Bidirectional 10&40 km Optical PHY for 50GbE

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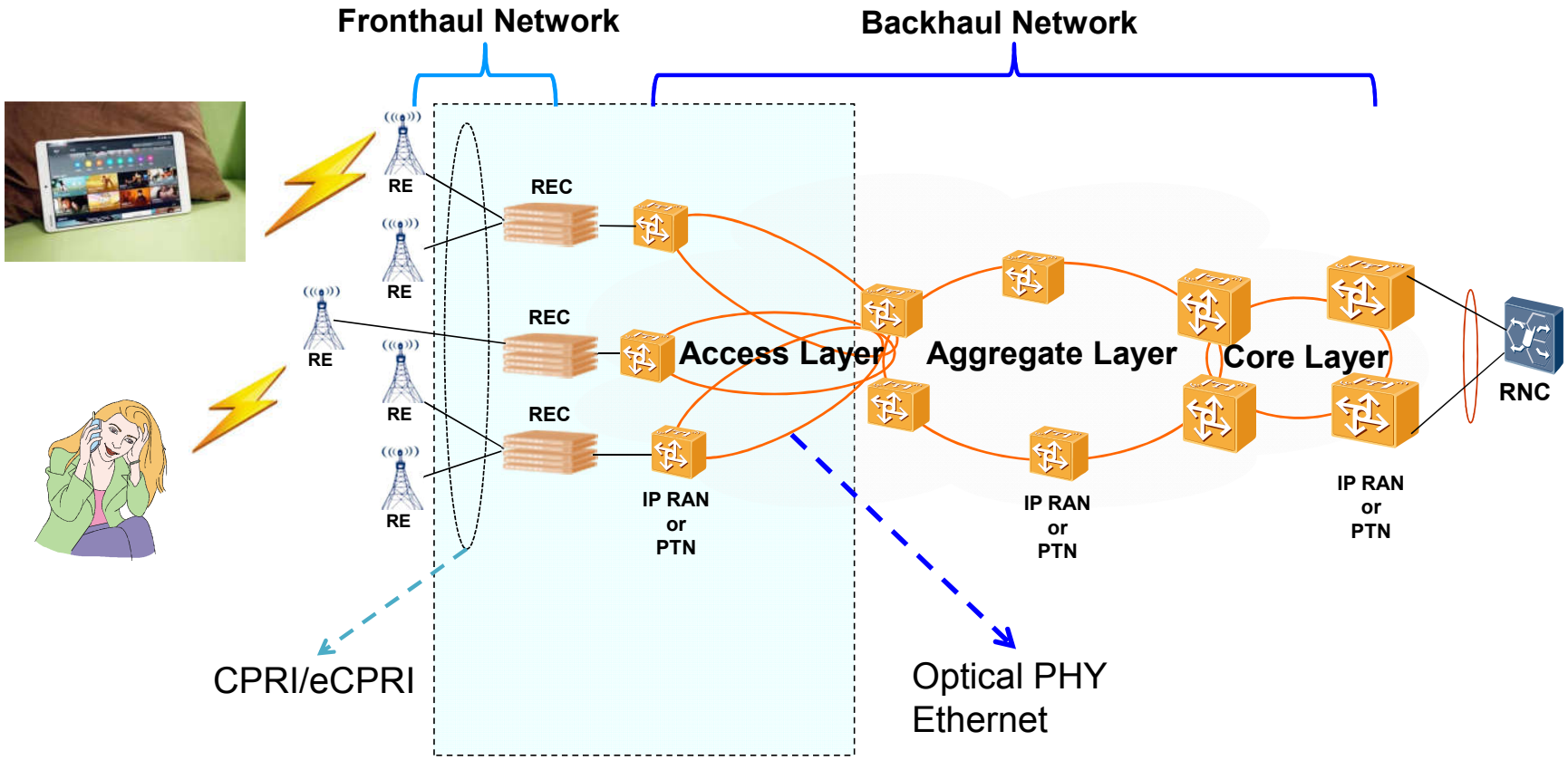
Background

- In IEEE 802 March plenary meeting， “Call For Interest Bidirectional 10Gb/s and 25Gb/s optical access PHYs” is accepted for optical access application and Study Group initiated
  - http://www.ieee802.org/3/NGBIDI/index.html
- For beyond optical access application, bidirectional optical PHY product, such as 1GbE/10GbE, is already deployed in some providers, Ethernet network for campus and enterprise.
- 50Gbps PAM4 based Ethernet standard is defined in 802.3bs/cd for 50/200/400GbE 10km.
- For beyond 10km optical PHY study group, 40km reach Objective of 50/200GbE is accepted.
- This contribution further present other application scenarios information of potential bidirectional 10&40 km Optical PHY for 50GbE objective.

Application of Mobile Fronthaul and Backhaul



- Potential application for bidirectional Optical PHY in mobile fronthaul and backhaul network.

Higher Bandwidth Challenge of Mobile Fronthaul

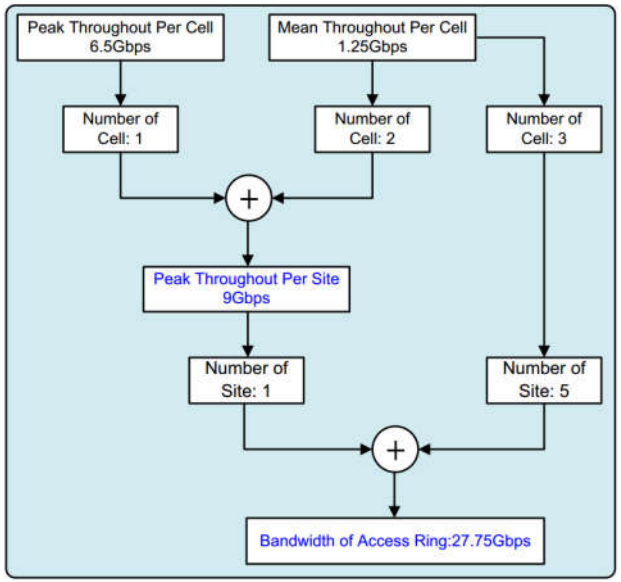
- CPRI interface in fronthaul require higher bandwidth in optical link
- IEEE Communications Magazine(February 2016) "An Overview of the CPRI Specification and Its Application to C-RAN-Based LTE Scenarios"
  - CPRI CPRI Technical Working Group already define upto 24330.24Mbps
  - Moreover, the upcoming 5G RANs, where 100 MHz channels with massive MIMO are envisioned, may require several tens or even hundreds of gigabits per second capacity in the fronthaul . As an example, an 8X8 MIMO Antenna covering four sectors produces 32 AxCs, which translate into around 32 Gb/s for 20 MHz bandwidth channels. In the case of 100 MHz LTE channels, this same scenario requires five times (i.e., 160 Gb/s) the revious CPRI band-width.
- "Industry leaders agree to develop new CPRI Specification for 5G"
- The target of the eCPRI Specification is to offer several advantages to the base station design:
  - The new split point enables ten-fold reduction of the required bandwidth
  - Required bandwidth can scale flexibly according to the user plane traffic
  - Use of main stream transport technologies like Ethernet will be enabled
  - The new interface is a real time traffic interface enabling use of sophisticated coordination algorithms guaranteeing best possible radio performance
  - The interface is future proof allowing new feature introductions by SW updates in the radio network

50GE in Access layer of Mobile Backhaul

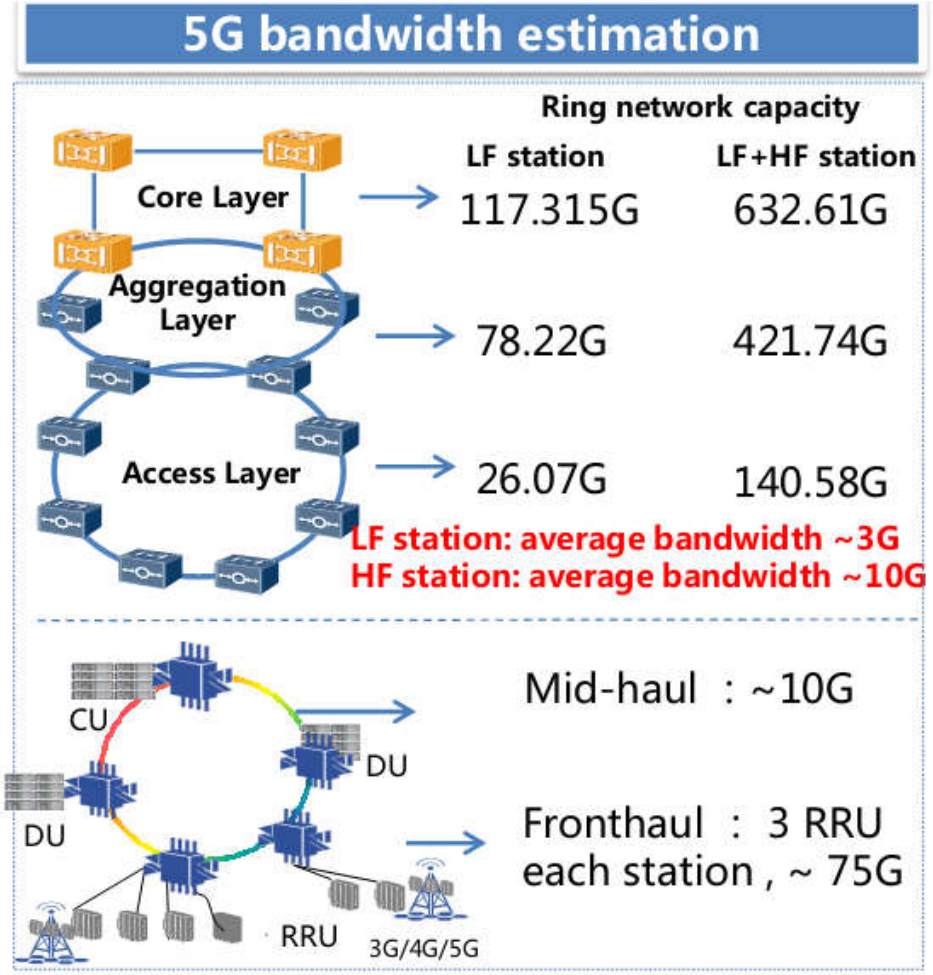
- In "wang_ecdc_01a_1116", the following information support a 50GE at access ring with same physical link when 4G upgrade to 4G+/5G 1st stage.

Bandwidth in Access Ring of 5G Mobile Backhaul Network

- For Ring topology in Backhaul network:
  - Multiple sites will share one physical/logic link
  - Per statistics multiplexing mechanism, bandwidth forecast depend on air interface, subscribers behavior
- Typical example for access ring bandwidth:
  - 6 sites per Ring
  - 3 LTE/5G Cells per Site
  - LTE: 5X20MHz carrier
  - 5G :100MHz carrier



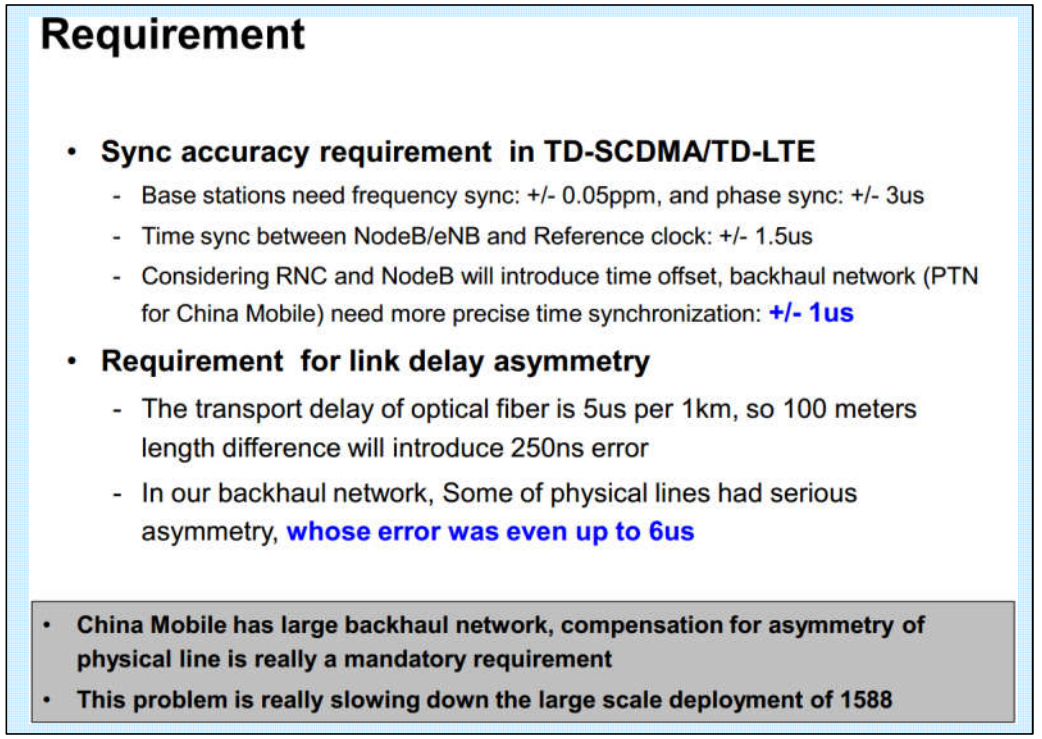
- In carrier network, 50GE is required in this case as service guarantee requirement



Benefit of Bidirectional 10&40 km Optical PHY in Mobile Backhaul

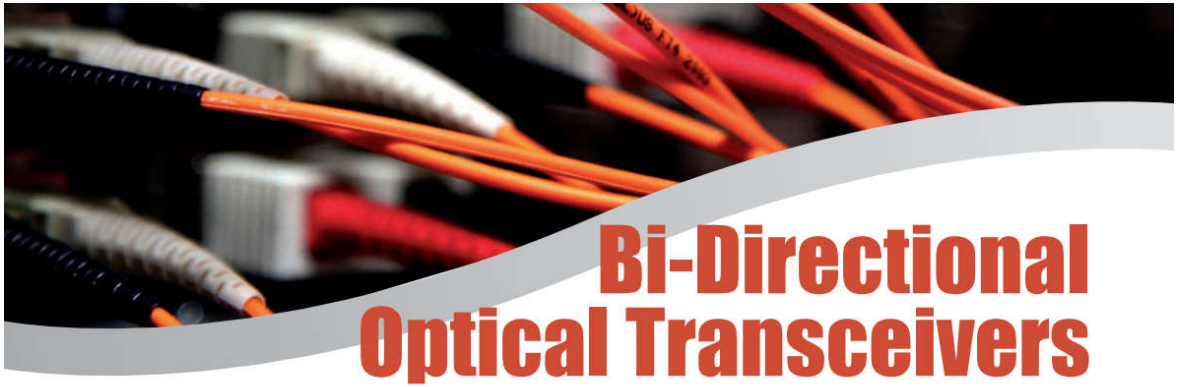
- As lack of fiber and expected bandwidth for mobile application, bidirectional optical PHY of 50GE can provide upgrade solution from most popular NX10GE, furthermore potential to reach 100GE with two 50GE bidirectional 10/40km optical link bonding.

- Another key benefit of BIDI in mobile application: To benefit IEEE 1588 time synchronous deployment, as provide identical latency rather than by duplex optical PHY with different fiber length at TX and RX side.
  - Time synchronous is mandatory in LTE-TDD/Advanced and 5G.
  - No link asymmetry issue with BiDi Optical PHY



http://www.ieee802.org/1/files/public/docs2014/asbt-huang-measurement-of-link-delay-asymmetry-0714-v01.pdf

Application of Bidirectional Optical PHY in Internet Exchange



Bi-Directional Optical Transceivers

LINX is offering a new fibre service to members which utilises the benefits of Bi-Directional Optical Transceivers.

What is a Bi-Directional Optical Transceiver and How does it work

When connecting to the London Internet Exchange most members will connect using a fibre pair or cross connect. One fibre is dedicated to receiving data from network equipment and the other fibre will be dedicated to transmitting data to the network. Bi-directional optical transceivers (or Bi-Di transceivers for short) allow both the transmitting and receiving of data on a single fibre.

This is achieved by splitting the light into different wavelengths using wave division multiplexors (WDM). Bi-Di transceivers must work as a matched pair having the correct receive and transmit wavelength.

Usual naming convention has one device referred to as upstream and one as downstream. For delivery of the LINX Bi-Di product LINX will always be the downstream device. The member will have to purchase the corresponding downstream device. The wavelengths of its Bi-Di transceivers are as shown in the table on the right.

Benefits of Bi-Directional Optics

- Reduced interconnect costs
- Double the capacity of each cross connect
- Optical Distribution Frame (ODF) port reduction
- Conduit space saving
- Ports charged at the same rate as traditional optics

Port Size	Member Side "Upstream"		LINX Side "Downstream"	
	Transmit (nm)	Receive (nm)	Transmit (nm)	Receive (nm)
1GE	1310	1490	1490	1310
10GE	1270	1330	1330	1270

https://www.linx.net/wp-content/uploads/2017/08/bi-directional-optics-datasheet.pdf

Summary

- This presentation introduce further applications of 50GE 10/40km Bidirectional optical PHY in Mobile transport and internet exchange, suggest Study Group to discuss it as an objective.
- Key issues to be solve by Bidirectional 50GE optical PHY:
  - Higher bandwidth in Mobile transport
  - Lack of fiber in physical link layer
  - Asymmetric in time synchronous of IEEE 1588 in duplex PHY


thank you
danke
謝謝
ngiyabonga
teşekkür ederim
спасибо
gracias
dank je
tapadh leat
mochchakkeram
go raibh maith agat
dziękuję
bedankt
obrigado
sukriya
kop khun krap
arigatō
takk
dakujem
grazie
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