IFS Stretch for WAN

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Supporters

- Hugh Barrass – Cisco
- Chris Cole – Finisar
- Koichiro Seto – Hitachi Cable

What, How, and Why

- Our Purpose
  - Provides future-proof LAN/WAN interworking
    - by supporting the simplest mechanism for WAN interoperability
    - Regardless of 100G-only or 100G-and-40G
- Our Approach
  - UNI-PHY
    - LAN-PHY with Inter-Frame-Spacing (IFS) stretch options
- Merits
  - Leverage install-base WAN infrastructure
  - Enhance 100G/40G LAN-PHY market

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Recap of 10GE WAN-PHY

- MAC
  - reduced 9.3G effective data rate by IFS stretch
- XGMII/XAUI
  - 10.00G MAC/PLS interface same as LAN-PHY
- PCS
  - 64B/66B same as LAN-PHY
- WIS
  - map into 9.58G STS-192c SPE of 9.95G OC-192
    - SPE: Synchronous Payload Envelope
  - effective data rate is 9.3G (= 9.58G x 64/66)
- PMD
  - dedicated 9.95G WAN-PHY, different from 10.3G LAN-PHY

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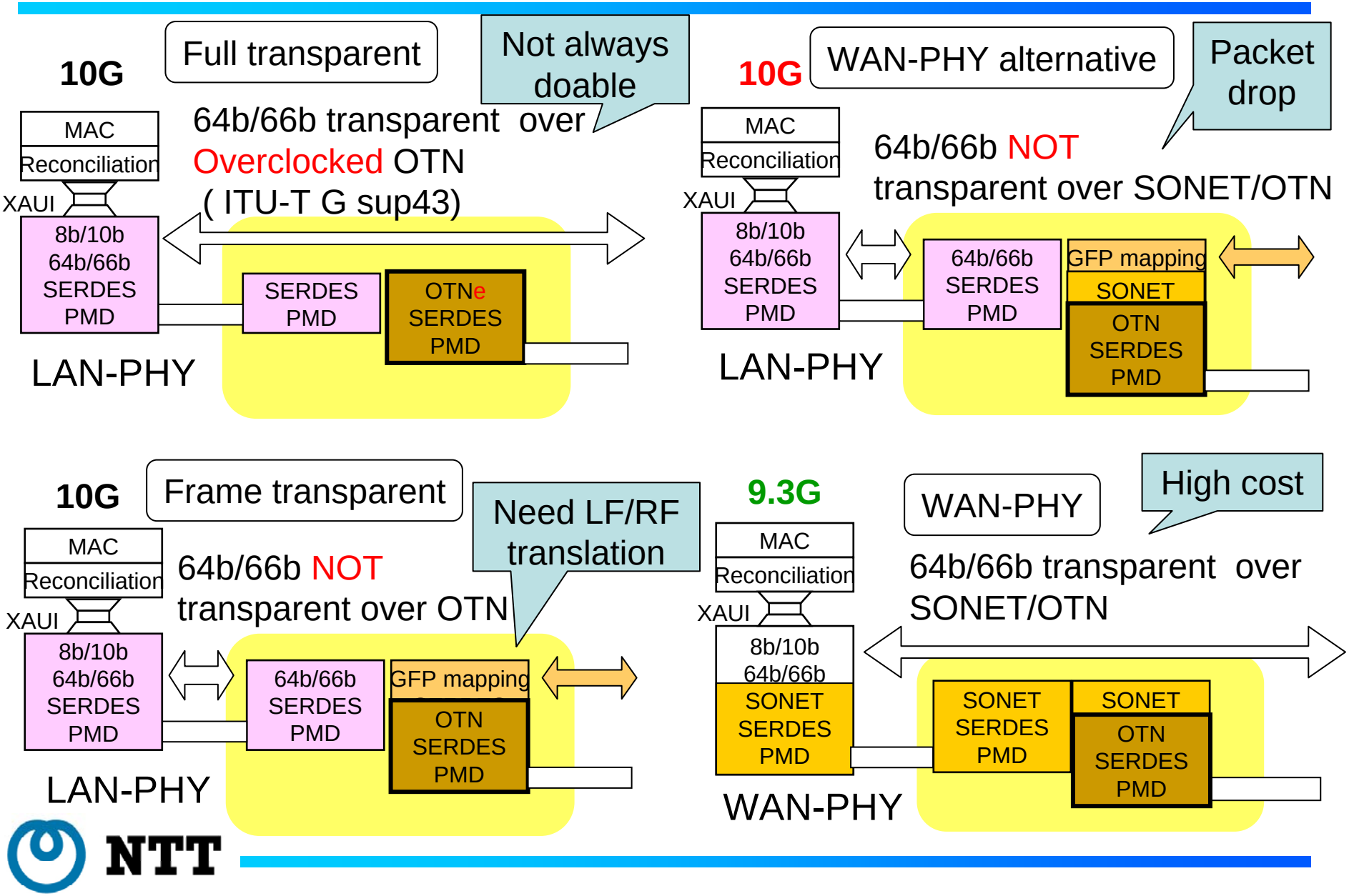
Access Provider's Issues on 10GE

- WAN-PHY is solely for interworking
  - small volume, less competition, higher cost
    - Users prefer LAN-PHY as User Network Interface (UNI)
- Rate mismatch between LAN and WAN sometimes drops user packets unexpectedly
  - LAN-PHY inevitably allows frame bursting, i.e. instantaneous 10G full-rate operation
  - WAN transponders sometimes drop user frames due to the limited buffers
- 10GE accommodation has too many options!
  - See next two slides

10GE Transponder Varieties



Each 10G mapping has its weakness

- Full transparent - 11.1G OTU2e clocked up from standard 10.7G Optical Transport Unit (OTU2)
  - OTU2e is defined in ITU-T G.Sup43 (10G Base-R in OTN)
  - Limited install-base compatibility
    - Only for End-to-End transparent systems (ROADM, P2P WDM)
- Frame transparent - GFP mapping into 10G Optical Payload Unit (OPU2) of 10.7G OTU2
  - IFG and preamble have to be removed
  - Link Fault Signaling (LFS) must be somehow translated
- WAN-PHY alternative - GFP mapping into 9.58G STS-192c SPE of 9.95G OC-192
  - Not fully transparent (ibid), and sometimes drop frames
- 802.3ae's favor - WAN-PHY
  - Far from success ……

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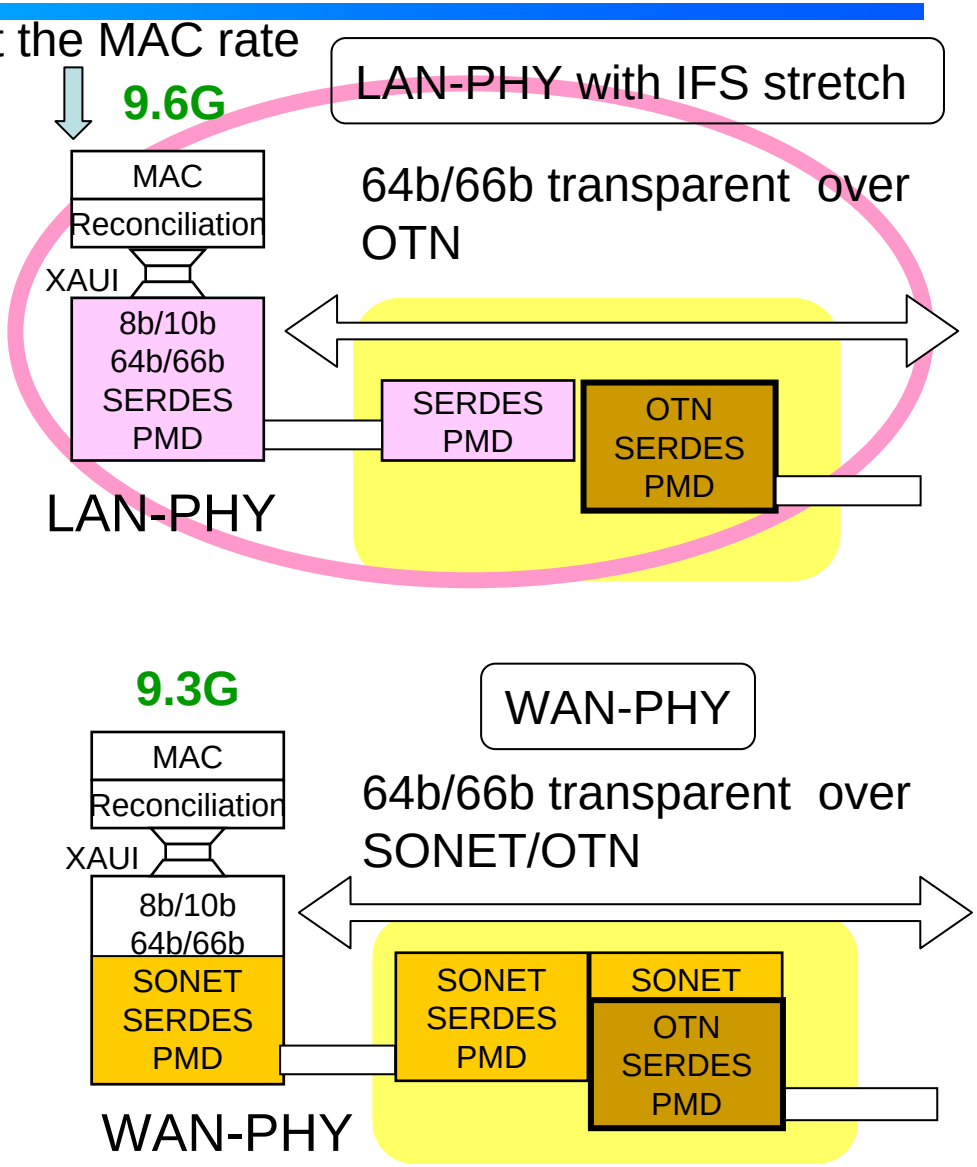
What we need was Std way to “IFS stretch”

- In 10GbE, we simply need a standardized way to set & monitor the “IFS stretch mode” that is defined in Clause 4.4.2 “ifsStretchRatio”
  - e.g, via MDIO interface (Cl.45)
    - Define “Rate Type” R/W register instead of “PHY type”

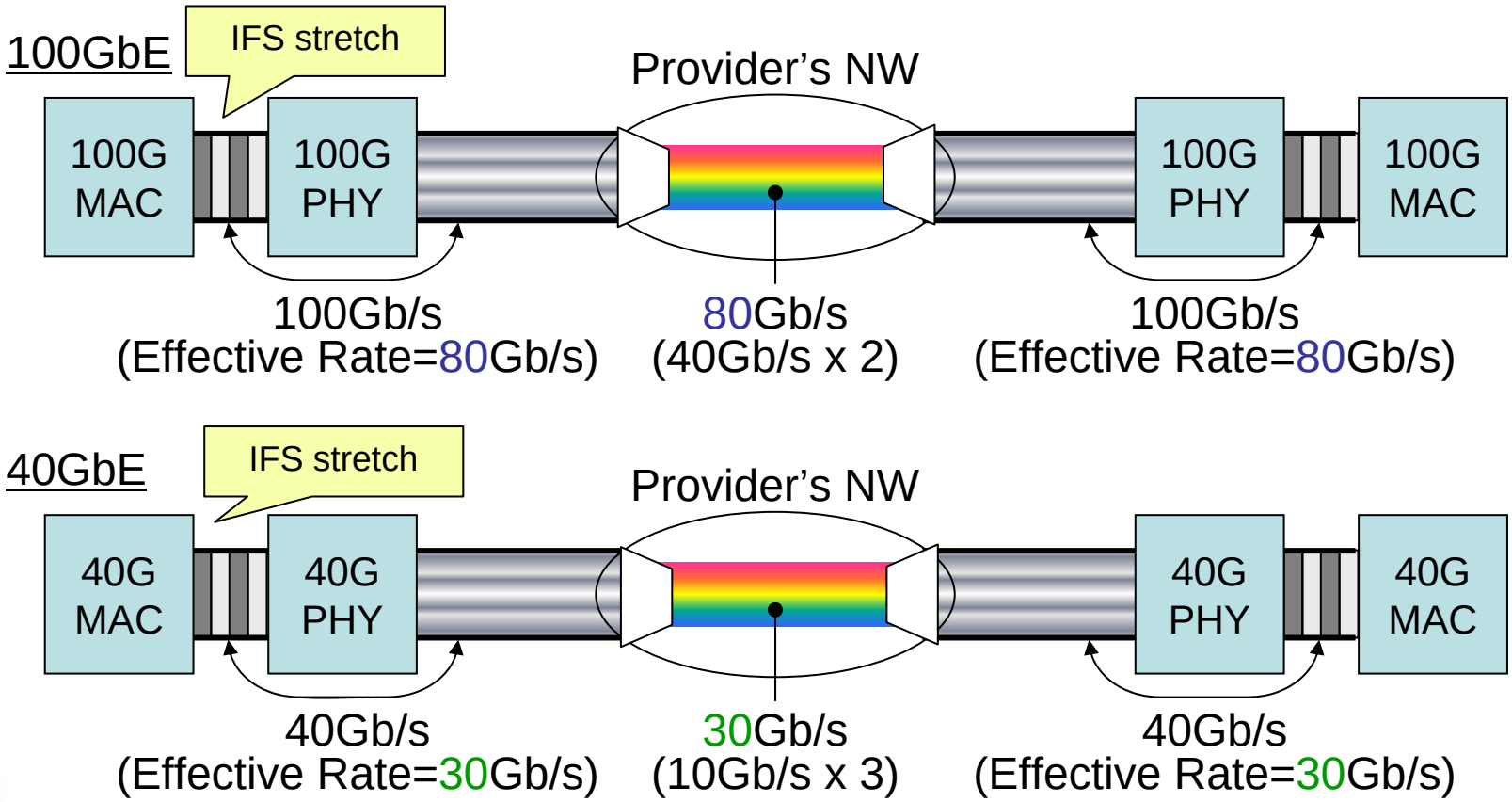


WAN interoperability via “IFS stretch”

Preset effective data rate for ‘tighter pipe’ in Provider’s Network

-simplifies transponders

-Increases LAN-PHY market as transponder UNI



Possible Choices in 100GbE

- LAN-PHY only, no IFS stretch function
  - will make it slow for Ethernet to penetrate into Metro/WAN
- LAN-PHY only BUT with IFS stretch options
  - Allow transparent mapping at
    - 80.3G OPU3-2v (77.9G data rate before 64/66),
    - 40.15G OPU3 (38.93G data rate before 64/66), and/or
    - 38.49G STS-768c SPE(37.32G data rate before 64/66)
  - The better interwork, the broader LAN-PHY market
- LAN-PHY and WAN-PHY
  - What we learned from 10GE is ….
- WAN-PHY only at OPU4 (120G?)
  - Can not fully leverage 10G LAN-PHY stuff

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Possible Choices in 40GbE

- LAN-PHY only, no IFS stretch function
  - will make it slow for Ethernet to penetrate into Metro/WAN
- LAN-PHY only BUT with IFS stretch options
  - Allow transparent mapping at
    - 40.15G OPU3 (38.93G data rate before 64/66)
    - 29.99G OPU2-3v (29.08G data rate before 64/66)
    - 19.99G OPU2-2v (19.38G data rate before 64/66), and/or
    - 38.49G STS-768c SPE(37.32G data rate before 64/66)
  - The better interwork, the broader LAN-PHY market
- LAN-PHY and WAN-PHY
  - What we learned from 10GE is ….
- WAN-PHY only at 40.15G OPU3 (38.93G data rate before PCS, assuming 64/66)
  - Can not fully leverage 10G LAN-PHY stuff

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IFS Stretch Options

- The smaller options, the better market opportunity

- Minimum examples
  - Focus on the simplest accommodation
    - Support LAN-PHY transparent
    - GFP mapping always has better efficiency and hence doable
  - For 100GbE
    - No IFS stretch: full rate for LAN
    - IFS stretch options for
      - *N* x 40G pipes: {1,2} x 40.15G OPU3 (38.93G before 64/66)
      - *N* x 10G pipes: {1,2,…,10} x 9.995G OPU2 (9.70G before 64/66)
  - For 40GbE
    - No IFS stretch: full rate for LAN, and overclocked 44.6G OTU3e
    - IFS stretch options for
      - 40G pipe : {1} x 40.15G OPU3 (38.93G before 64/66)
      - *N* x 10G pipes: {1,2,3,4} x 9.995G OPU2 (9.70G before 64/66)

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Summary

- LAN-PHY with IFS stretch options will
  - allow Ethernet transparency over installed-base WAN
  - avoid WAN/LAN rate mismatch issues
  - provide better WAN interoperability
  - enhance 100G/40G LAN-PHY market as UNI
  - require almost NO additional COST to implement
    - IFS stretch function is already defined in 10G MAC
- We recommend:
  - to support IFS stretch mechanism for WAN interoperability
- Need an objective?
  - Basic concept & mechanism already exist in 10G
  - Might be too minor as an “Objective”
- Let’s continue to discuss in Task Force
  - establish a liaison with ITU-T SG15

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