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Evolution of Timing Adoption In Mobile Backhaul

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Timing Adoption in Mobile Backhaul Networks



- TDM networks
 - SONET/SDH
- Packet Networks

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- Direct GNSS hook up
- Synchronous Ethernet (G.8261, G.8262)
- PTP over unaware IPv4 network (G.8265.1)

- GNSS
- PTP
 - Full Path Support (FTS G.8275.1)
 - Partial Path Support (PTS G.8275.2)
 - Assisted Partial Path Support (APTS -G.8275.2)

Phase Sync deployment models





Time-sync in Advanced Packet Network Deployments





Time-sync challenges in Advanced Packet Network

PTP time-sync challenges

- Time-sync as a service
 - Same as data packet path no specific overlay timing network
 - Required to go through time unaware nodes wherever possible
- Topology

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- Ring topology for link and node failure protection
- Quick convergence including time-sync
- Mixed transport
 - No more single transport domain (Combination of IPv4, IPv6, L2 & MPLS)
 - No more localized to Access or Edge network, spans from Core network
- Advanced Network adoption
 - Not plain vanilla IP or L2 network
 - PTP over multiple VLANs, IRB, VRF, Link Aggregation



Timing deployment models at different regions of the world

Deployment across the world

Current and/or future

- AMERICA
 - Linear/Tree topology
 - GNSS/GPS and APTS (over backhaul service) → Macro Cells
 - GNSS/GPS and PTS or FTS \rightarrow Small cells indoor
 - Small percentage of PTP based on FTS
- ASIA
 - Ring and Linear/Tree topology
 - GNSS, PTP + Sync-E in FTS and PTS network
 - Predominately IPv4 and IPv6 network both for Data and Time-sync
- EMEA
 - Linear/Tree, Ring and Ladder topology
 - Sync-E, PTP and combined mode of operation

AMERICA : PTP with Edge GM or Direct GPS





AMERICA: APTS Network



EMEA – Ladder topology

- Core nodes CR-1 and CR-2 source PTP (Blue line) and Sync-E (Green line) from two redundant GM/PRCs
- Time flow is uni-directional from Core (CR) to Aggregation nodes (AG)
- Access / pre-aggregation nodes (CSR) form semi-rings with bi-directional time-flow
- Every node in the ladder operates in combined PTP and Sync-E mode with full redundancy for both data and timing flows



EMEA – Ring and Linear



- R-B is Router in Boundary clock mode of operation
- CSR-T is CSR in Transparent clock mode of operation
- CSR-B CSR in Boundary clock mode of operation
- CSR-T/B CSR acting as Boundary node for BTS/eNodeB, and acting as Transparent clock within Ring
- AE Aggregated Ethernet between two R-B

ASIA : Ring topology – Macro and Small cells



ASIA : PTP over IRB for small cells in PTS network





SUMMARY

- There is a huge momentum for Timing and Synchronization (PTP and Sync-E) adoption in mobile backhaul networks
- Time-sync using PTP is expected as one of network service offerings
- Even advanced packet networks are adopting time-sync using PTP across multiple transport and network domains
- Every region uniquely show cases different deployment topologies
- It is expected that PTP to operate on VLANs (Tags), PTPoE, PTPoIPv4, PTPoIPv6, LAG, MC-LAG, IRB etc.
- PTP is becoming the preferred method to provide time-sync for small cells deployment



Thank you