ITSF 2016



Time for a Smart Future

Deployment Experience of Phase Synchronization

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Last year recap

New interesting use cases and deployments

Advancements in time-stamping logic

PTS deployment



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Phase sync deployments in advanced packet networks

- America, APAC and EMEA regional based time-sync deployments
- PTP in linear, tree and ring topology
- PTP and Sync-E combined mode of operation
- APTS deployment
- Different PTP transport mechanism

Note: please refer to backup slides for last year deployment scenarios

Time-sync in Advanced Packet Network Deployments





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PTP and SyncE in opposite direction

Good redundancy without redundant GM



PTP over VRRP

- BC1 and BC2 are VRRP peers
- One IP and one virtual MAC towards TC
- All CSRs (OC/BC) see BC1 and BC2 as single node (Master)
- BC1 and BC2 Master port must advertise same clock-id (virtual-id), maintain sequence number continuity in case of failure, needs constant object sync
- Only one BC's Master port must be active at any given time



PTP over LR (Logical Routers)

- AG1 and AG2 with Logical Routers (LR1, LR2)
- AG1 and AG2 are BC
- Single PTP domain but multiple logical domains
- Sync clock/GM attributes across LRs and main instance
- Slave and Master parts can be in two different LRs



Phase sync using BC and TC on a single node

- Edge routers act as BCs and connect to GM
- CSR routers act as TC to other CSRs and BC to downstream Small cells (S)
- CSR peers directly to Edge routers via other CSR acting as TC
- Fast convergence during link or node failure inside the ring
- Higher scale more clients can be supported







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Evolution of Time stamping points in a node/device



Time stamping methods – Transparent Clock



Time stamping parser logic in PHYs

- Packet Parsing logic A logic to scan and identify the <u>PTP packets</u> at the Ingress and/or Egress of a port, based on programming attributes in the PHY parser block.
- Single/dual VLAN tags but restricted to one or two Trunking Protocols TPIDs
- Typical transports: PTPoE, PTPoIPv4, PTPoIPv6
- MPLS: one to three labels
- Only PTP packet time-stamping and parsing is possible
 - OK for synchronization not for analytics and other applications.

Advanced Time Stamping Logic

- Time stamp all PTP packets in ingress and egress direction
- Time stamp all data packets using PTP recovered time in both ingress and egress directions for analytics
- Selective time-stamping per stream
- Support both "in-line CF" and "Reserve field" based TC modes
- Time stamp at line rate

Time stamp all PTP packets irrespective of:

- Transport
- Number of VLAN tags
- Different TPID
- Number of MPLS label
 - GRE tunnel
- IPoIP
- VxLAN (MAC over IP)
- MAC-in-MAC (PBB)
- Anything else?

High end routers need for advanced times tamping logic





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Backup slides

PTP/Sync-E deployment across the world

- AMERICA
 - Linear/Tree topology
 - GNSS/GPS and APTS (over backhaul service) → Macro Cells
 - GNSS/GPS and PTS or FTS → Small cells indoor
- ASIA
 - Ring and Linear/Tree topology
 - GNSS, PTP + Sync-E in FTS and PTS network
 - Predominately IPv4 and IPv6 network
- 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 – Ring and Linear



ASIA : Ring topology – Macro and Small cells



Assisted Partial Timing Support (PTS) in T-BC and T-TSC clocks



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
- Combined mode of operation





JUNIPE

ASIA : PTP over IRB for small cells in PTS network

