Four Candidate NG-EPON Solutions

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Authors: Shengping Li & Wei Lin
Presenter: Duane Remein

HUAWEI TECHNOLOGIES CO., LTD.

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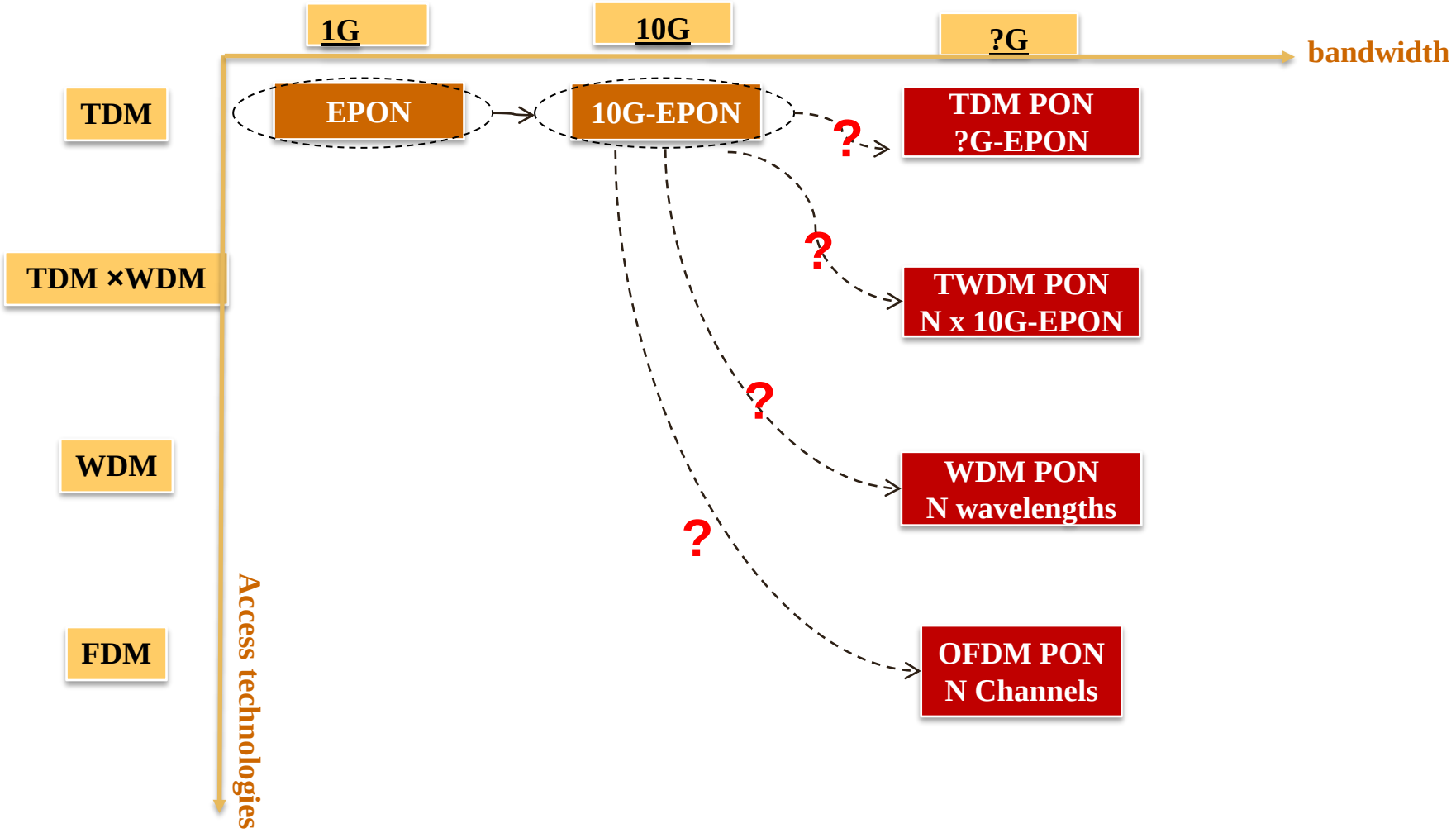
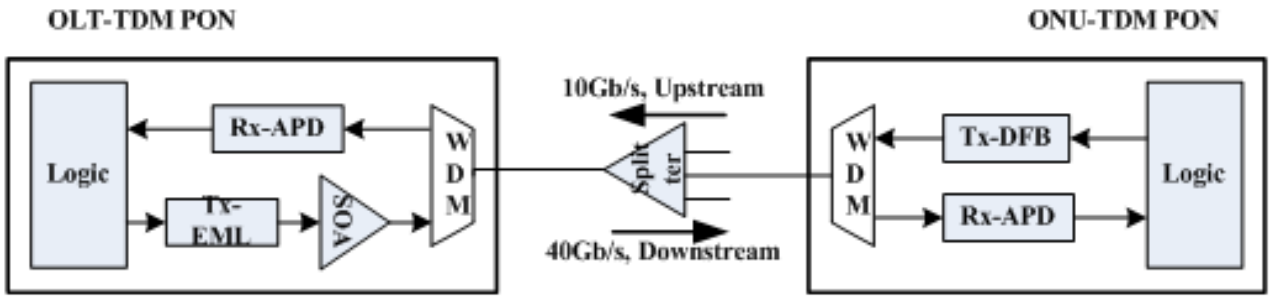
All possible directions



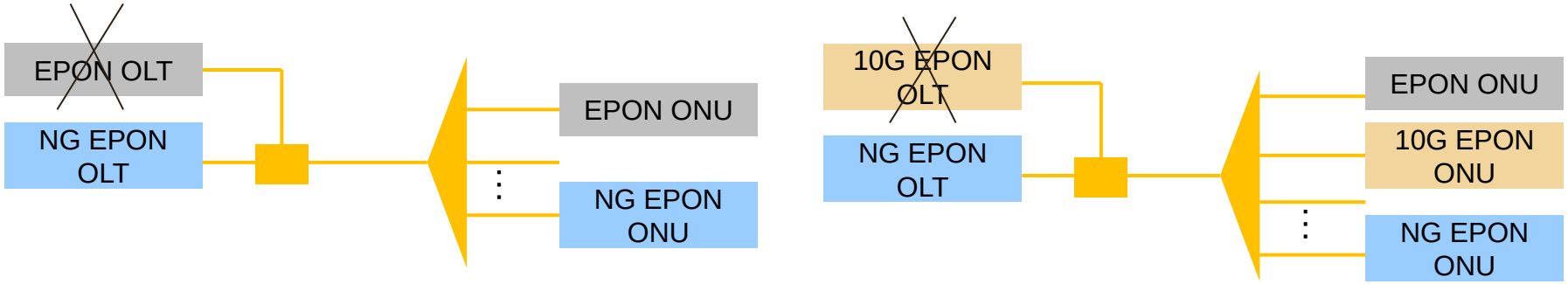
Candidate A: TDM-PON



40G/10G TDM-PON reference architecture

- **40Gb/s D/S**
  - 40Gb/s based on 25G optical components (25G EML TOSA and 25G APD ROSA)
  - with complex modulation (PAM-4 or Duo-binary).
- **10Gb/s U/S**
  - 10Gb/s, re-use commercial 10G-EPON optical component
  - TDMA, with NRZ modulation.

Candidate A: TDM-PON (cont.)



Smooth migration: replacing the EPON, 10G-EPON OLT and ONU optical modules by NG-EPON

◆ Pros

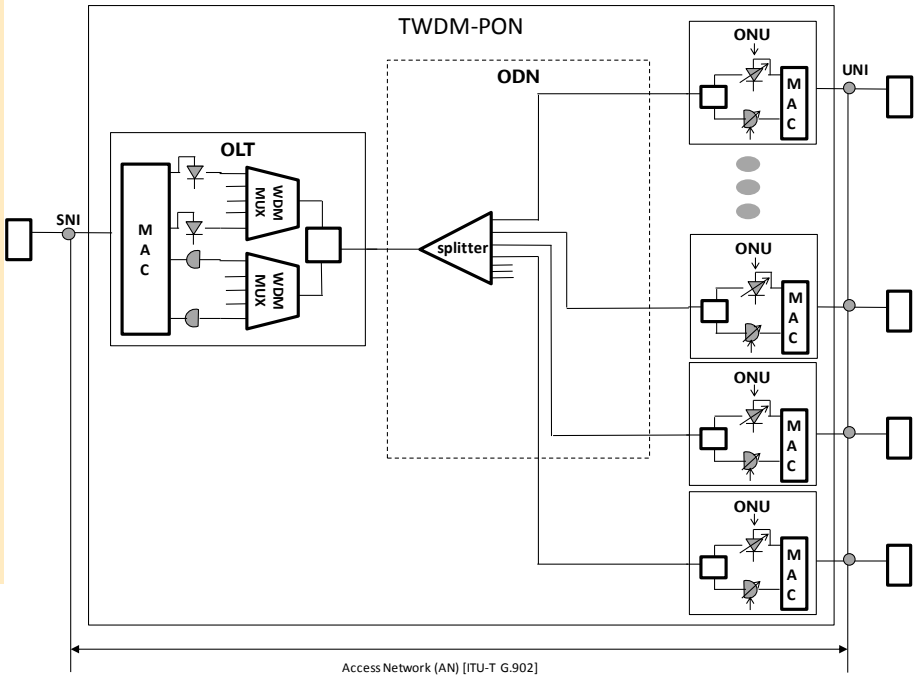
- ➢ Compatible with power-splitter based ODN
- ➢ Smooth migration from 1G/10G-EPON
- ➢ No complex wavelength configuration
- ➢ Coexistence with legacy 1G/10G-EPON, WDMA for D/S, TDMA for U/S

◆ Cons

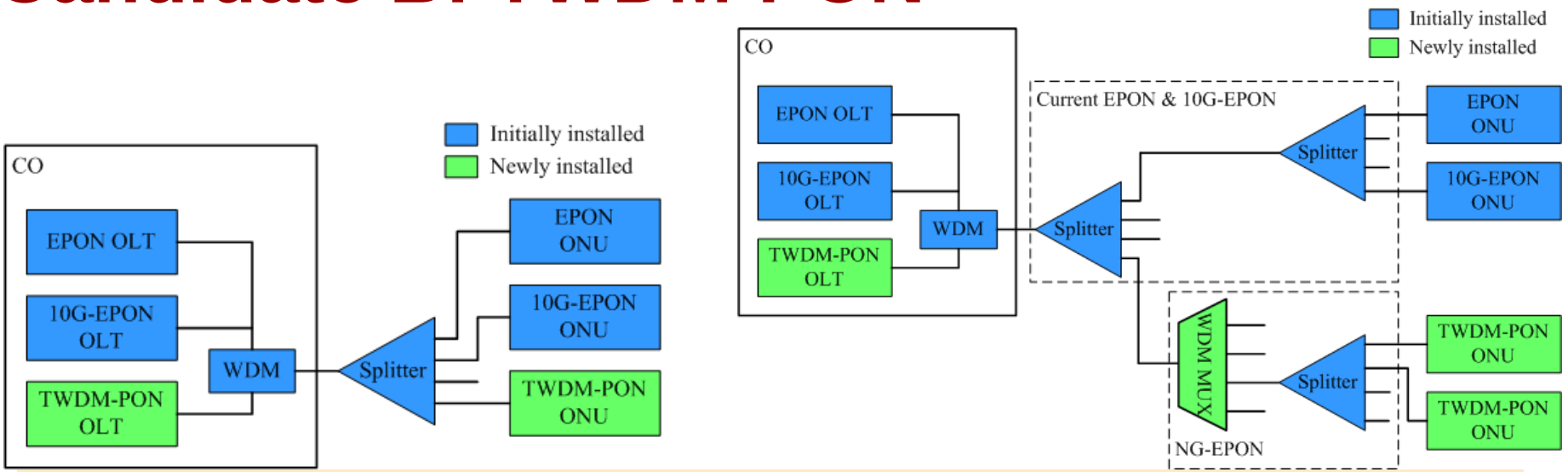
- ➢ At 40Gb/s, chromatic dispersion (CD) is a critical issue. 16x CD and 4x PMD larger than 10G for NRZ .
- ➢ Low power budget
- ➢ High peak data rate per ONU and low date efficiency.

Candidate B: TWDM-PON

- **40Gb/s or 100Gb/s D/S**
  - N λs stacked EPON with WDM Mux.
  - N DFB laser array at OLT.
  - NRZ.
  - RX with Tunable filter at ONU to receive the assigned wavelength.
- **10 Gb/s or 40Gb/s U/S**
  - N λs for 4 types of ONUs respectively operating at different λs, 10Gbps per λ U/S.
  - TDMA in U/S for ONUs working at the same λ.
  - NRZ



Candidate B: TWDM-PON



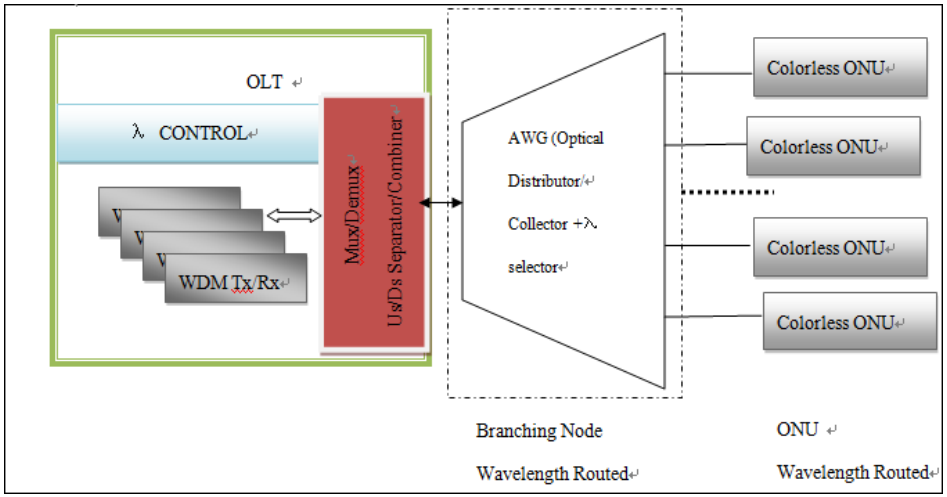
◆ **Pros**

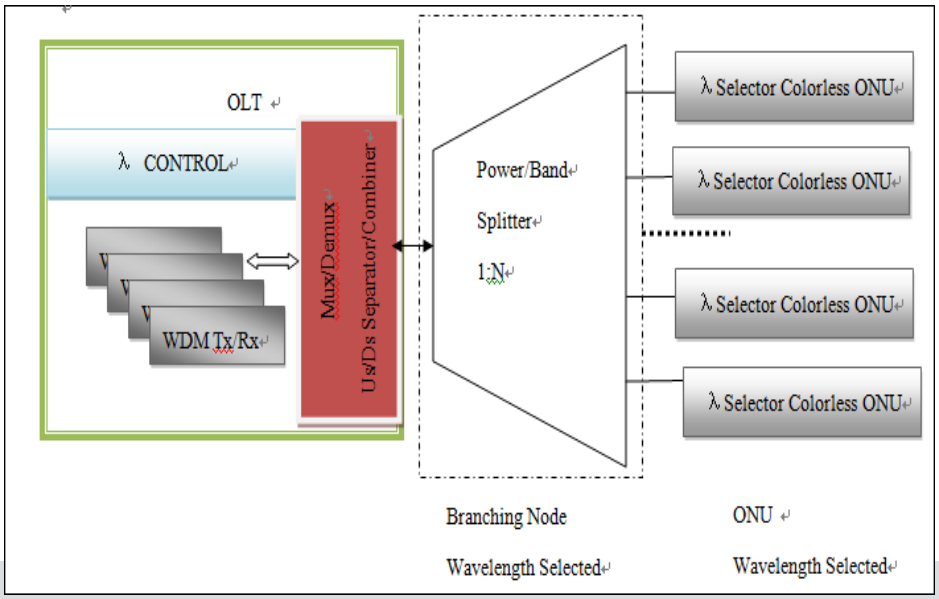
- ➢ Smooth evolution from E-PON/10G-EPON, and co-existence with legacy PONs and OTDRs.
- ➢ Dynamic bandwidth assignment.
- ➢ Mature technology
- ➢ Low cost

◆ **Cons**

- ➢ Wavelength management issues, wavelength drifting between different type of ONUs
- ➢ Tunable laser and tunable filter are required.

Candidate C: WDM PON





Two classes of WDM PONs are defined

- **λ-routed** (WR)

  Wavelength is determined by its physical connectivity to the ODN;

  This class of WDM PON supports filtered ODN

- **λ-selected** (WS)

  The λ selector is built into the ONU;

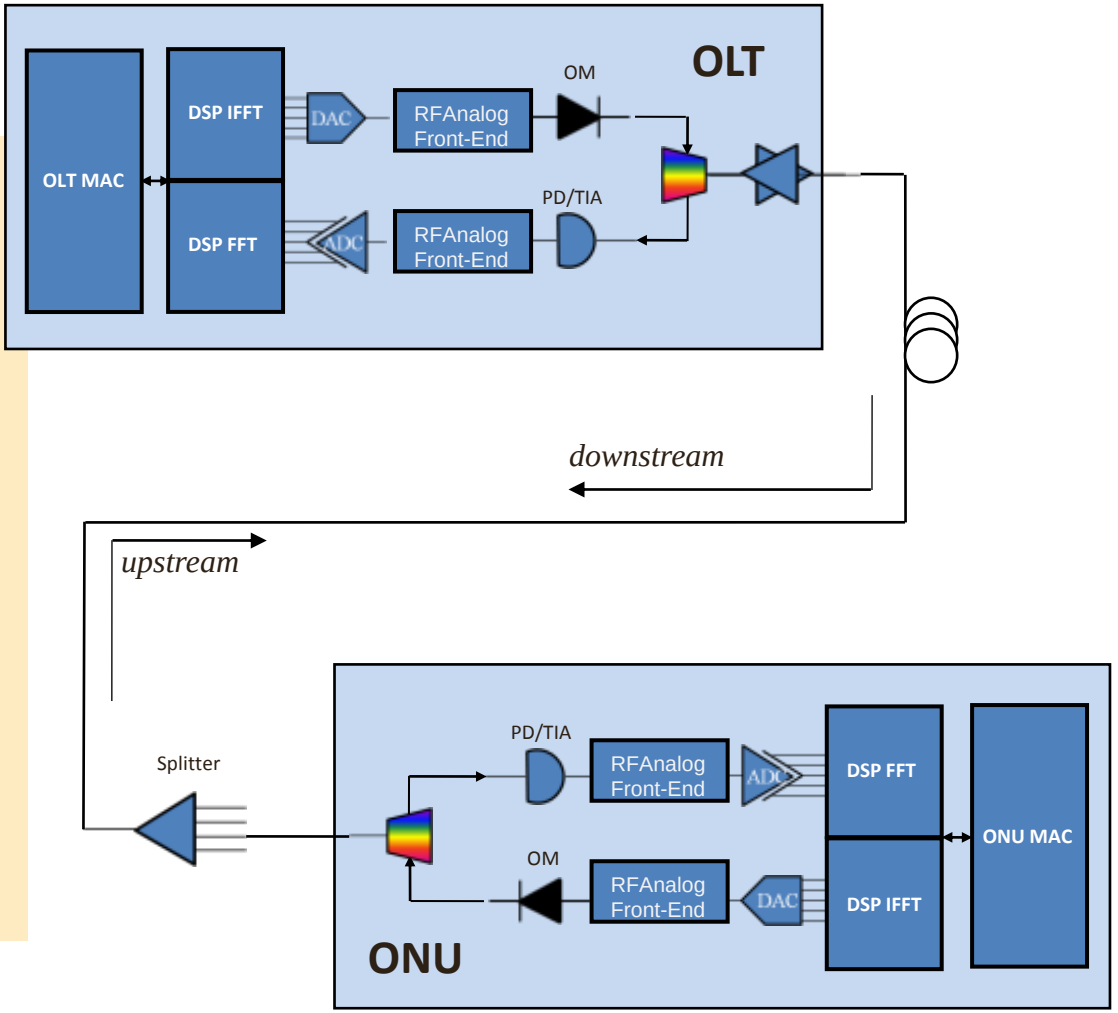
  This class of WDM PON supports power Splitter based ODN

Candidate C: WDM PON

- **Coexistence with legacy PON**
  - Power splitter ODN: suitable for WS architecture
  - Filtered PON: supported by both WR and WS architectures
- **Pros**
  - Low power budget requirement
  - Exclusive , Ultrahigh speed Access per λ per user
  - High security, no Rogue ONU issue
  - Low delay, low jitter
- **Cons**
  - High cost
  - Wavelength drifting between different type of ONUs
  - Use AWG to replace power splitter
  - No statistical gain on the media resulting in better apparent performance.

Candidate D: OFDM PON

- **40Gb/s or 100Gb/s D/S**
  - Intensity Modulation-Direct Detection （IM-DD）
  - DMLs/EMLs, PD/APD
  - OLT/ONU with SOA/EDFA
  - OFDM+high level modulation
  - ADC/DAC
- **10 Gb/s or 40Gb/s U/S**
  - TDMA
  - OFDM+high level modulation
  - ADC/DAC



Candidate D: OFDM PON

- **Pros**
  - By encoding vector signals in each subcarrier, bandwidth requirement is lessened and dispersion tolerance is increased.
  - Mature optical components can be reused.
  - Co-existence with legacy ODNs with legacy splitting ratios.
  - Flexible dynamic bandwidth access to accommodate full services.
  - Software-defined modification.
- **Cons**
  - High SNR requirement because of high level modulation and PAPR.
  - High speed ADC/DAC increases the cost.
  - More logic resource of DSP
  - High power consumption

Summary

Candidates	Pros	Cons
TDM-PON	➢Simple structure ➢Smooth migration from EPON /10G-EPON, Coexistence with legacy EPON /10G-EPON. ➢ No complication of wavelength configuration	➢ At 40Gb/s, CD is a critical issue. ➢ Low power budget ➢ High peak data rate per ONU and low efficient date ➢ 40G and 25G optical components are not mature
TWDM-PON	➢Mature technology ➢Smooth migration from EPON/10G-EPON, Coexistence with legacy EPON/10G-EPON.	➢ Wavelength management ➢ Tunable laser and tunable filter
WDM-PON	➢ Low power budget ➢ High security ➢ Per user per λ ➢ Low delay, low jitter	➢ High cost ➢ Wavelength drifting between different type of ONUs ➢ AWG is required ➢ No statistical gain on media
OFDM-PON	➢High spectrum effectiveness and dispersion tolerance ➢Low BW optical components ➢Flexible and soft-defined modification	➢ High SNR requirement ➢ High sample rate ADC/DAC ➢ DSP ➢ High power consumption

Thank you

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