How Long to Propagate Synchronized Time Through a Network?
Propagation of Synchronized Time Through a Network

Tinst_sync_{Relay1A} depends on time recovery algorithm
Tinst_sync_{Relay1B} depends on time recovery algorithm
Tinst_sync_{EndInst} depends on time recovery algorithm

Tres_{Relay1A} max residence time can be estimated per 802.1Qch
Tres_{Relay1B} max residence time can be estimated per 802.1Qch
Tlink link delay
Propagation of Synchronized Time Through a Network

• **Components:**
  
  • Link delays ($T_{link}$)
  
  • Time to send a Sync message through each Relay instance ($T_{res}$):
    • 802.1Qch cyclic-queuing and forwarding mechanism could be used to determine the maximum residence time per Relay Instance
  
  • Time for each PTP instance to synchronize ($T_{inst\_sync}$):
    • If low-pass filtering is not used in time recovery algorithm:
      • $T_{inst\_sync}$ can be small (time for a few Sync messages and a few Pdelay message exchanges)
    • If low-pass filtering is used in time recovery algorithm:
      • $T_{inst\_sync}$ depends on the filter’s time constant
    • What effect does the ppm offset of local oscillators have?
      • Affects initial magnitude of error in rateRatio value
Propagation of Synchronized Time Through a Network

- Result:
  - Time to propagate Sync through a network of PTP Instances \( (T_{sync}) \):
    - Is the result a linear sum of the components?
      \[ T_{sync} = \sum T_{link} + \sum T_{res} + \sum T_{inst\_sync} \]
    - Or would all PTP instances converge simultaneously?
      \[ T_{sync} = \sum T_{link} + \sum T_{res} + \text{MAX}(T_{inst\_sync}) \]