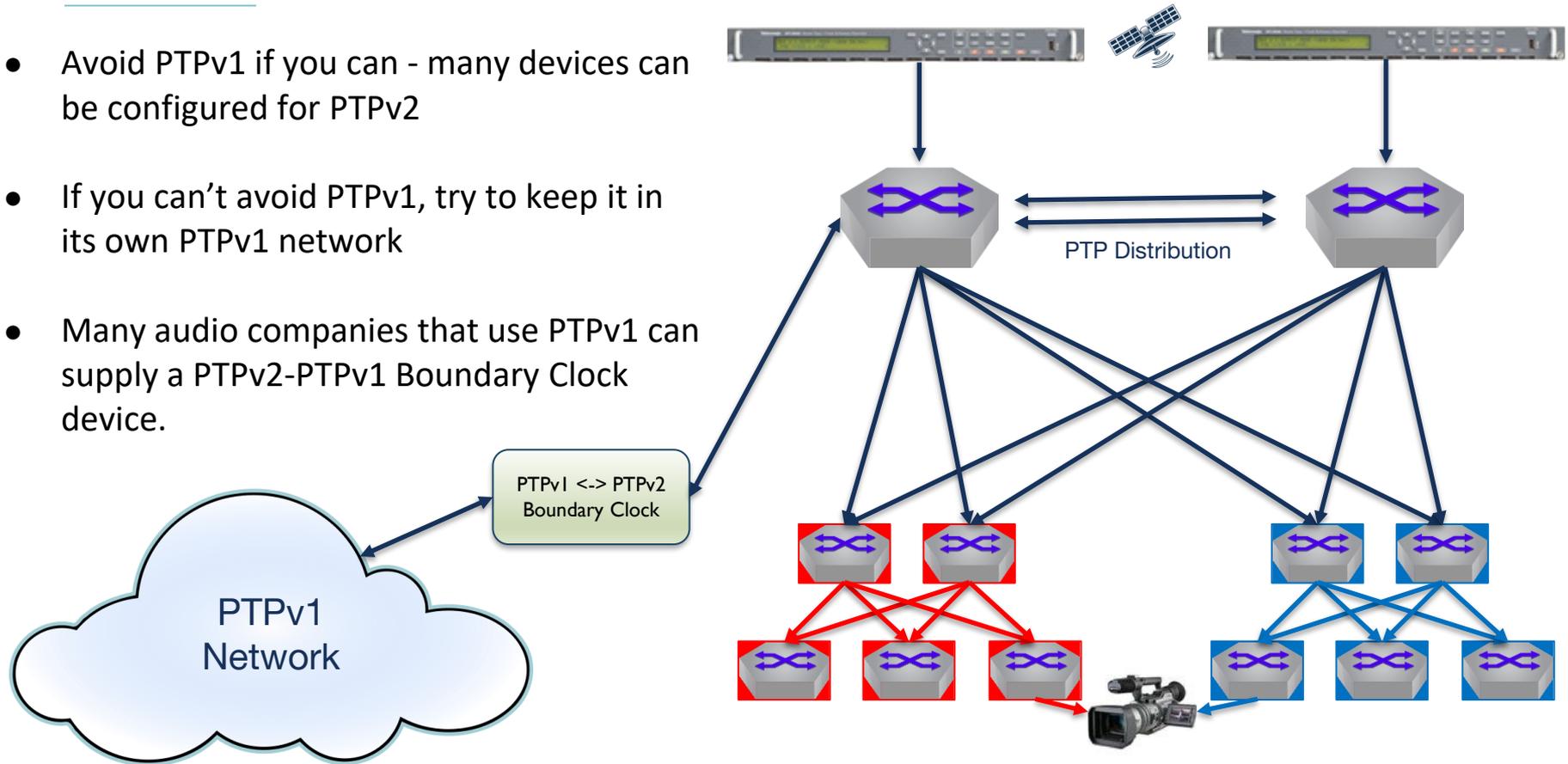
BP#4 - Use Boundary Clock Everywhere that you can

- Greatly reduces end-point processing load
- Reduces impact of one end-point on another
- Provides high level of security
- Relieves GM load



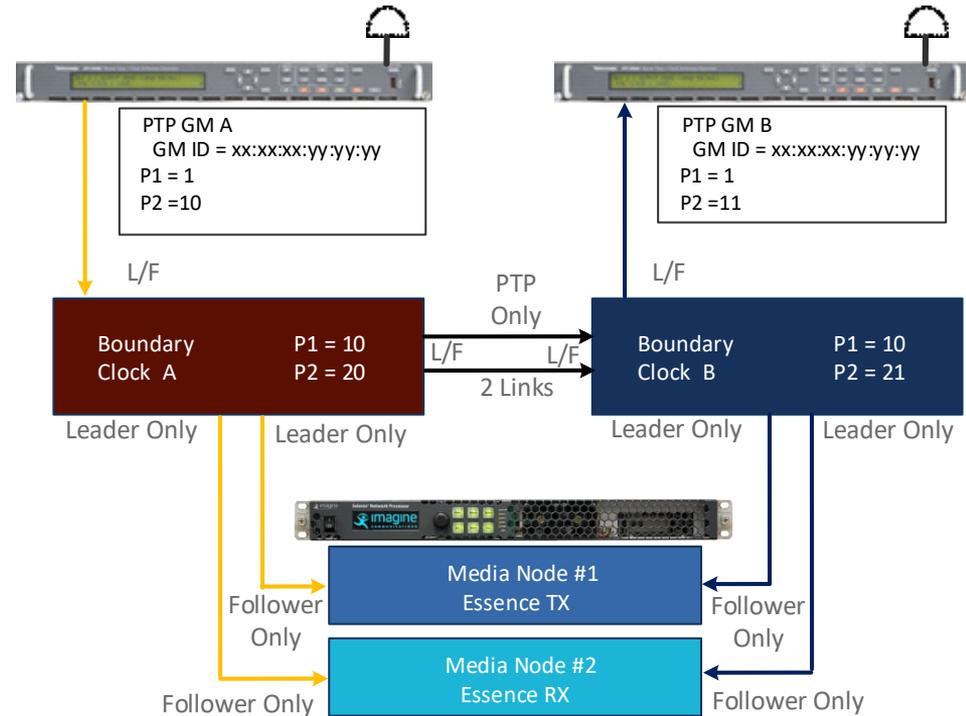
BP#5 - Use Only PTPv2 and Avoid PTPv1

- Avoid PTPv1 if you can - many devices can be configured for PTPv2
- If you can't avoid PTPv1, try to keep it in its own PTPv1 network
- Many audio companies that use PTPv1 can supply a PTPv2-PTPv1 Boundary Clock device.

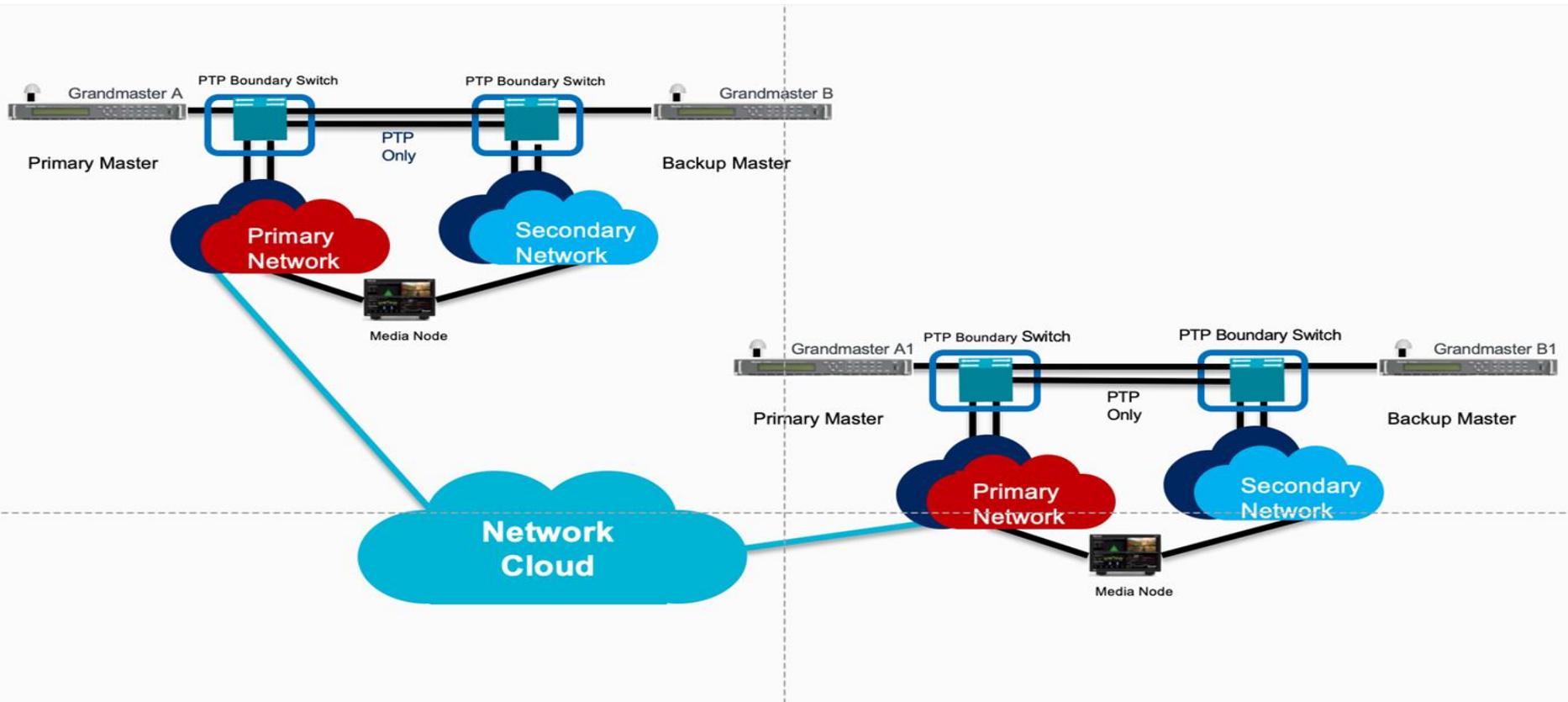


BP#6 - All GMs must have the same time

- Failure over has no large jump in time
- GNSS used as reference for GM
- External link between GMs

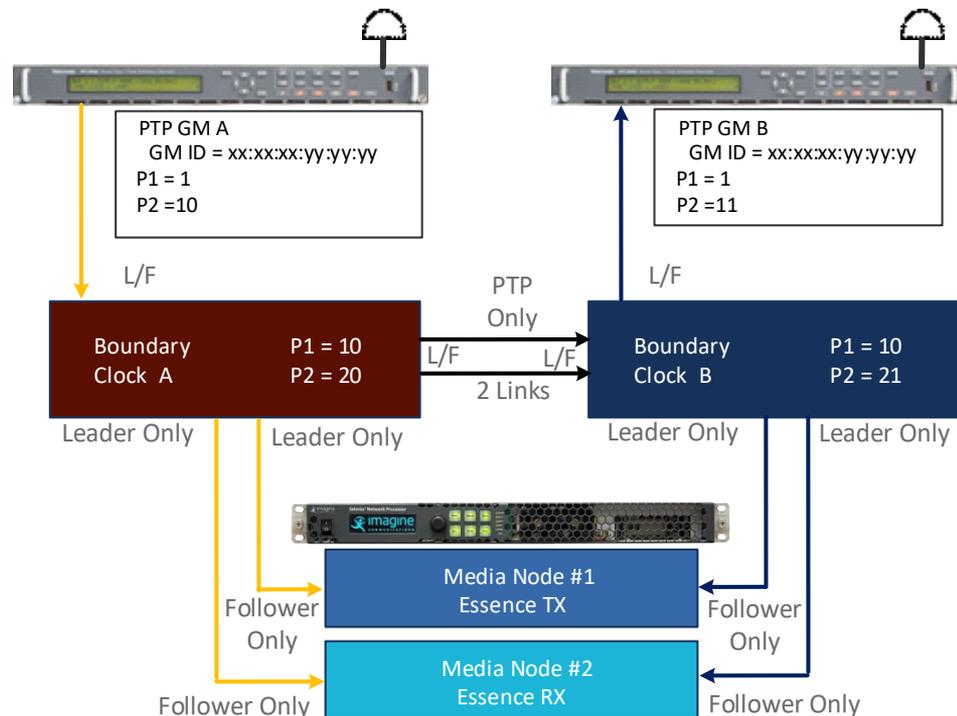


BP#7 - Each site should have their own active GM



BP#8 - PTP links between both ST 2022-7 sides

- Network **MUST** converge to a single GM during failure events
- Do NOT want a 100% air gapped networks
- Need at least 2 PTP links between the ST 2022-7 sides



Best Practices for PTP Configuration

BP#10 - Enable ST 2059-2 TLV messages

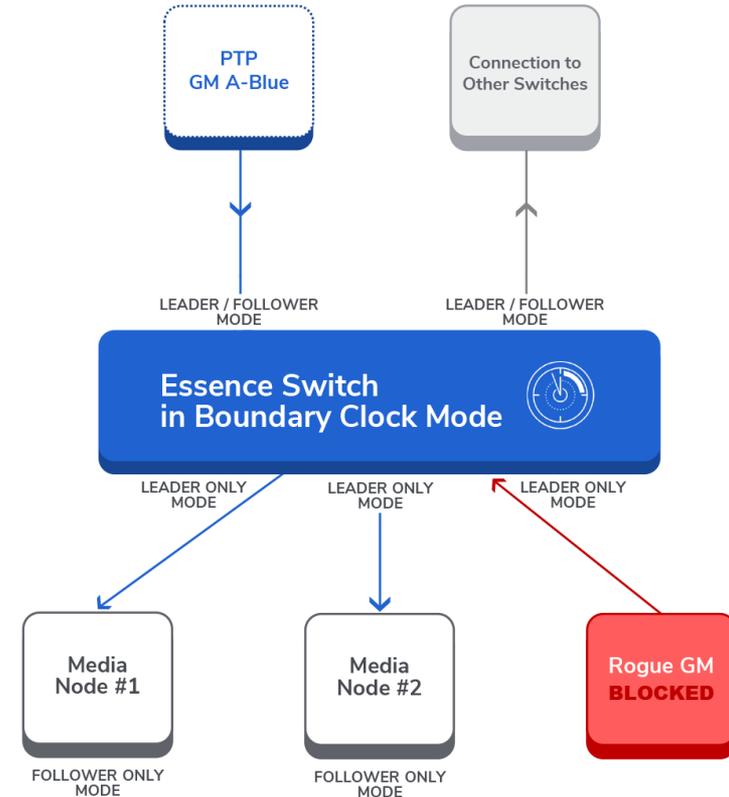
- Used by Media Nodes to generate Drop Frame Timecode
- Management messages sent from the GM

Why since I don't use Timecode?

- Avoid issues in the future

BP#11 - Use “ptp role leader” on All Media Node facing ports

- Prevents a BC port from taking part in BMCA
- Limits the role of the port to be Leader
- Prevents unauthorised end-points taking over
 - Rogue end points
 - Badly configured end-points
- Not used on port with path to GM
- All Media Nodes (end-points) should be in “Follower only” mode

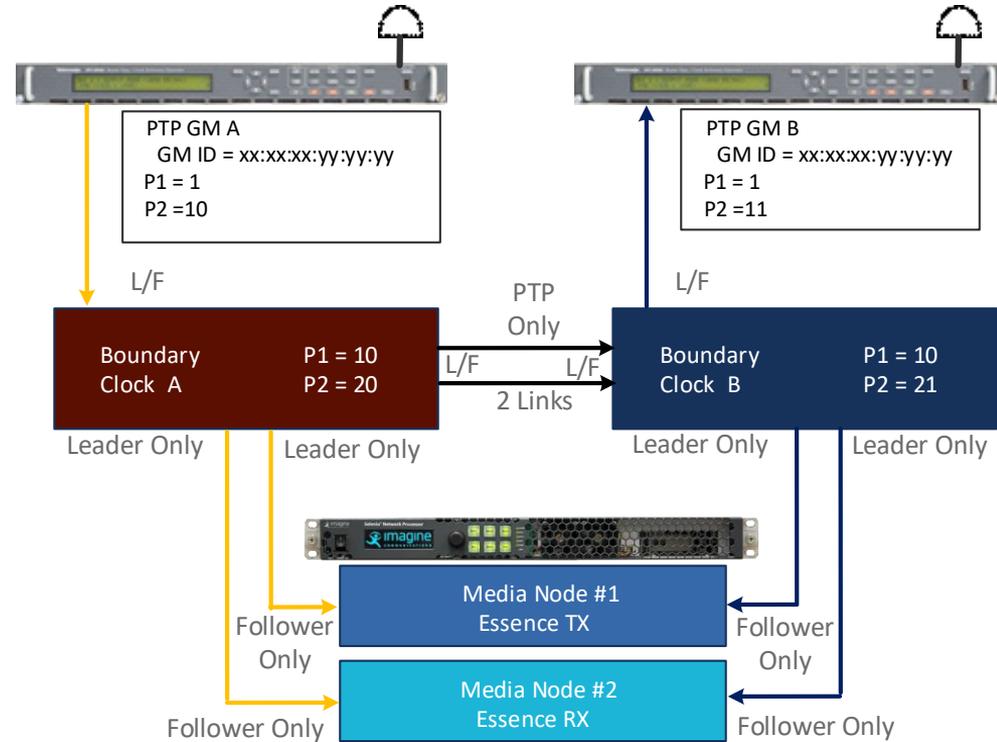


BP#12 - Set the PTP Domain 1-126 (not 0 or 127)

- Domain value ranges from 0 to 127
- Default Values for
 - ST2059-2 =127
 - AES67 and IEEE1588 = 0
- Set the PTP Domain 1-126
- Why?

BP#13 – Devices at the same level have same P1 and different P2

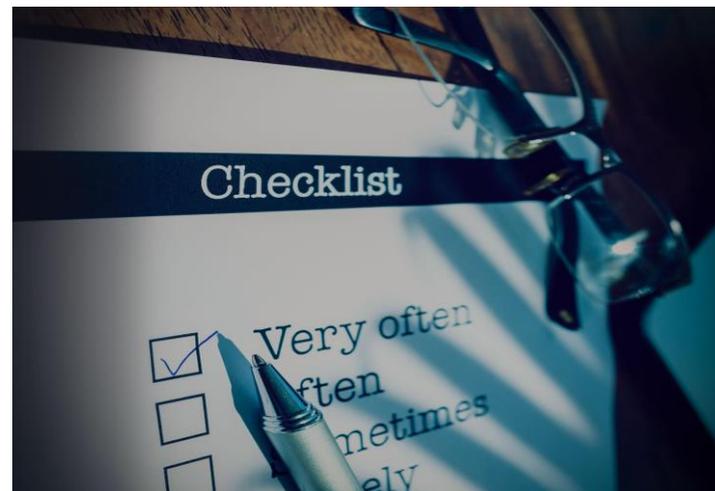
- All devices at the same level in the PTP hierarchy have the same P1 value and a different P2 value.
- Devices at different level in the PTP hierarchy have different P1 values



Best Practices for Commissioning and Operation

BP#14 - Do proper Commissioning

- Now that you have designed and built your system, you need to verify that it is working properly
- PTP can appear to be working properly, when in reality it is not
- Issues can be
 - Design
 - Device features
 - Configuration
 - Implementation bugs
- How
<https://youtu.be/tTGZMLpXozg>



BP#15 - Implement a PTP monitoring solution

- Monitor critical parameters
 - GM ID
 - Locked status
- Detect changes in the system

- SMPTE has DG working on PTP Monitoring (RP 2059-15)
 - Coming up with standardize parameters and encoding to monitor
 - YANG Model
 - Public Committee Draft (PCD) - <https://github.com/SMPTE/rp2059-15>

- Monitoring data collector

Summary of Best Practices

Network Architecture/Topology

BP#1 - Solid Network and PTP Foundation

BP#2 - Network Considerations - Choose a Routed Network

BP#3 - Network Considerations - Working with Layer 2

PTP Network Architecture/Topology

BP#4 - Use Boundary Clock Everywhere that you can

BP#5 - Use Only PTPv2 and Avoid PTPv1

BP#6 - All GMs must have the same time

BP#7 - Each site should have their own active GM

BP#8 - PTP links between both ST 2022-7 sides

Summary of Best Practices

PTP Configuration

BP# 9 - Use ST 2059-2:2021 Profile Default Values

BP#10 - Enable ST 2059-2 TLV messages

BP#11 - Use “ptp role leader” on All Media Node facing ports

BP#12 - Set the PTP Domain 1-126 (not 0 or 127)

BP#13 - Devices at the same level have same P1 and different P2

Commissioning and Operation

BP#14 - Do proper Commissioning

BP#15 - Implement a PTP monitoring solution

PTP is THE most important multicast flow on your network!

If these Best Practices are followed, PTP works very well

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