draft-huang-detnet-xhaul-00

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Ethernet Based Fronthaul and Backhaul

- Ethernet can provide many advantages

  Flexible, widely used, low cost …
- Ethernet based Backhaul is a mainstream solution

  IP RAN, PTN, etc.
- Ethernet Based Fronthaul

  Promising, with challenges: delay, jitter, synchronization
- Integrated Fronthaul and Backhaul based on Ethernet
  - Interest in the industry: operators, vendors, research project (such as 5G-PPP XH AUL)
  - Stringent requirements in Fronthaul, research on alternatives is ongoing; in the future, some new applications require very low E2E latency; FH/BH may have similar requirements in the future.
  - Various types of traffic in a network, with network slicing support

Ethernet or MPLS or IP ?

- Pinned Path
  - MAC forwarding path is usually not pre-determined
    Well, of course, SDN MAY configure the MAC forwarding table to establish a pinned path but not yet widely accepted.
  - MPLS
    Pinned path is usually used in MPLS (TP) [Architecture draft]
    Static path definition or dynamic (IP / MPLS) path definition
  - IP
    Path definition based on IP routing table
    Routing table generated by protocols (OSPF, etc.), or configured by SDN controller
- Slicing
  - VLAN for Ethernet, small network
  - MPLS Label
  - Multiple routing instance for IP

Ethernet or MPLS or IP ?

- QoS – resource reservation to avoid congestion
  - RSVP for IP
  - RSVP-TE for MPLS
  - PCE
- Protection
  - Linear protection [ITU-G.8031] and ring protection [ITU-G.8032]
  - Fast ReRoute for IP and IP-MPLS
  - MPLS-TP can support multiple levels protection: LSP, PW and sector, Linear protection [ITU-G.8131]
- Conclusion

  MPLS (over Ethernet) should also be considered besides native Ethernet for Fronthaul and Backhaul.

Fronthaul Encapsulation

- One encapsulation for all?
  - IEEE 1904.3 is defining encapsulation for Radio over Ethernet
    Is same encapsulation OK for “Radio over MPLS“ too?

- CPRI Aware or Unaware
  - CPRI Aware
    1. Compression may be considered – but it isn’t the RRU a better place?
    2. CPRI is not fully standardized, difficult to interpret.
    3. How about possible future non-CPRI traffic?
  - CPRI Unaware
    Decouple the transport network from service; avoid the interference of CPRI upgrade

Packet Loss due to BER

- CPRI over Ethernet will have a packet loss problem due to BER
- Cut-through forwarding does not check the FCS, but still can not resolve packet lo ss issue
- One bit error will lead to 1500byte or 9000byte (jumbo) CPRI data loss (encapsula tion not included, to simplify calc)

Equivalent BER is: link-BER * packet-size = 10E-12 * 1500 * 8 ?

not exactly, from the consequence point of view:

1. FEC (such as turbo coding in LTE) can resolve part of the BER problem
2. FEC can do little to block data loss; HARQ retransmission should handle this.

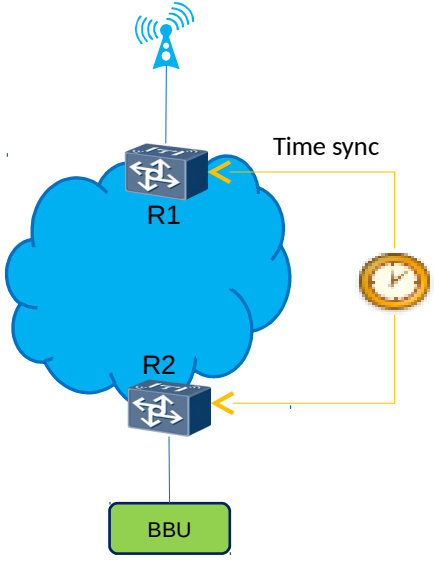
But, how many retransmissions will be required? Ethernet frame/CPRI frame / wireless (LTE) frame / various encoding algorithms … a lost data block may impact multiple frames. LTE allows maximum 10% BLER.

Need further study!

Synchronization for Re-timing

- CPRI requires ±8.138ns one way jitter, and ±16.276ns round-trip jitter
- Re-timing maybe considered to reduce jitter
- Time synchronization is required at the ingress and egress node.

What is the maximum allowed TAE, or maybe the variation of the (aligned) time?



Questions
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