Application of Ethernet in Mobile Backhaul Network

Xinyuan Wang

HUAWEI TECHNOLOGIES CO., LTD.

HUAWEI

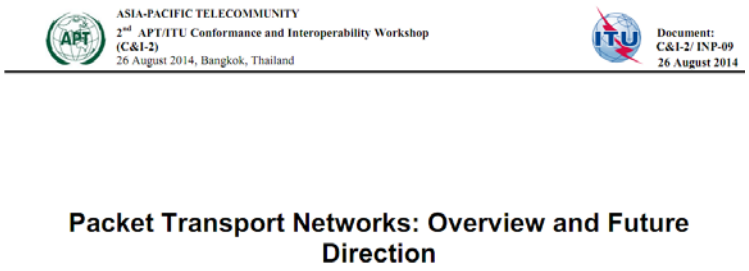
Background

- In IEEE 802.3 NG-ECDC meeting at San Antonio TX, question raised about the physical layer solution in Mobile backhaul network
  - Ethernet or DWDM?
- This contribution gather public information and document to further explain that Ethernet is popular solution in this application

Architecture of Mobile Backhaul Network

- PTN:
  - Packet Transport Network
  - MPLS-TP (Transport Profile) technology
  - Standardized in ITU Q10/SG15
- IP RAN
  - IP Radio Access Network
  - IP/MPLS technology
  - Most protocol defined in IETF
- Telecom carrier deploy PTN or IP RAN based on particular network requirement
  - Physical layer solution is similar

General Introduction of PTN


ASIA-PACIFIC TELECOMMUNITY
2nd APT/ITU Conformance and Interoperability Workshop (C&I-2)
26 August 2014, Bangkok, Thailand

Document: C&I-2/ INP-09
26 August 2014

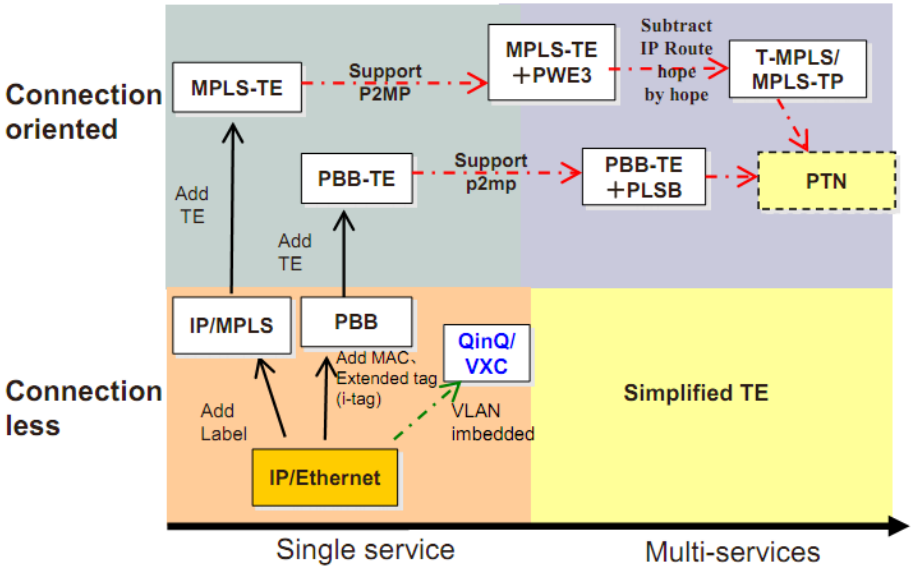
Packet Transport Networks: Overview and Future Direction

https://www.itu.int/en/ITU-T/C-I/interop/Documents/20140826/CI-2_INP-09_Packet_Transport_Networks_Overview_and_Future_Direction.pdf

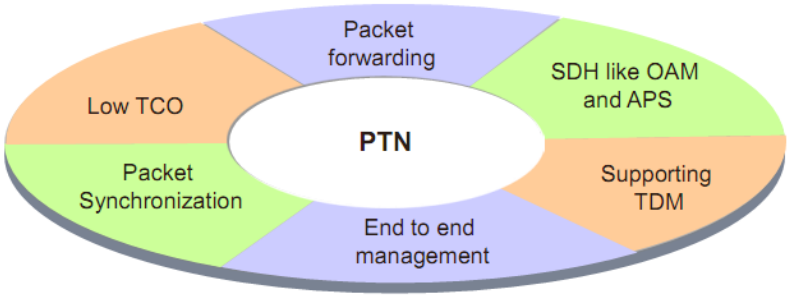
- The number of Internet protocol (IP) services continues to increase drastically, and telecom carriers have been willing to efficiently accommodate their client traffic. Packet network technologies including Ethernet and multiprotocol label switching (MPLS) were introduced in response to such a demand;
- MPLS-TP is a new packet transport network technology that uses existing MPLS data-forwarding mechanisms with enhancements based on technology proven in carrier-grade Ethernet services and legacy transport networks.

PTN Technical Evolution

PTN Technical Evolution



Transport & Data Converged Technology



PTN is a blend of grouping of Ethernet and IP/MPLS technology advantage, improve connectionless, the shortcomings of the OAM, protection and network management is weak.

- PTN is emerging, based on the grouping, connection-oriented uniform transmission technology, the IP/MPLS technology simplified (IP by jumped forward, the last pop-up, equivalent multipath, etc.) and improvement (OAM, protection and network management.

12

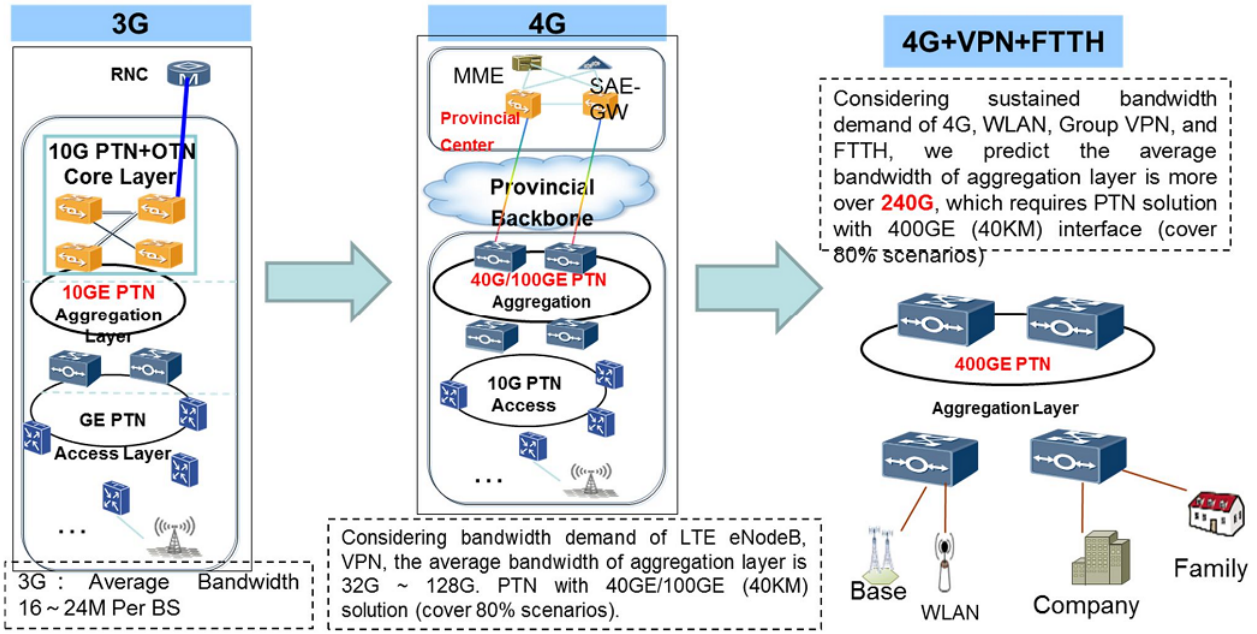
https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Session%209-1%20ITU-T%20G.8113.1%20Part%20I-Li%20Fang%20%E6%9D%8E%E8%8A%B3.pdf

PTN in CMCC: Ethernet and Dark Fiber Connection

- In "huang_ecdc_01_0716":

Link Scenario in Mobile Broadband Backhaul Network

- Based on Ethernet technology, we choose PTN to build the mobile backhaul networks of China Mobile
- Because backhaul network is in metro area, where is usually lack of OTN, most of link between PTN nodes are direct fiber connection
- With the large scale deployment of TD-LTE, PTN is evloving from 10GE to 40GE/100GE, and we believe 400GE will be necessary in the near future



IP Ethernet in Mobile Backhaul Infrastructure (2010)

Summary

- Backhaul costs are the principal driver, due to traffic growth
- Operators are making the investment to move to the IP/Ethernet backhaul networks
- IP/Ethernet backhaul
  - Solves ARPU-traffic disconnect today
  - Solves backhaul problem for HSPA today
  - …and LTE tomorrow

http://www.comsocscv.org/docs/Workshop_062410_Infonetics.pdf

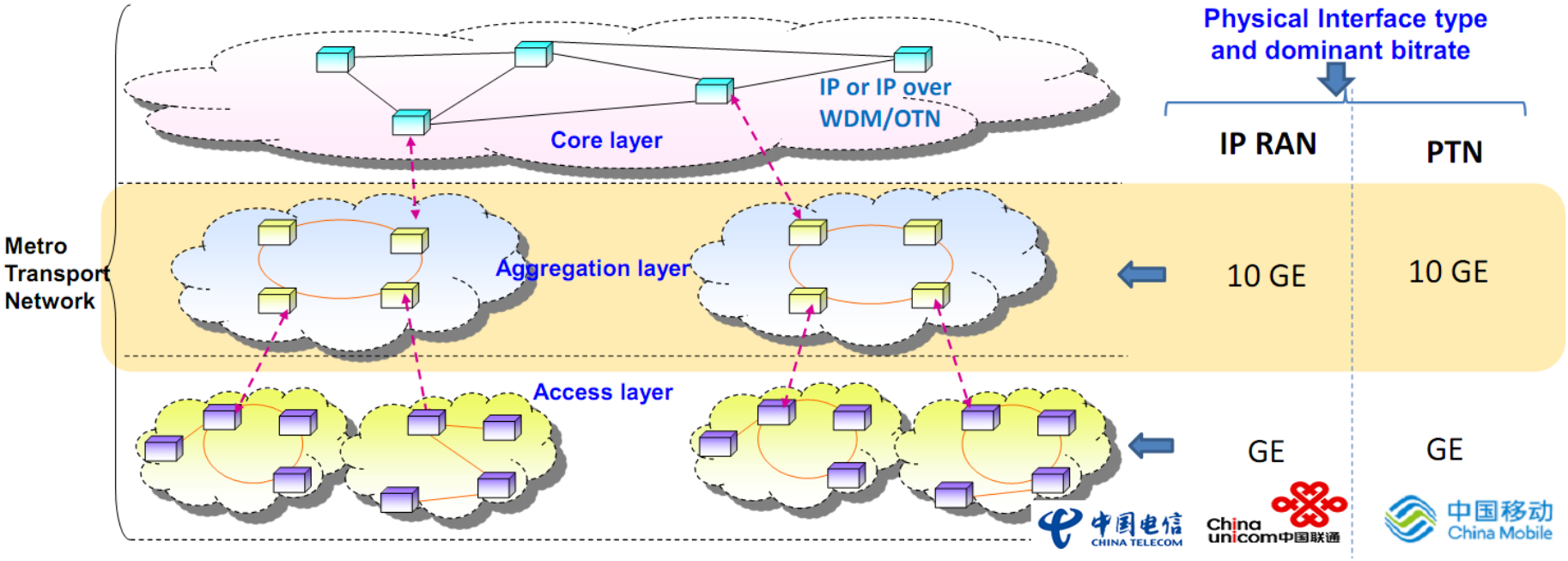
Academia of Carrier Ethernet for Mobile Backhaul

- In “IEEE Communications Magazine Year: 2010, Volume: 48, Issue: 10”, several publication on Carrier scale Ethernet
  - http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=5594663
- “Carrier ethernet for mobile backhaul ” by Peter Briggs, Ericsson UK, Rajesh Chundury, Ericsson USA, Jonathan Olsson, Ericsson Sweden
  - http://ieeexplore.ieee.org/document/5594683/
- “Mobile broadband backhaul network migration from TDM to carrier ethernet” by Zere Ghebretensaé, Ericsson Sweden, Janos Harmatos, Ericsson Hungary, Kåre Gustafsson, Ericsson Sweden
  - http://ieeexplore.ieee.org/document/5594684/

IP RAN in China Telecom and China Unicom

Metro transport network status in China

Typically ,metro transport network is divided into three sublayers in China operators, i.e., core layer, aggregation layer and access layer ,and the last two layers are mainly used to provide transport function with different technology (IP RAN and PTN) for mobile back-haul and IP Router/switch for fixed Broadband ,etc..



http://www.ieee802.org/3/ad_hoc/ngrates/public/16_07/zhao_ecdc_01_0716.pdf

NGMN White Paper: LTE Backhauling Deployment Scenarios

- "For the sake of simplicity all scenarios have been defined only on top of Ethernet (IEEE 802.3), as it is expected to be the dominant transport technology in future. Other technologies can be considered as well, and at the end of section 5.2.2 an example with DWDM is given. The use of Ethernet interfaces has been also assumed for all base station and controller types. With LTE this is anyhow the only defined transport interfaces and more and more 3G as well as 2G systems are moving towards Ethernet connectivity."

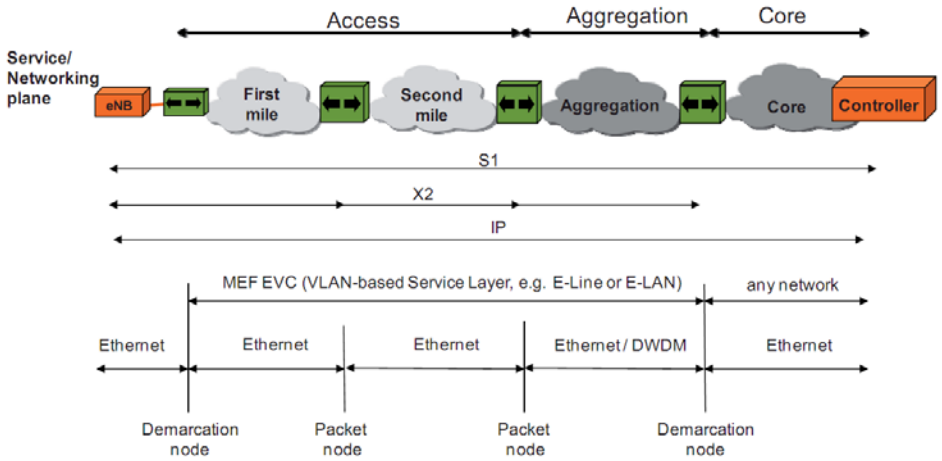


Figure 6: Backhaul Scenario based on Carrier Ethernet

https://www.ngmn.org/uploads/media/NGMN_Whitepaper_LTE_Backhauling_Deployment_Scenarios_01.pdf

- Observation: Ethernet is best solution in Access. In Aggregation, both of Ethernet and DWDM are candidate solution, low cost and technical feasibility will enable marketing selection and deployment.

Summary

- Ethernet already deployed as main stream connection in current Mobile Backhaul Network
- 40km reach in IEEE 802.3 50/200/400GbE standard is needed for mobile application, especially future 5G

Thank You