



NG-PON2 & XGS-PON: Lowering the Cost of Consolidating Residential and Business Services

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ADTRAN



September 24, 2015

Taking PON to 10G and Beyond

Lowering the Cost of Consolidating
Residential & Business Services



USTELECOM
THE BROADBAND ASSOCIATION

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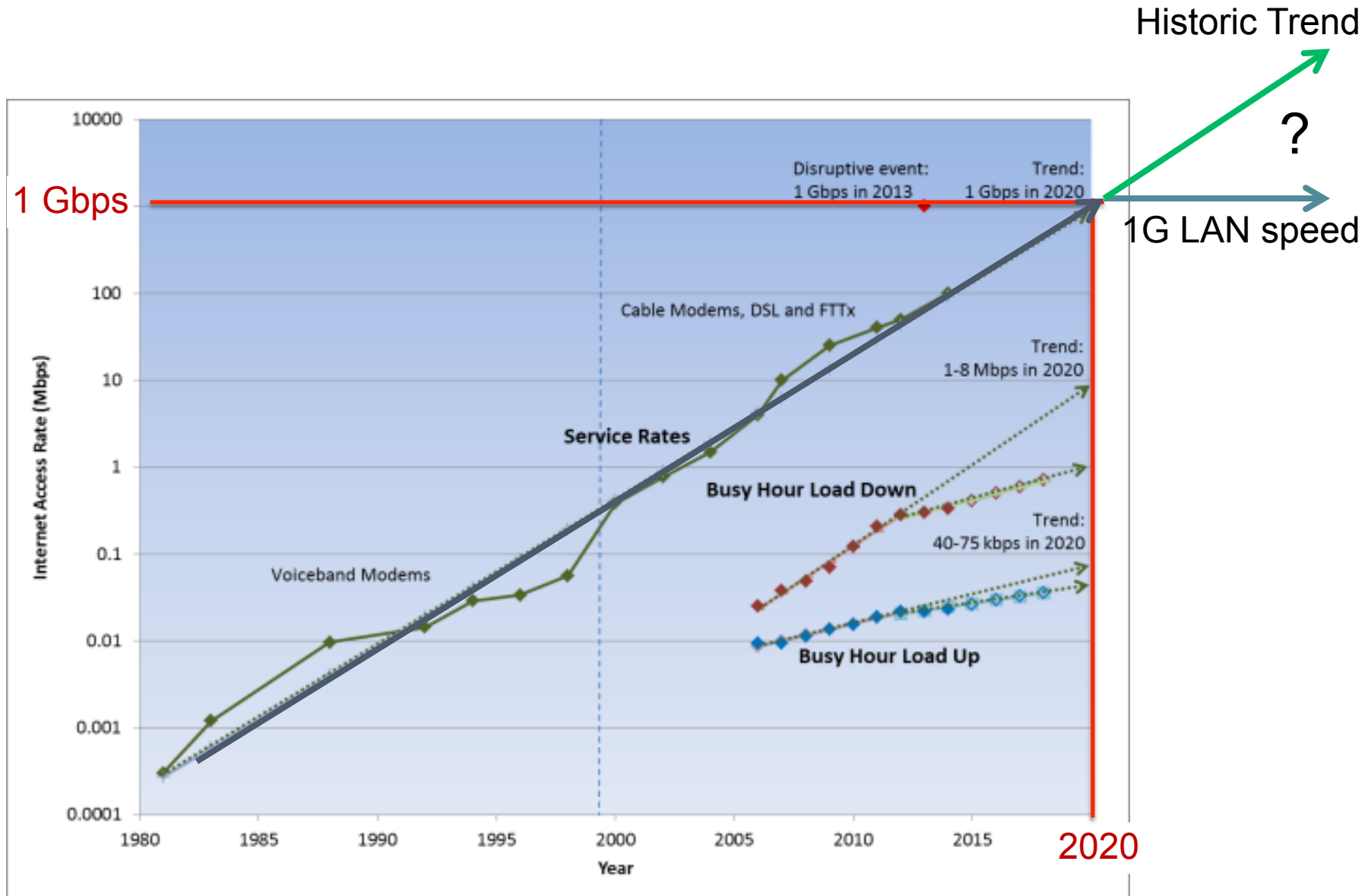


- **Market outlook**
- What can 10G PON deliver?
- PON standards evolution
- How it all fits together

- Infrastructure Longevity
 - 15 - 20 Year Investment Horizon
- Converged Infrastructure Requirements
 - Residential – Business – Backhaul
- Evolving UHD Video Standards impacting DS & US
 - 4K will be de facto with 8K rising
- IoT will result in baseline capacity erosion
 - It will be more than smart coffee pots

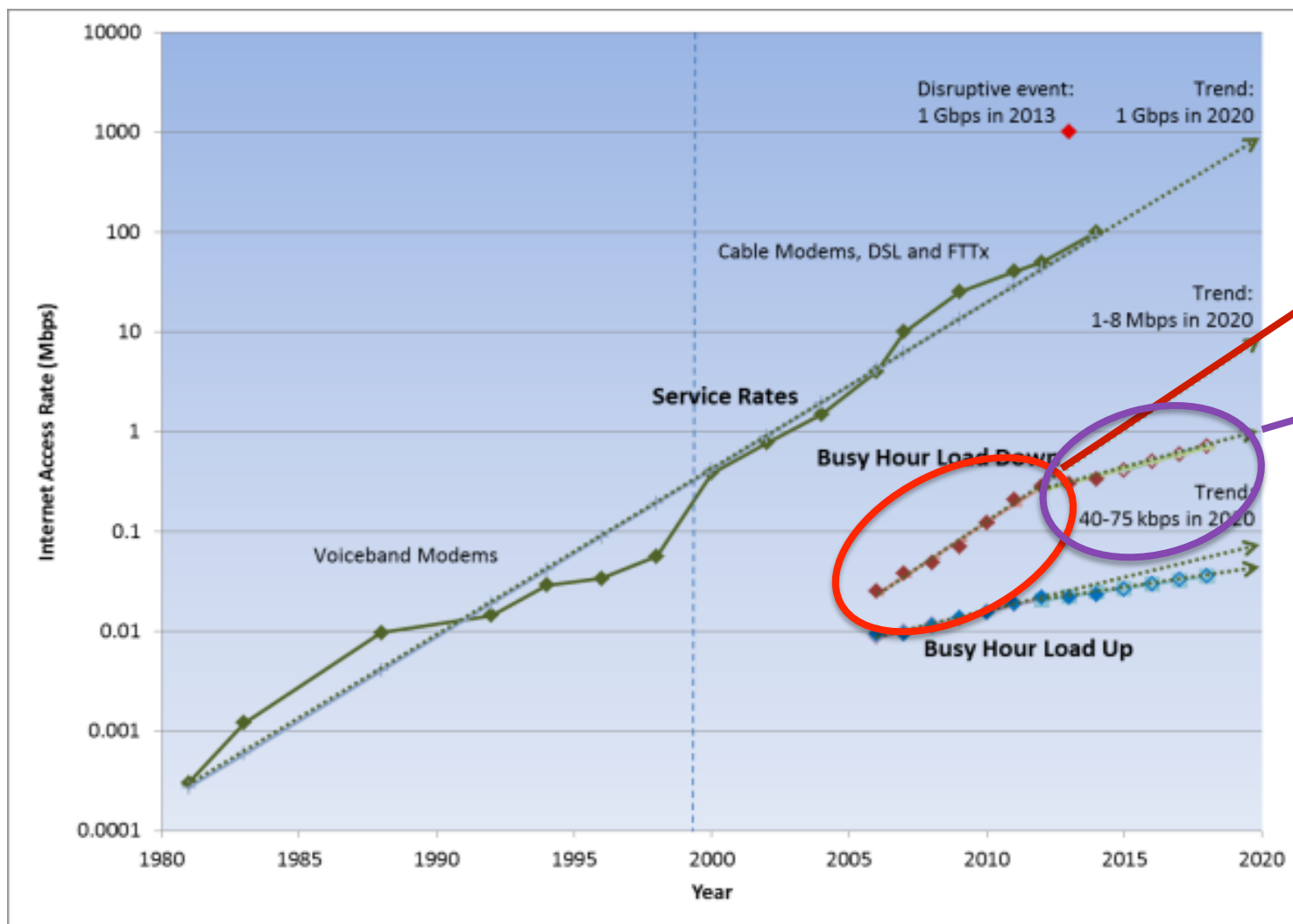


Residential Internet: Beyond 2020



Source: ADTRAN estimates, Busy Hour Load derived from published US Internet traffic statistics

Residential Internet: Beyond 2020



Future Data
Growth Rate:

50%

?

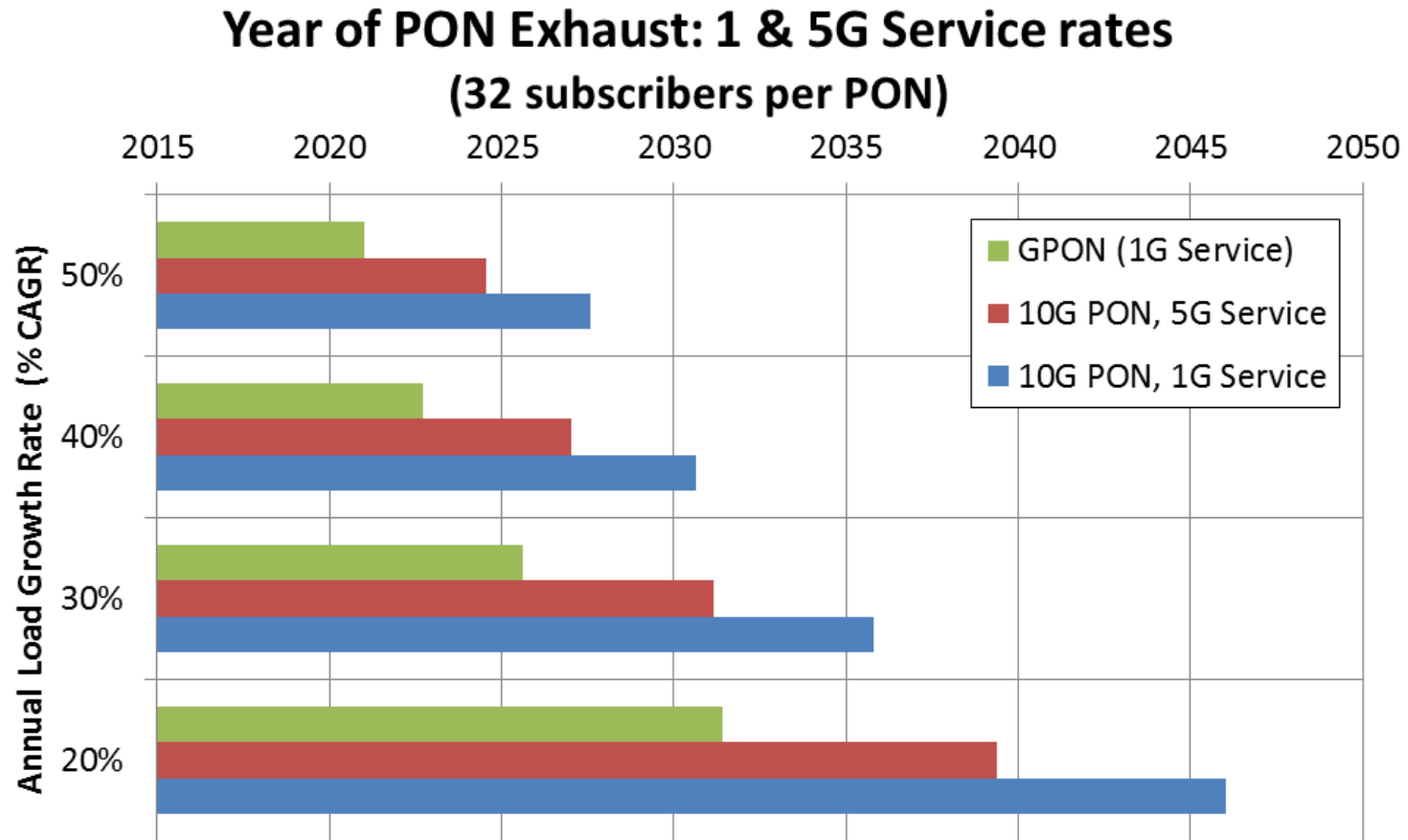
20%

Source: ADTRAN estimates, Busy Hour Load derived from published US Internet traffic statistics



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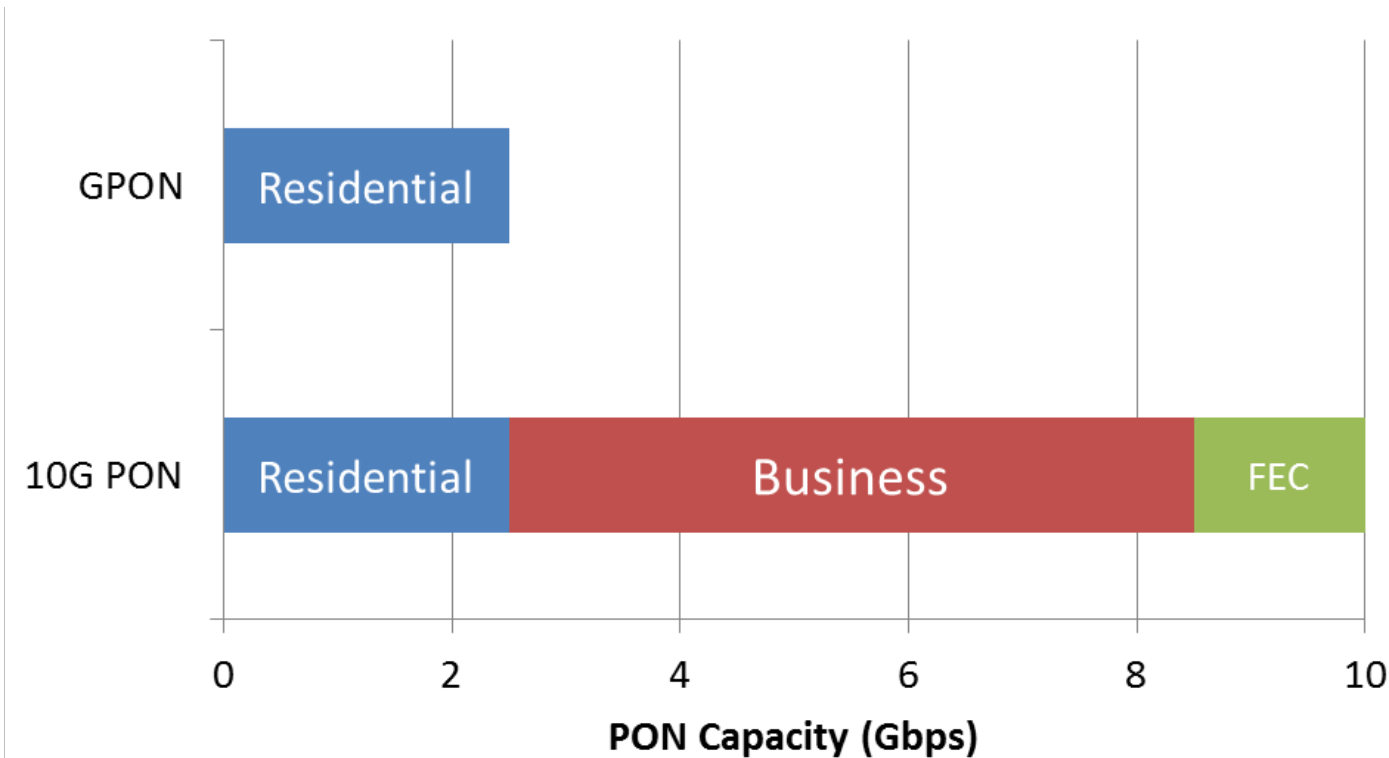
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■ 10G PON:

- 100% greater lifetime for 1G services (~15X load)
- 50% greater lifetime for 5X service rate (~4X load)

More Capacity for Business Services



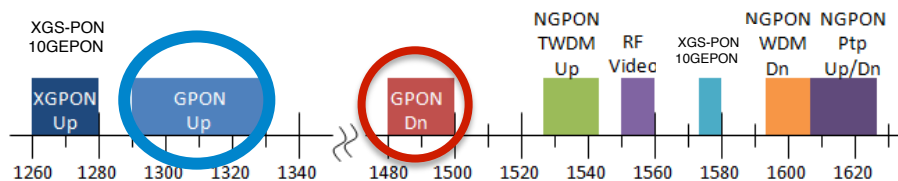
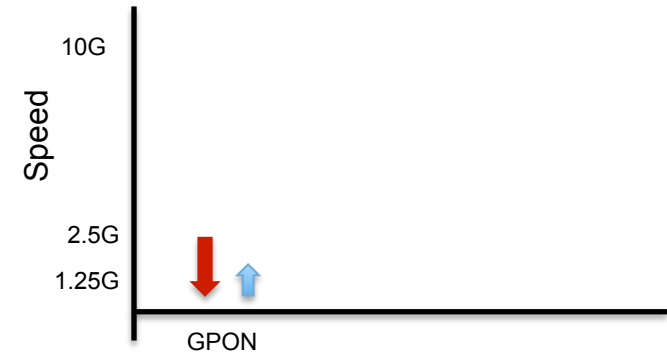
10G PON matches GPON capacity for residential services
+ 6 Gbps of symmetric capacity for new (business) services



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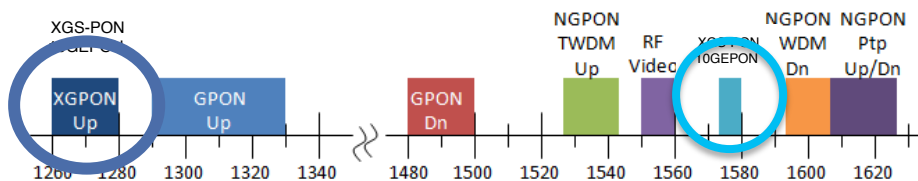
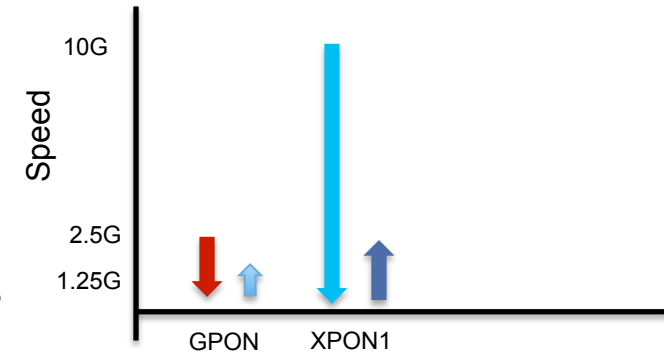
PON Evolution (ITU-T Family)

- GPON (2.5G Down x 1.25G Up)



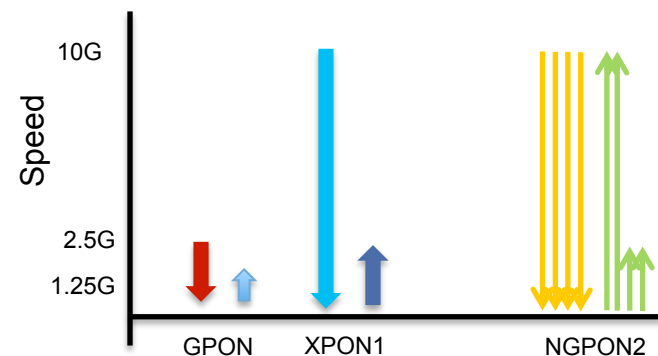
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- **GPON (2.5G Down x 1.25G Up)**
- **XGPON1 (10G Down x 2.5G Up)**
 - Wavelength overlay to coexist with GPON
 - At a cost of Filters and Subscriber Density
 - Management, Framing & DBA built on GPON
 - Low upstream rate limits attractiveness for enterprise services

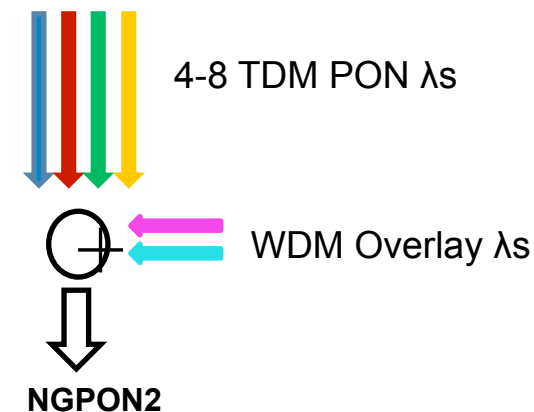
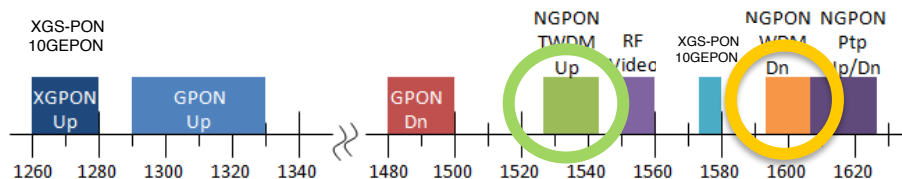


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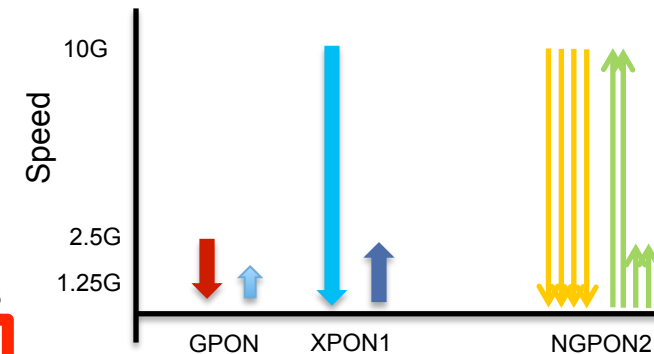


- **NGPON2 (4-8 x 10x2.5 or 10x10 + PTP)**
 - DWDM + PON = TWDM
 - Higher cost components:
 - Tunable filters and lasers at ONTs
 - Increased optical loss
 - Management, Framing & DBA built on XGPON1
 - 10G Upstream supports enterprise service revenues
 - Multiple wavelengths for capacity, wavelength diversity

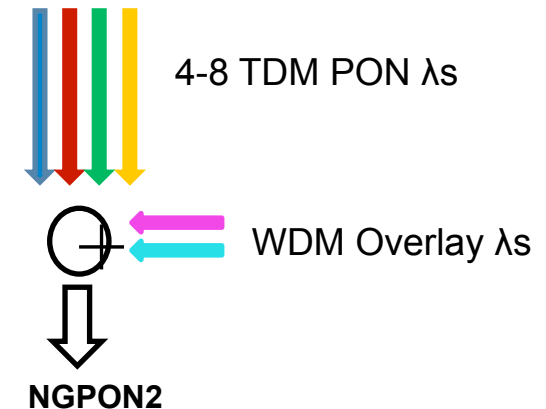
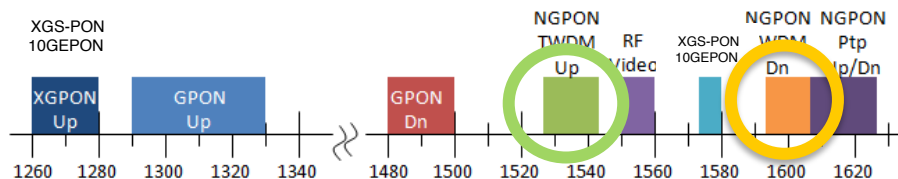


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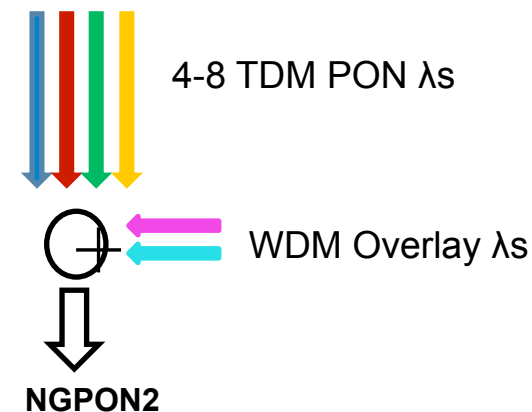
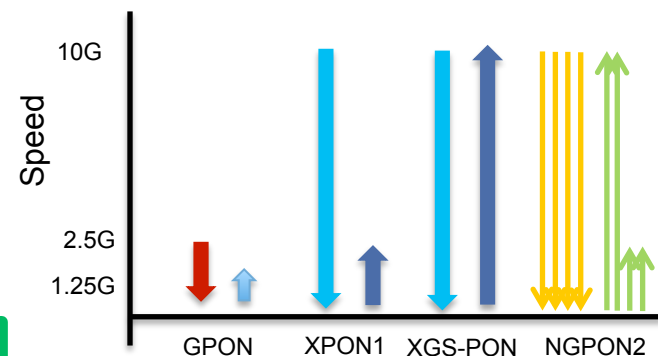
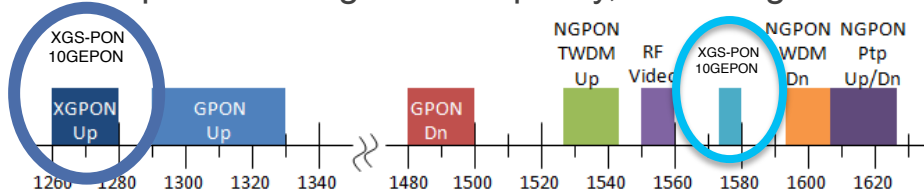


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- **GPON (2.5G Down x 1.25G Up)**
- **XGPON1 (10G Down x 2.5G Up)**
 - Wavelength overlay to coexist with GPON
 - At a cost of Filters and Subscriber Density
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 - Low upstream rate limits attractiveness for enterprise services

- **XGS-PON (10G Down x 10G Up)**
 - Same wavelengths as XGPON1 / 10G-EPON
 - Same Management, Framing & DBA as NGPON2
 - 10G Upstream supports enterprise service revenues

- **NGPON2 (4-8 x 10x2.5 or 10x10 + PTP)**
 - DWDM + PON = TWDM
 - Higher cost components:
 - Tunable filters and lasers at ONTs
 - Increased optical loss
 - Management, Framing & DBA built on XGPON1
 - 10G Upstream supports enterprise service revenues
 - Multiple wavelengths for capacity, wavelength diversity



What is XGS-PON?

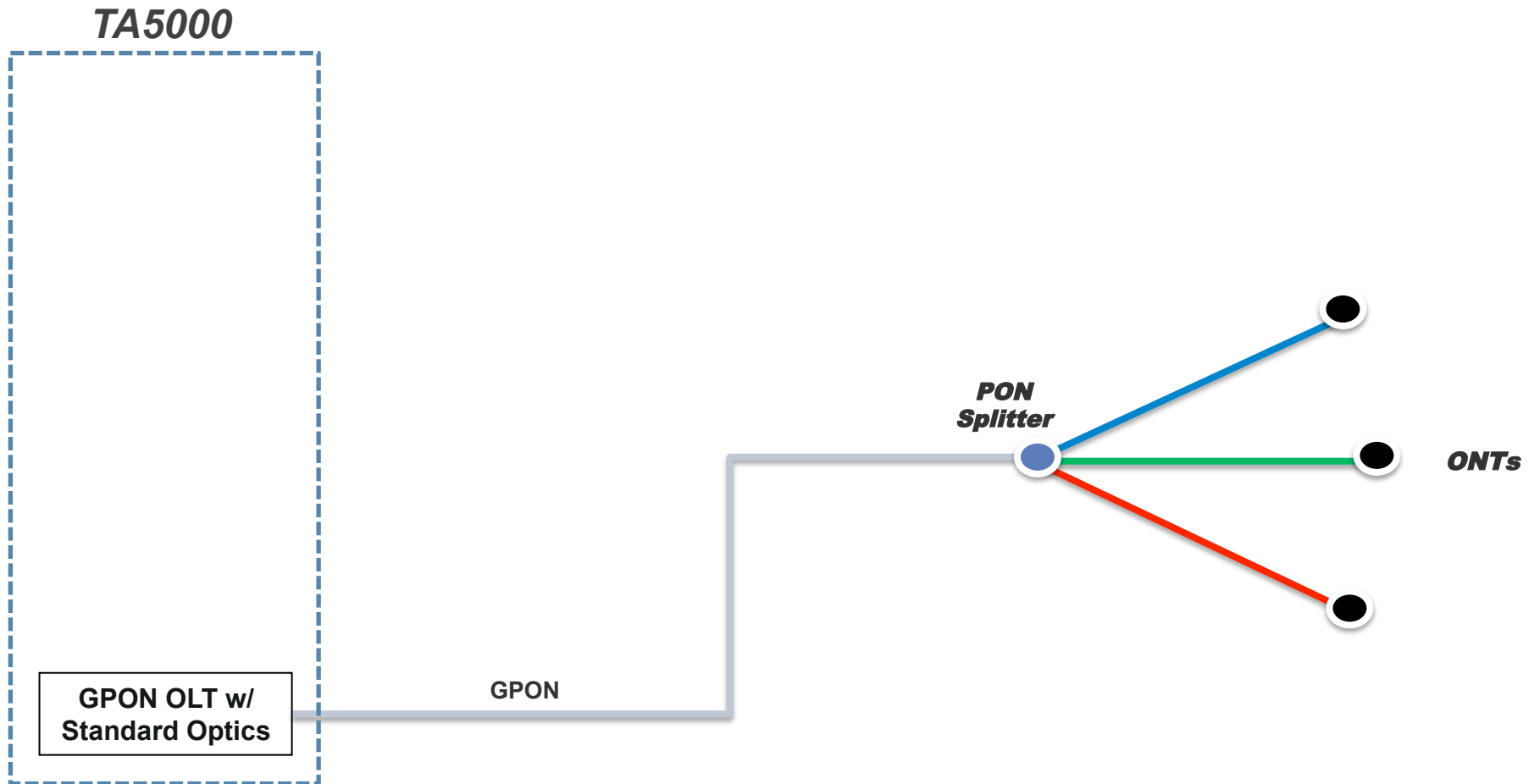
- XGS-PON = 10 Gbps (**XG**) **S**ymmetric fixed wavelength PON
- First introduced in FSAN and ITU-T in April 2015 by ADTRAN, then approved as a project by ITU-T in July 2015
 - Based on NGPON2 TC (MAC), XGPON1 compatibility
 - Supported by CenturyLink, China Telecom, Orange, BT, China Unicom, China Mobile, ADTRAN, Huawei, ZTE and Fiberhome
 - ADTRAN and China Telecom are editors
 - Target completion date February 2016
- Provides ramp toward TWDM NGPON2 deployment
 - Use 10GEPON optical components to lower today's costs
 - Share common infrastructure with GPON/NGPON2
 - Common management/provisioning
 - Common DBA Scheduling
 - Uses common ICs and ONT designs



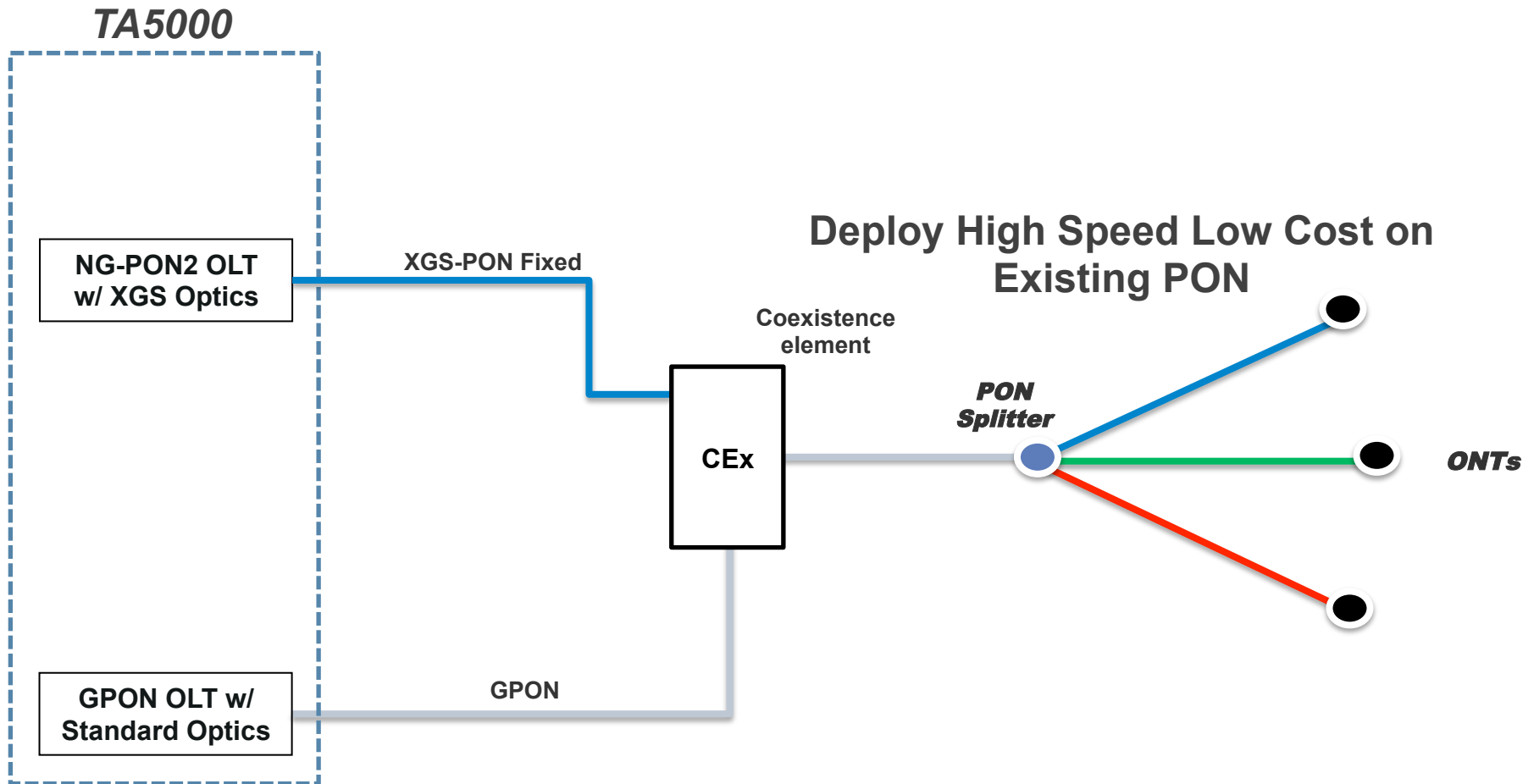
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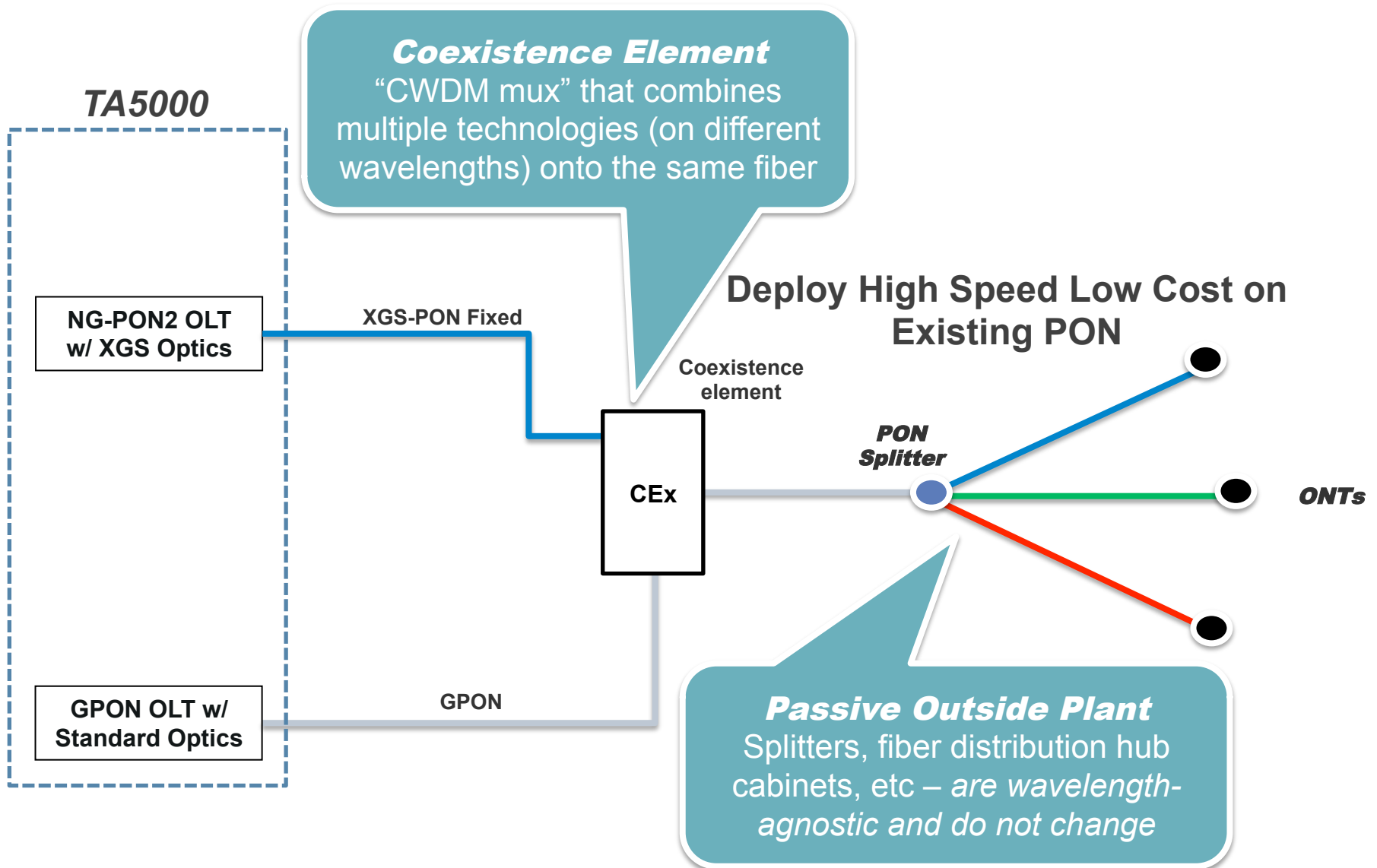
Seamless Bandwidth Growth



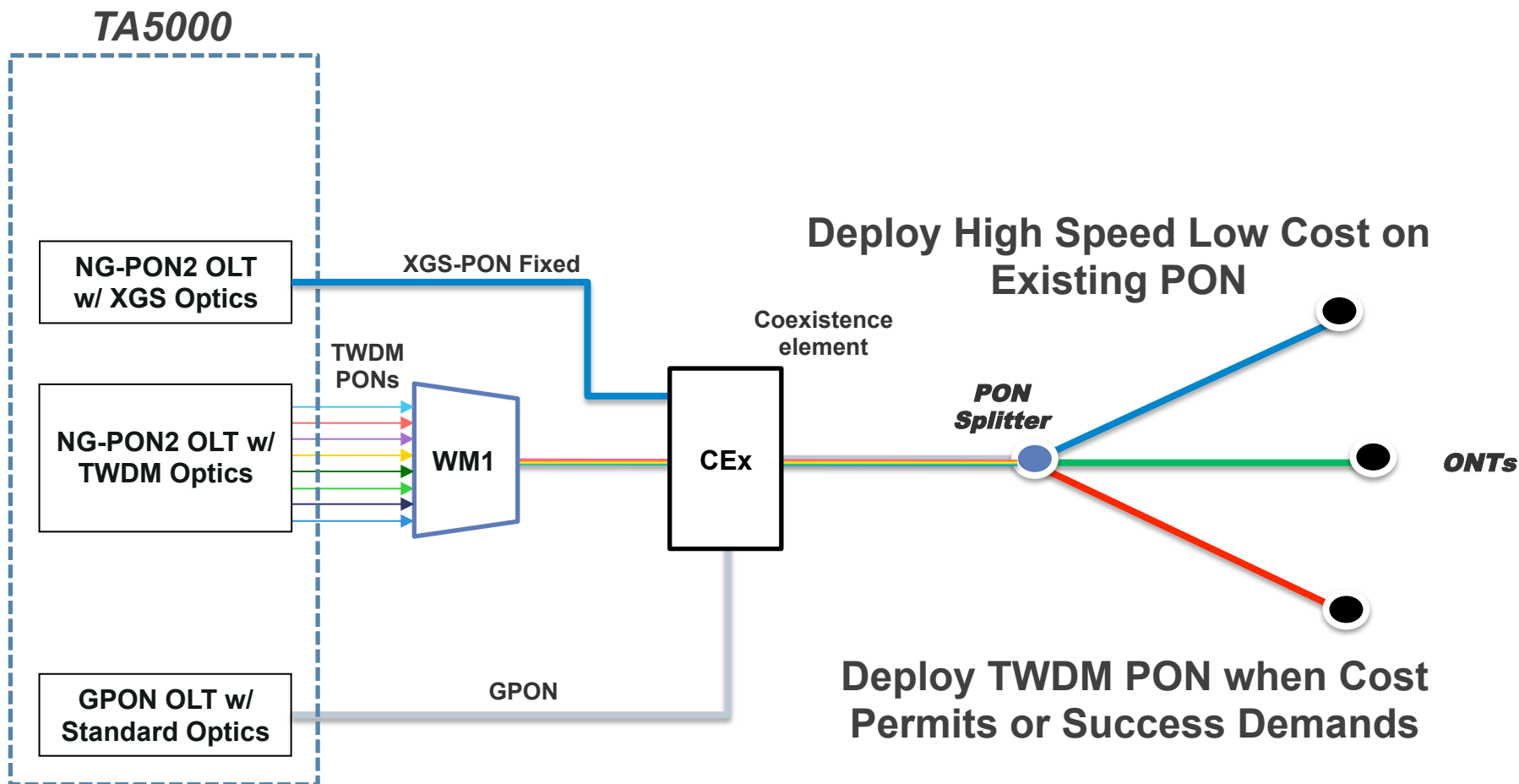
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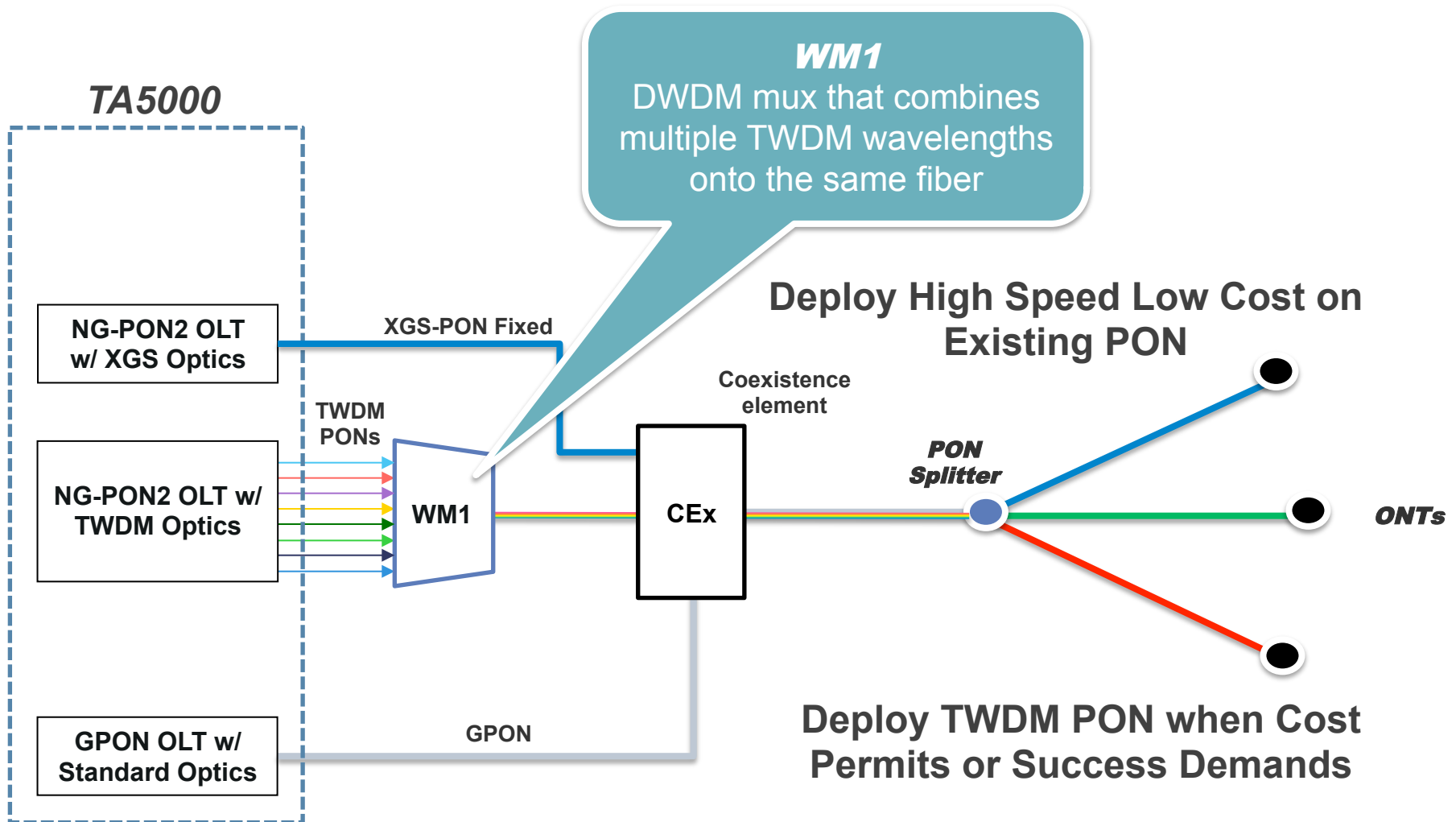
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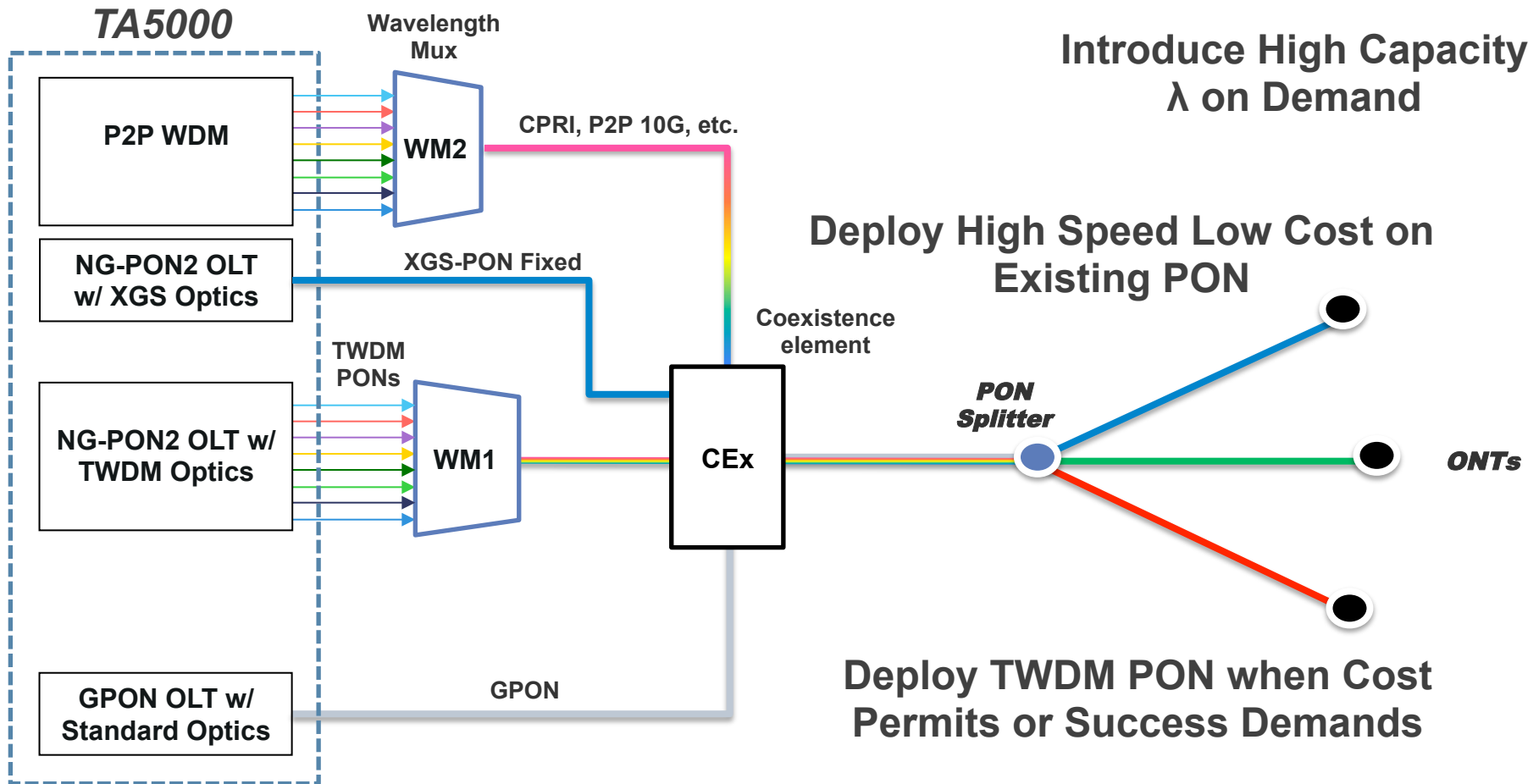
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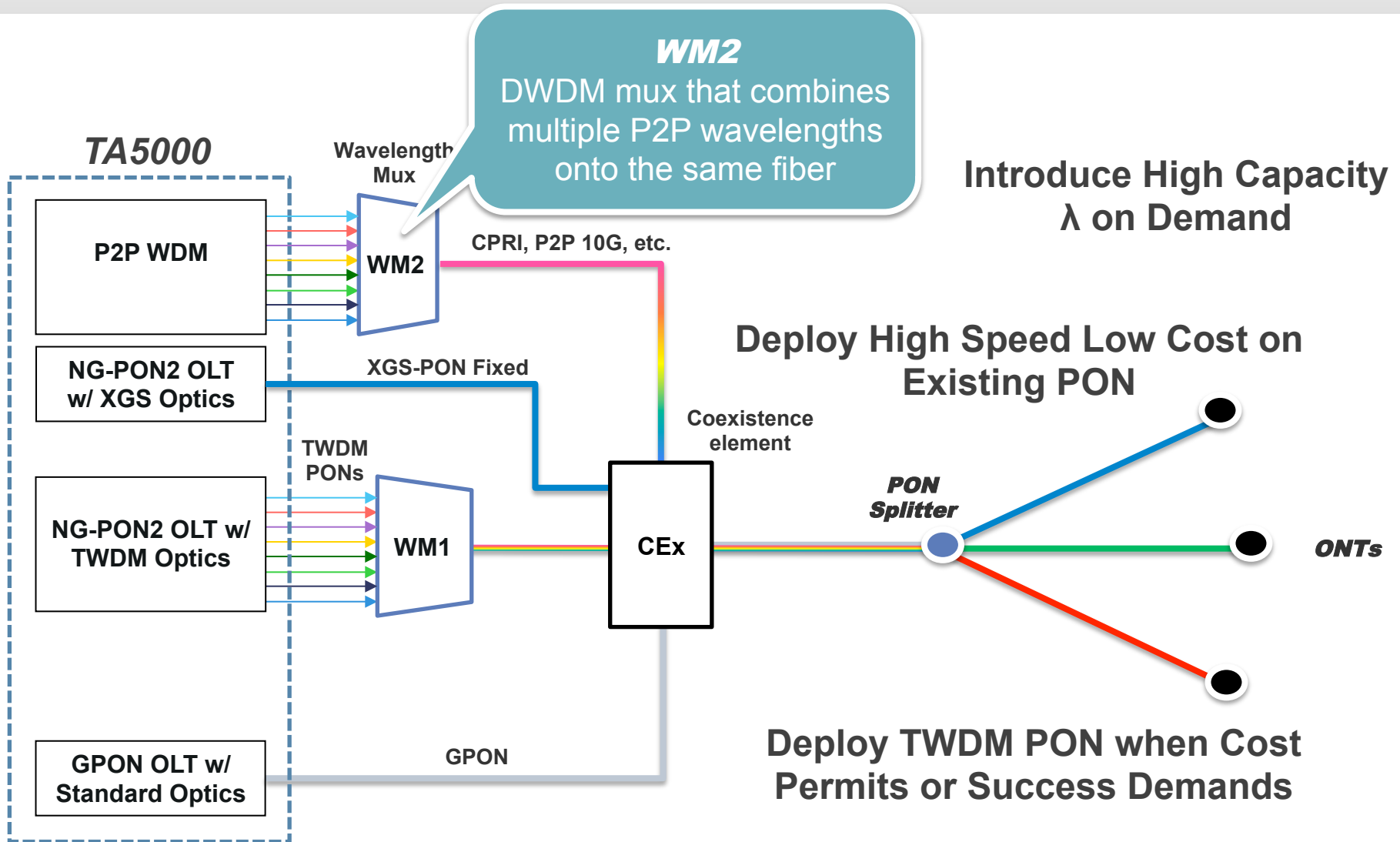
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Seamless Bandwidth Growth



Seamless Bandwidth Growth



- Generate more revenue
 - Allow Gigabit Broadband expansion
 - Deliver multi-Gigabit solutions
 - Deliver more service types
 - Support more users, markets

- Get more value from the network
 - Extend the life of network
 - Deploy on the same fiber
 - Use the same passive and active plan

- Decrease cost and risk
 - Improve operational efficiency
 - Converge residential and premium business services





Thank you