

EDFAs and WDM Operation

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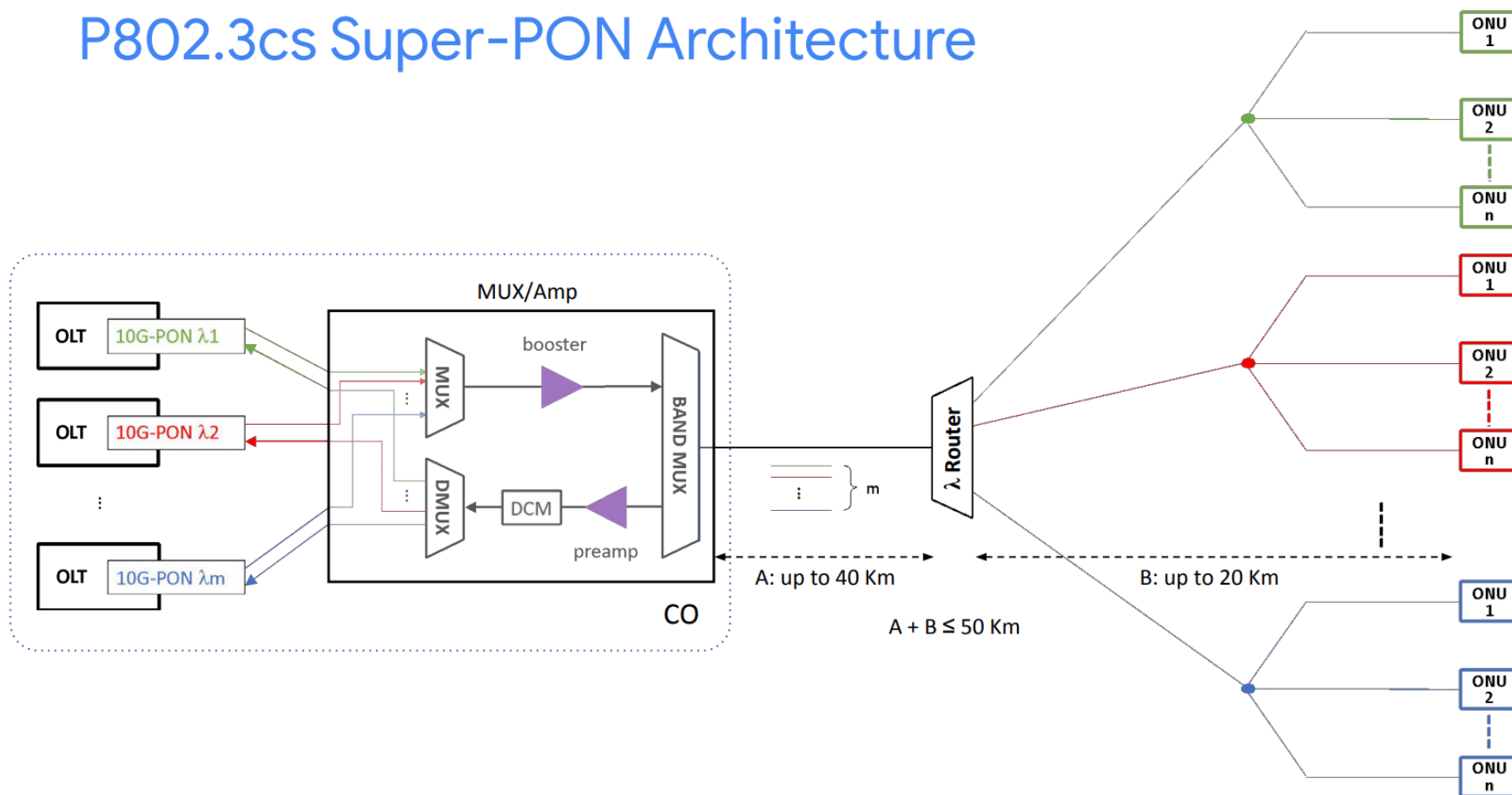
802.3cs Increased-reach Ethernet optical subscriber access (Super-PON) Task Force
IEEE 802 Plenary, Vienna, Austria, 15-18 July 2019

Overview

- During the last meeting concerns were raised about using preamp EDFAs when the relative powers from different ONUs could be drastically different
- In this contribution we explore the problem and present a solution where the loss difference in ODNs is constrained

From Super-PON_Link_Budget.pdf

P802.3cs Super-PON Architecture

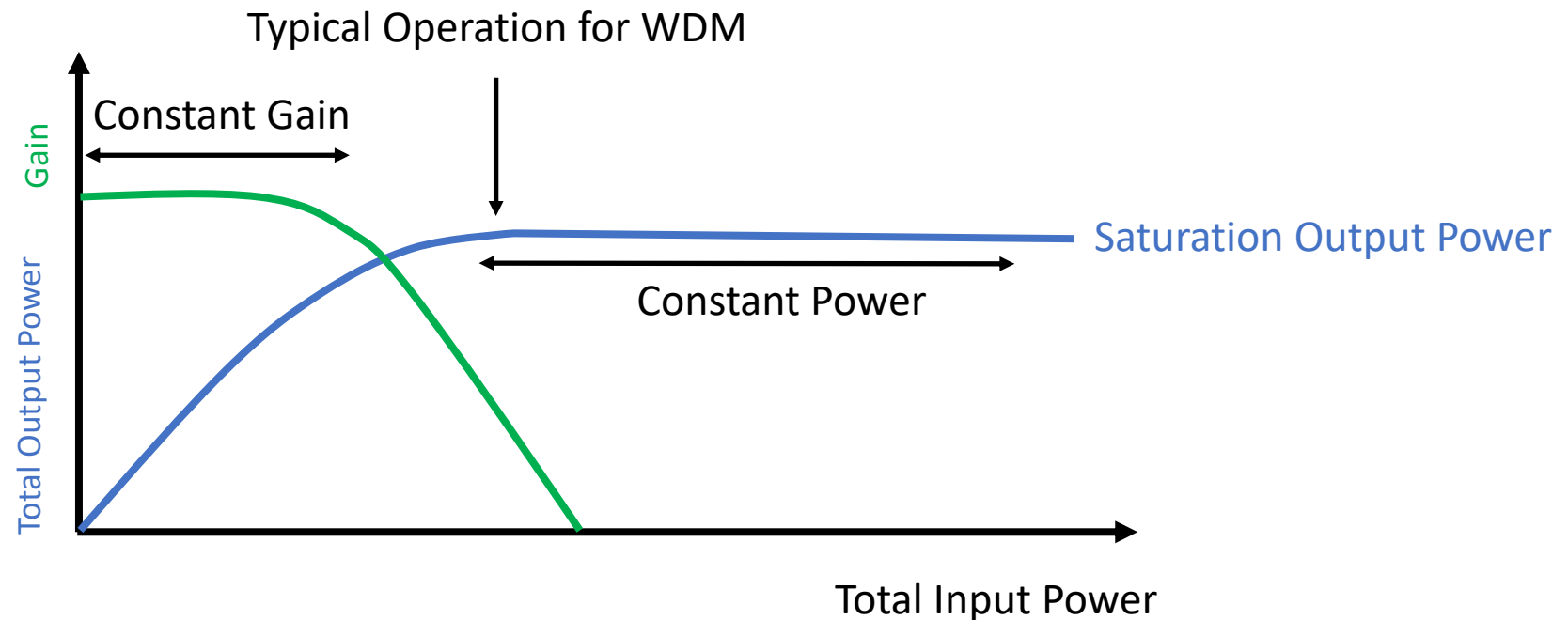


Loss budget (Worst case)		
Components	Loss Max (dB)	Comment
50km Fiber	12	0.24dB/km
λ Router	6.6	4 to 6.6
1x64	21.5	
Total	40.1	

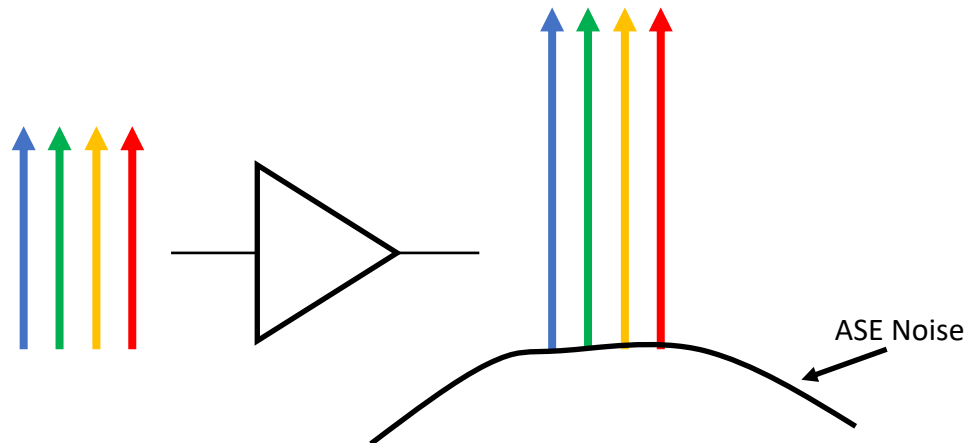
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EDFA operation

- EDFAs can amplify several WDM channels simultaneously
- EDFAs have constant gain and constant power regimes (also called saturation)
- Usually operate in constant power for WDM
- Power and gain depends on total power from all channels

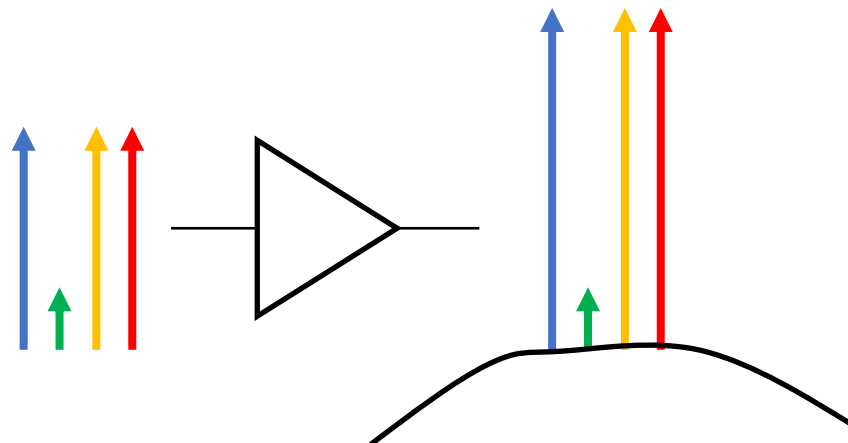


In saturation, the gain and OSNR of each channel depends on the power of all the channels



Channels with equal input power

- Equal output powers
- All channels high OSNR

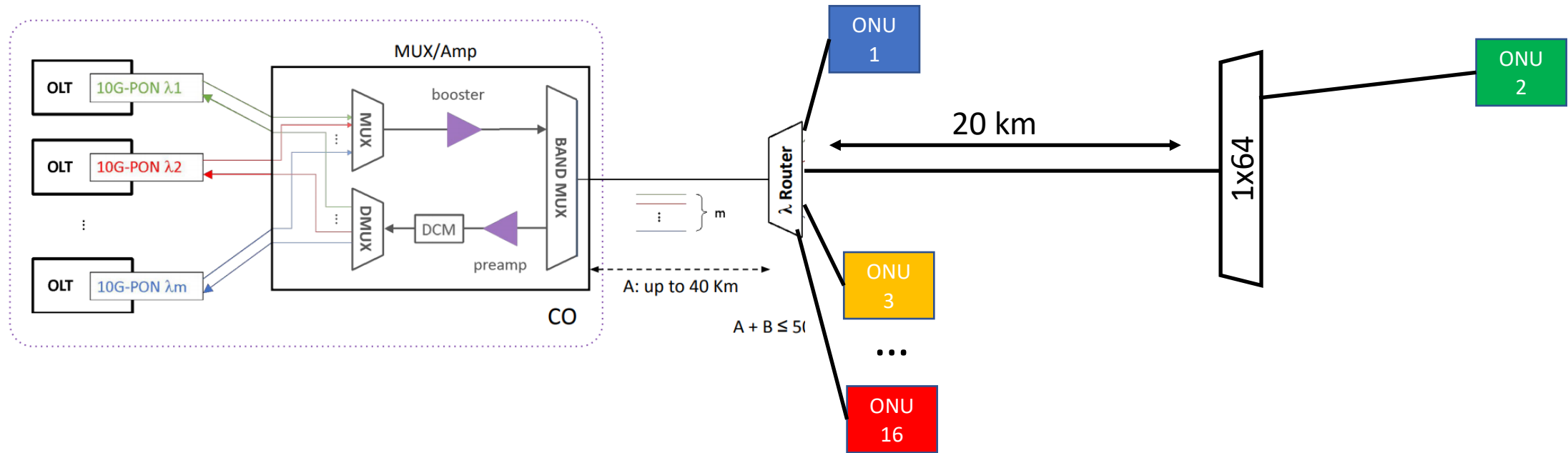


One channel weaker

- Low gain
- Low OSNR

We need to control the total input power to keep the EDFA in constant gain mode

Worst case upstream



- ONU 2 sees 26.3 dB = ((20 km * 0.24 dB/km) + 21.5 dB)) more loss than the other ONUs
- 15 ONUs w/ +9 dBm launch power (max) = 21 dBm, well above saturation
- We need to constrain the maximum power excursion (i.e. 15 dB max difference between ODNs)
- This can be done by adding attenuation to ODNs with short reach, small split ratio

Conclusions

- Signals from ODNs with low loss may drive preamp EDFA into saturation
- Signals from ONUs with high loss ODNs will see low gain and OSNR if EDFA is in saturation
- We need to constrain the difference in loss between ODNs
 - E.g., 15 dB difference