Reclaim RFoG Spectra for 100G EPON with PON DOCSIS Backhaul

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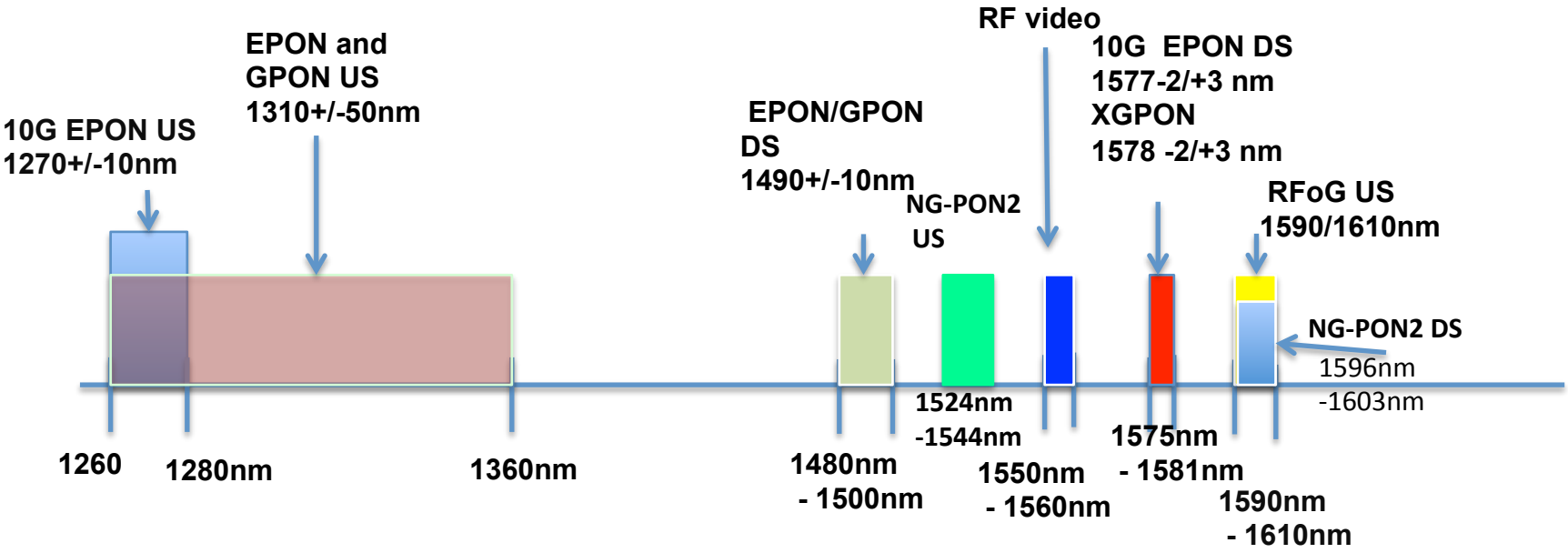
Outline

- Reclaim L band wavelength
- RFoG in a nutshell
- Replace RFoG with PON DOCSIS Backhaul
- Standardization of PON DOCSIS Backhaul

Why we need to reclaim RFoG spectra

- The 20nm lower L band optical resources are attractive for PON applications
- ITU-T NG-PON2 downstream uses lower L band which conflicts with RFoG. As a result NG-PON2 can not coexist with RFoG
- The lower L band optical resources are also preferred for 100 Gb/s EPON downstream
- If an alternative method can be found to backhaul RFoG signal, reclaiming the RFoG spectra is beneficial to operators who deploy NG-PON2 and/or 100G EPON

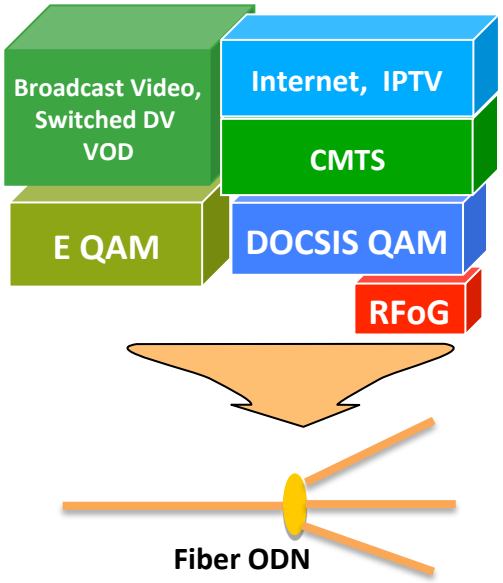
Current optical spectrum allocations

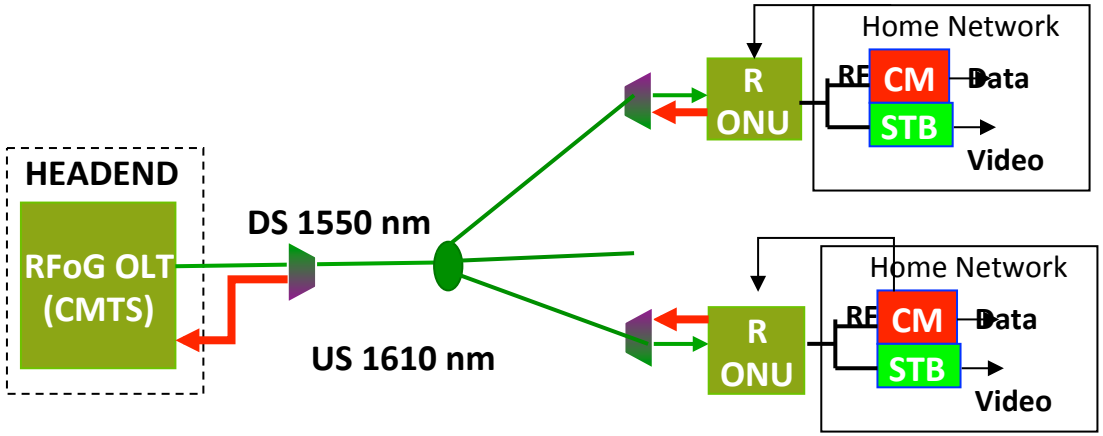


- The 20 nm spectra in L band is used by RFoG US and NG-PON2 DS
- The L band spectra are suitable for 100G EPON downstream
- NG-PON2 cannot coexist with RFoG because of resource conflicts

Reclaiming RFoG US spectra with an alternative method to backhaul RfoG signal will provide the resources needed for 100G EPON and solve the resource conflict with NG-PON2.

RFoG in a nutshell



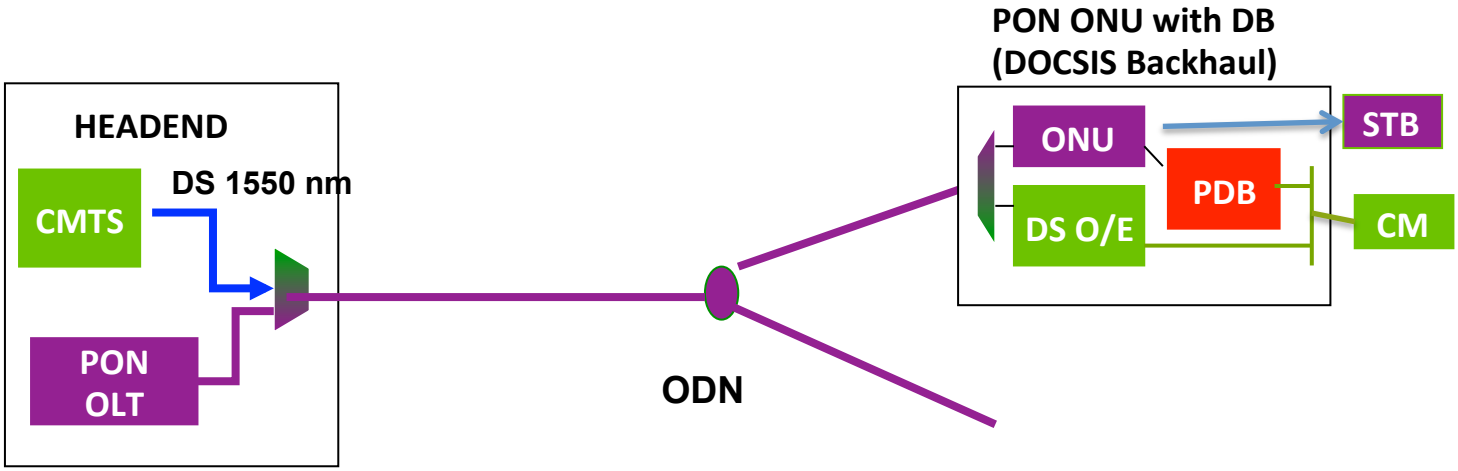


- RFoG was developed at SCTE under IPS 910 and later became ANSI/SCTE 174
- RFoG defines transmission of DOCSIS upstream via optical fiber
- RFoG delivers DOCSIS services over fiber ODN; could coexist with PON
  - No changes in video Headend and CMTS
  - Bandwidth is limited by DOCSIS protocol
- RFoG is considered as a transitional solution eventually leads to PON FTTH

RFoG and PON

- **RFoG could coexist with PON for a long time period**
  - Depends on the transition time of MSO Headend to all IP
  - It could be a very long time period
- **The L band RFoG spectra are suitable for 100G EPON downstream**
- **ITU-T NG-PON2 downstream wavelengths overlaps with RFoG US**
- **Releasing L band RFoG wavelength will be beneficial for both NG-PON2 and 100G EPON customers**
- **However, if reclaiming RFoG wavelength for 100G EPON, an alternative method is needed to backhaul RFoG signal**

PON DOCSIS Backhaul Architecture



- PON DOCSIS Backhaul (PDB) architecture applies to both EPON family and GPON family
- PDB provides the same function as RFoG
- PDB releases the 1610nm wavelength for 100G EPON downstream

Benefits of PON DOCSIS Backhaul

- **PDB releases the 1610nm wavelength for 100G EPON**
- **PDB is compatible with NG-PON2**
  - RFoG does not work with NG-PON2
- **PDB aligns better with PON migration than RFoG**
  - It provides a smooth migration from DOCSIS to PON
- **PDB has the potential to have much lower cost than the RFoG + PON ONU solution**

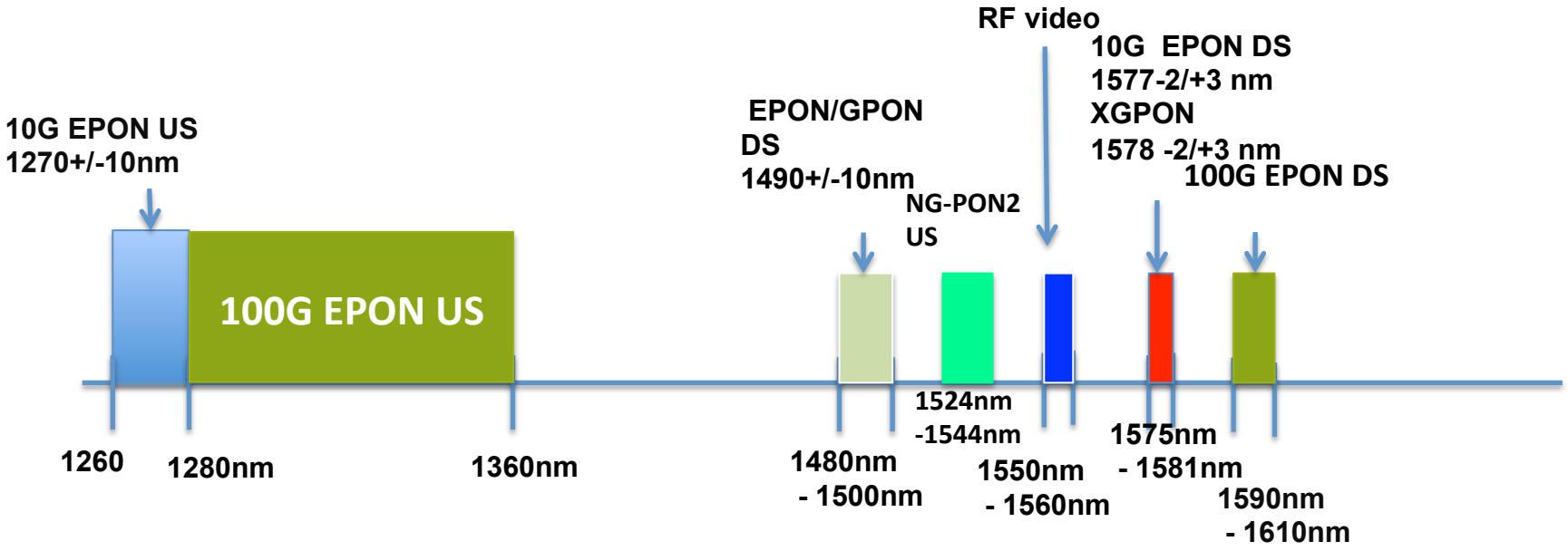
Feasibility of PON DOCSIS Backhaul

- **The 25G & 100G EPON, NG-PON2, XGS-PON have enough upstream bandwidth to backhaul DOCSIS traffic**
- **The PDB method could be implemented to backhaul DOCSIS with RF carriers (40 MHz-80 MHz bandwidth)**
  - **Similar to CPRI mobile front-haul**
- **The PDB method could be implemented to backhaul DOCSIS without RF carriers**
  - **Similar to mobile backhaul**
- **The detailed discussion of PDB is out of scope of NG EPON SG.**

PON DOCSIS Backhaul Standardization

- PDB method could be standardized at various organizations
  - IEEE 1904
  - SCTE IPS
  - Cablelabs
- PDB could be standardized with different flavors
  - PDB with 10G EPON, 25G EPON and 100G EPON
  - PDB with XGS-PON and NG-PON2

100G EPON wavelength allocation (example)



- 100G EPON US: 1280 nm to 1360 nm with 20nm spacing
- 100G EPON DS: 1590nm to 1610 nm with 5 nm spacing

Conclusions

- PON DOCSIS Backhaul (PDB) architecture provides the same function as RFoG and it applies to both EPON family and GPON family
- PDB releases the lower L band resources for 100G EPON
- PDB is compatible with NG-PON2 and XGS-PON
- PDB aligns better with PON migration than RFoG
- PDB has the potential to have much lower cost than the RFoG + PON ONU solution
- PDB method could be standardized

Thanks

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