Overview on WDM-PON – the NG-PON Perspective

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Outline

- Requirements for NG-PON
- Short Presentation of different systems
  - TDWM
  - WR-WDM-PON with RSOAs
  - WR-WDM-PON with tunable laser
  - WS-WDM-PON with tunable filter
- Conclusion

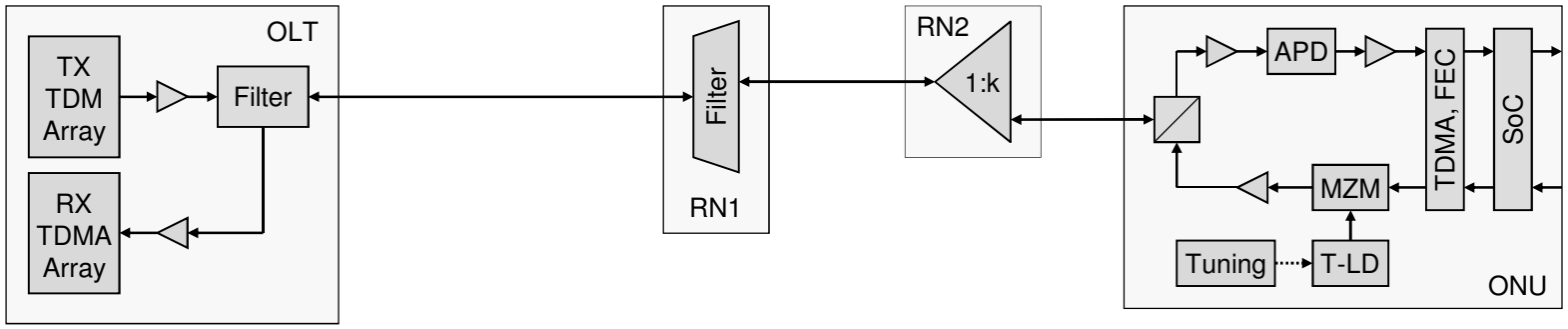
Requirements / Wish list

- High Client Count & Passive Reach
  - Central-office consolidation
- Per-client capacity scaling for combined backhaul and access
  - Up to (and beyond) 1 Gb/s for residential access
  - Higher for 3G, 4G backhaul and business access (GbE, 10GbE)
- ODN migration and co-existence
  - Migration from currently deployed (X)G-PON
  - Co-existence with deployed (X)G-PON
- CapEx / OpEx
  - Cost-effective CapEx
  - Power consumption and OLT form factor
- Technical complexity
  - Direct detection vs. coherent heterodyne detection (UDWDM-PON)
  - 10G high-power TRX vs. 1G medium-power TRX

most discussed solutions in FSAN

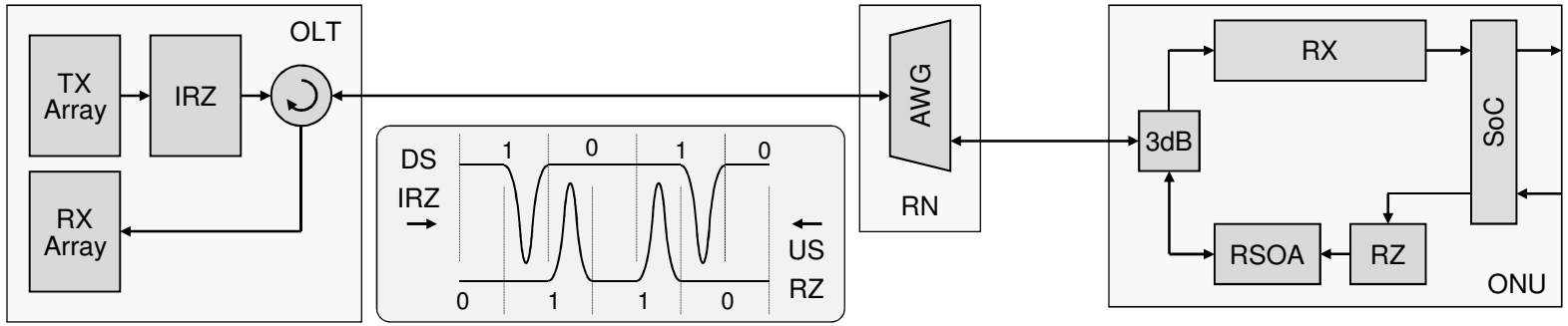
- WDM-PON and hybrid TDM/WDM-PON (TWDM-PON)
- WDM-PON variants
  - filtered (Wavelength-Routed) infrastructure
  - power-split infrastructure (Wavelength-Selected)
- WDM-PON technologies
  - tunable lasers
  - (self-) seeded reflective devices (RSOA, REAM, IL-FP lasers)
  - direct detection (DWDM-PON) or coherent heterodyne detection (UDWDM-PON)
- WDM-PON receivers can be based on per-wavelength, dedicated access (WDMA) or shared access (primarily TDMA, also SCMA, CDMA, OFDMA) is possible

TWDM-PON (Filter + Power-Splitter)



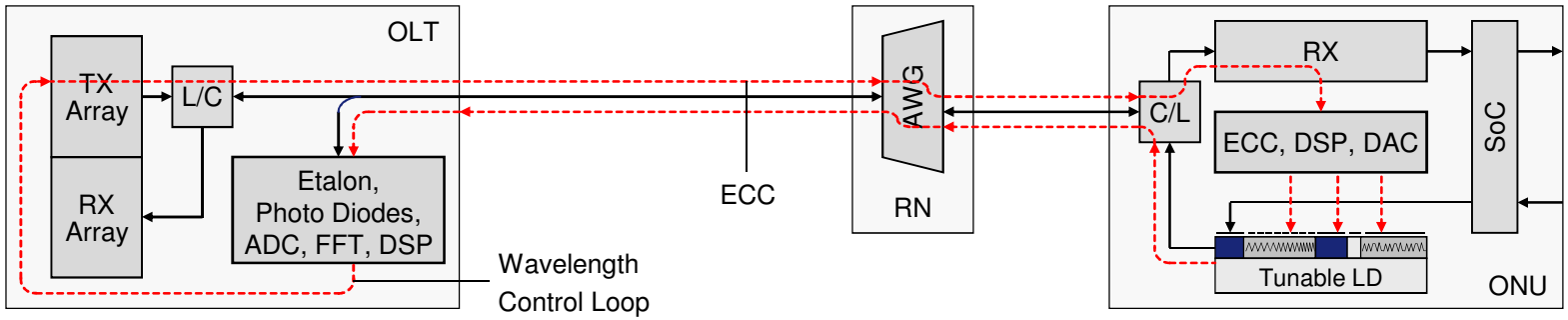
- Limited per-client capacity and transparency
- **Optimum for migration and co-existence**
- Client Count: very high number per feeder fiber
- Passive Reach: Limited due to high-power-budget transceivers
- **Backhaul: Not suitable due to bandwidth sharing**
- OpEx: Higher density and lower power consumption in the OLT

WR-WDM-PON with RSOAs (Filter)



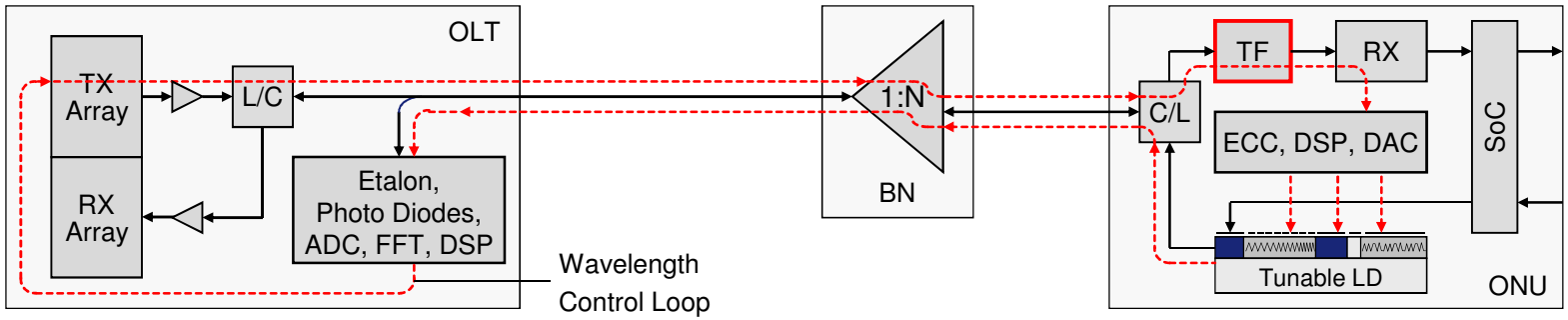
- **low complexity ONUs**, low cost per Gb/s
- **Issues with legacy ODN migration and co-existence**
- reduced bit rates due to seeded RSOA concept (reflections)
- Client Count: high , Spectrum efficiency due to wavelength re-use
- Passive Reach: high, Reach Extender possible
- Backhaul: suitable
- OpEx: Relatively low power consumption, mean OLT density

WR-WDM-PON with Tunable Lasers (Filter)



- low complexity ONUs, low cost per Gb/s
- **Issues with legacy ODN migration and co-existence**
- Client Count: high
- Passive Reach: very high, Reach Extender possible
- **Backhaul: very suitable, scaling to very high per-client and total capacity possible**
- OpEx: Relatively low power consumption, mean OLT density

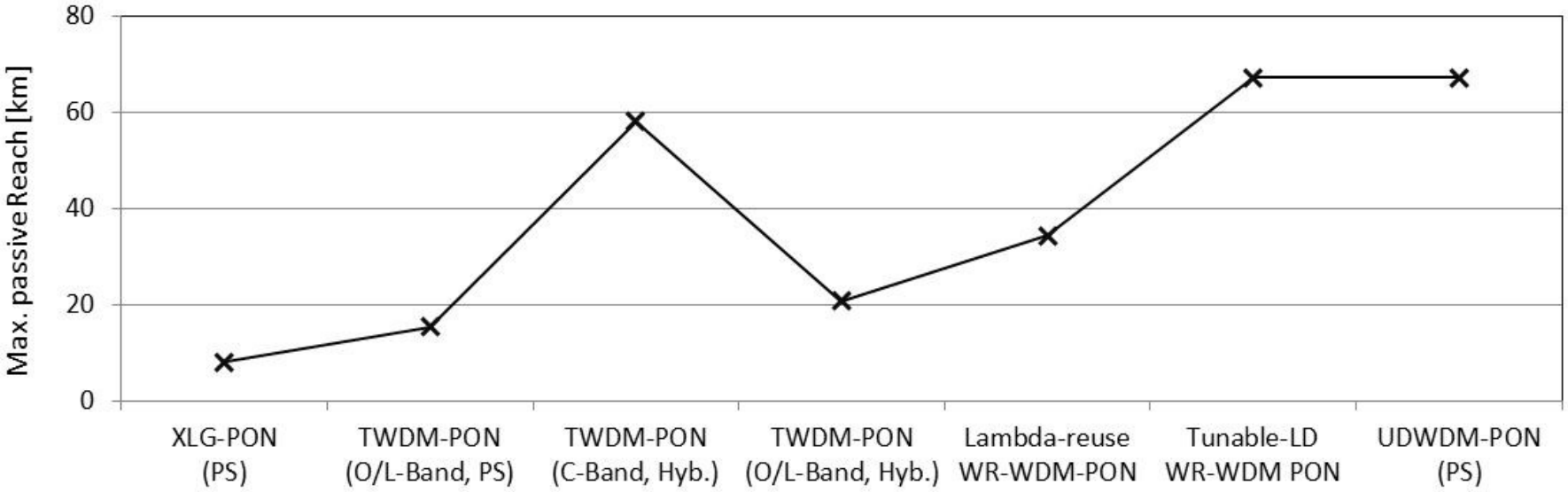
WS-WDM-PON with Tunable Lasers and Tunable Filters (Power Splitter)



- More complex and **costly** than WR variant due to tunable filter
- **Can support legacy ODN**
- Client Count: high
- Passive Reach: high, Less passive reach than WR variant
- **Backhaul: suitable, scaling to very high per-client and total capacity possible**
- OpEx: Relatively low power consumption, mean OLT density

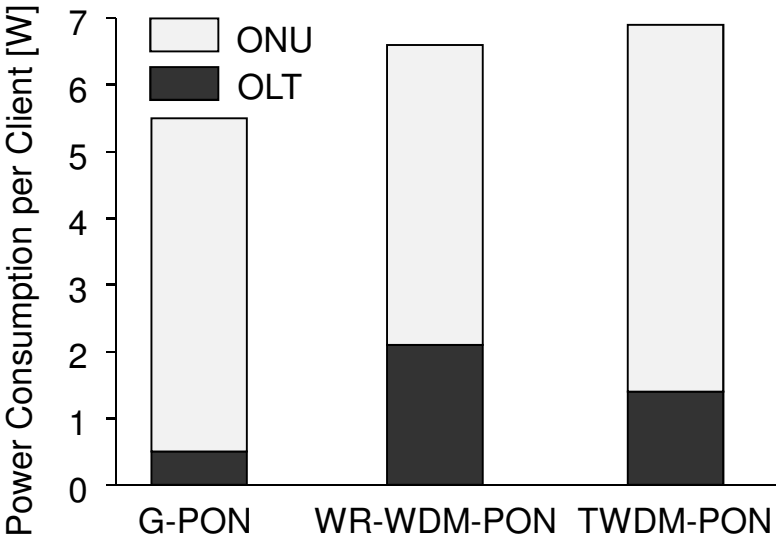
Reach Overview

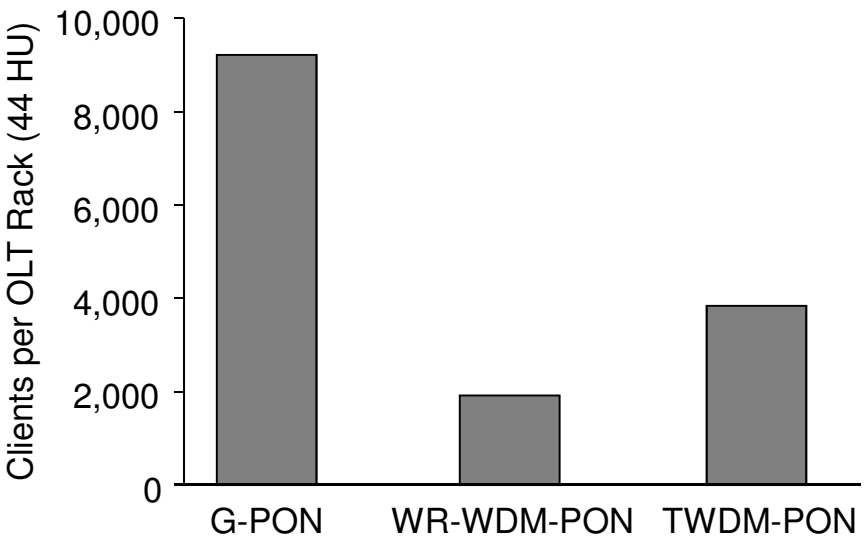
- Maximum NG-PON passive Reach (acc. to FSAN NG-PON2 Study and OASE WP4) for a ODN with 64 users (without reach extender)



OpEx comparision

- PON Per-Client Power Consumption and OLT Client Density





Overview table

	TWDM	WR-WDM-PON (seeded)	WR-WDM-PON (laser)	WS-WDM-PON (splitter)
High Client Count	++	+	+	+/-
Passive Reach	+/-	+	++	+/-
Backhaul, business access	--	+	++	+
ODN migration	++	--	--	+
CapEx	+	+	+	+/-
OpEx	+	+/-	+/-	+/-
Technical complexity	+	+	+	+/-

Conclusion

- No system fits all needs
- Every System has advantages / disadvantages depending on the focus

- Focus on Migration / co-existence
  - TWDM-PON
- Focus on Mobile Backhaul
  - WR-WDM-PON (laser or seeded)
- Focus on Passive Reach
  - WR-WDM-PON (laser)

Thank you

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