

WDM a vlnové délky v metropolitní a přístupové síti P2P, PON, NGPON, XG-PON, WDM-PON

Brno, 8. 3. 2018

Josef Beran

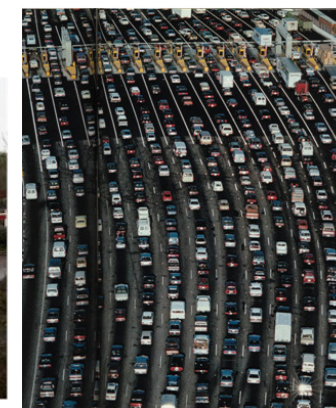
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optical
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Technologie WDM - koncept

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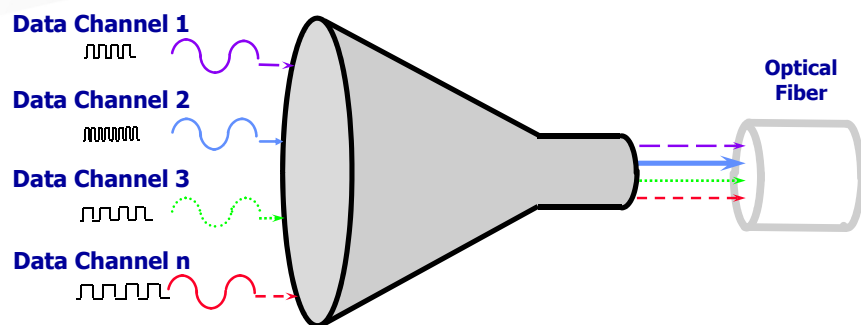
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Wavelength Division Multiplexing (WDM) acts as "optical funnel" using different colors of light (wavelengths) for each signal

Wavelength = λ = lambda

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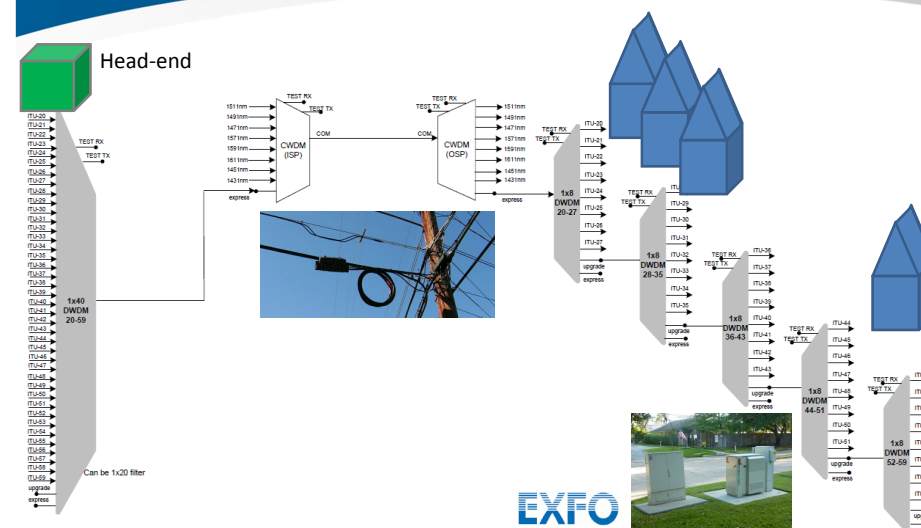
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Pasivní CWDM/DWDM síť

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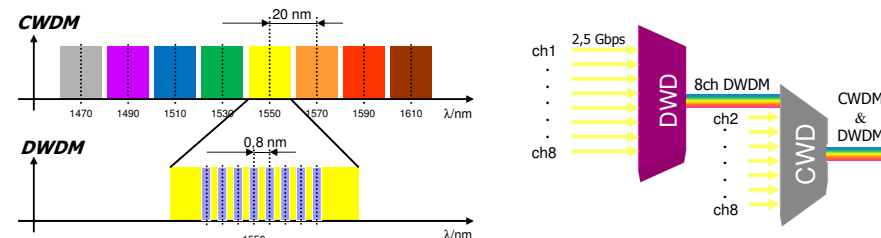
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CWDM/DWDM pro přístupové metropolitní ethernet linky

- P2MTP přístupové sítě, **služby koncovým účastníkům** (CPEs)
- **Různé topologie sítě** než Metro/Core, potřeba jiné testovací metody!!
- Potřeba **OTDR se stejnou vlnovou délkou** kanálu pro testování skrze MUX/DEMUX

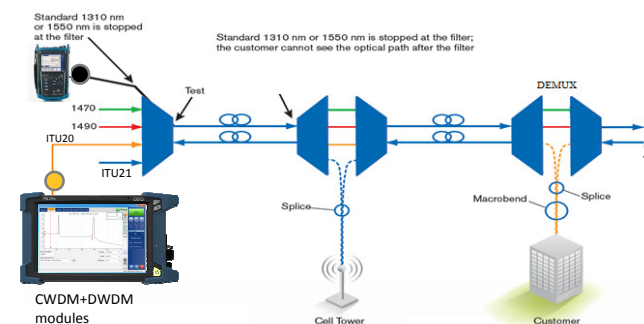
- Všechny **kanály CWDM** jsou již využity
- Požadavky na 10G/40G komerční služby
- Future-proof nasazení v krátkém čase (den)

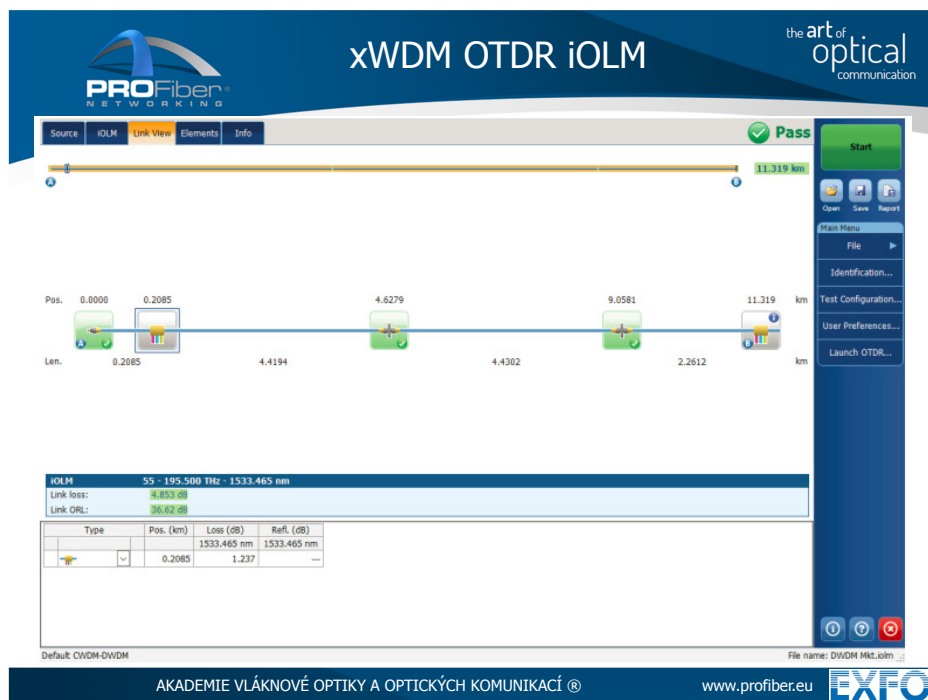
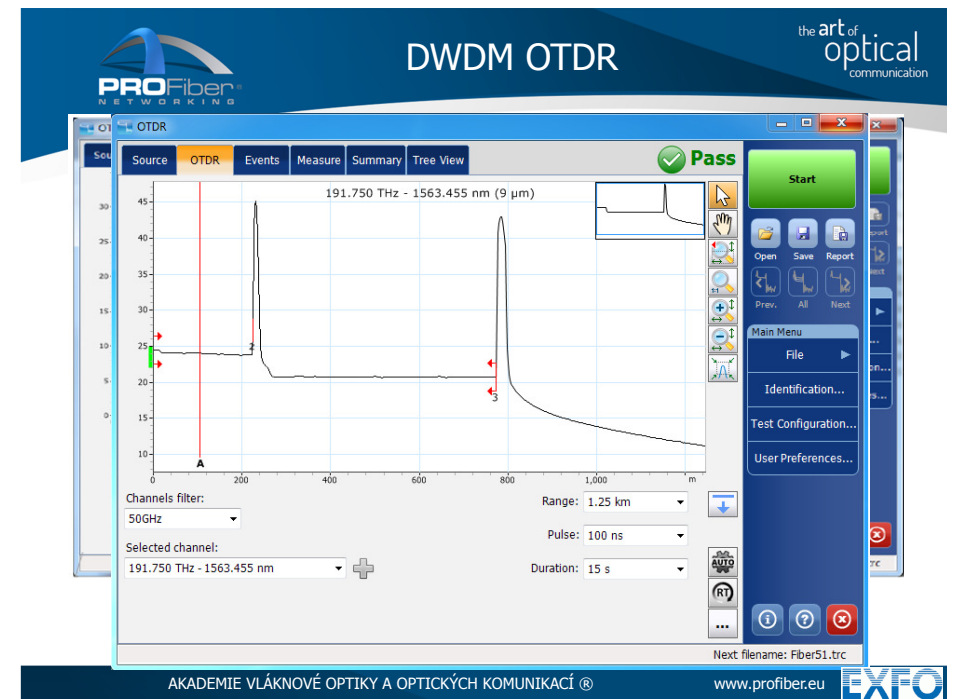
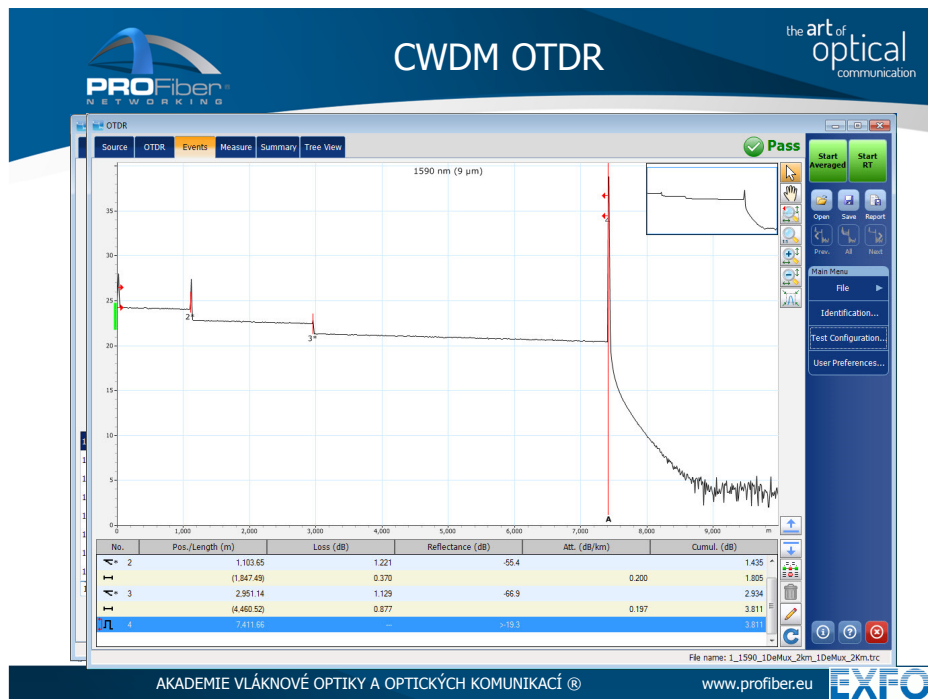
**DWDM
services**



- Troubleshooting high-value DWDM links under **4h SLA**
- Validation of DWDM links during construction cant be done in one shot
- Must have quick access to a DWDM OTDR for troubleshooting
- **SLA penalties** could be very expensive
- Techs cannot use same **testing procedures** as with current CWDM

- Use the C/DWDM OTDR to **validate continuity** during construction **through the MUX/DEMUX** and get End-to-End budget loss
- Use the C/DWDM OTDR to **troubleshoot from the head-end**
- In-service testing using the customer's λ port (ITU DWDM or CWDM)
- Single-ended CWDM/DWDM fiber characterization in one box





CWDM OTDR

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- 1 single-slot module that covers all 18 CWDM channels – including water peaks

FTB-740C-CW18

- Compact and Evolutive CWDM solution → Hardware-ready for all 18-λ
 - Start with standard 8 channels to remain in budget
 - Upgrade with software keys

- iOLM READY** modules → Intelligent characterization of WDM MUX/DEMUX

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740C xWDM OTDR Series

C-BAND DWDM AND 18-WAVELENGTH CWDM TUNABLE OTDR SERIES FOR METRO ETHERNET AND C-RAN LINK CHARACTERIZATION

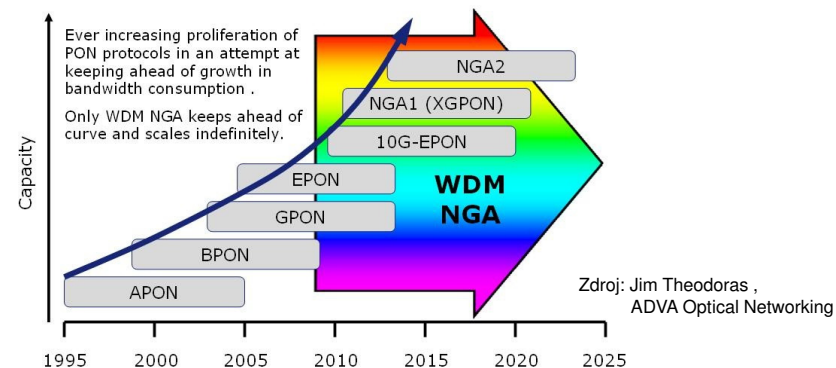
TECHNICAL SPECIFICATIONS

	740C-CWDM	740C-DWC
Laser nominal wavelength (nm)	1270, 1290, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610	C-Band tunable 1527.99-1563.86 nm ITU-T G694.1 Channels 17-62 (191.7 THz - 196.2 THz)
Central wavelength uncertainty (nm) ^a	±3	DWDM 50GHz channel wavelength control
Channel spacing tuning	N/A	50 GHz and 100 GHz increments on ITU-T G694.1 grid
Dynamic range at 20 μs (dB) ^b	>37	40
Event dead zone (m) ^c	1.1	0.7
Attenuation dead zone (m) ^c	5	3.5
Distance range (km)	0.1 to 400	0.1 to 400
Pulse widths (ns)	5 to 20 000	5 to 20 000
Sampling points	Up to 256 000	Up to 256 000
Sampling resolution (m)	0.04 to 10	0.04 to 10
Distance accuracy (m) ^d	±(0.75 + 0.0025 % x distance + resolution)	±(0.75 + 0.0025 % x distance + resolution)

iOLM
READY

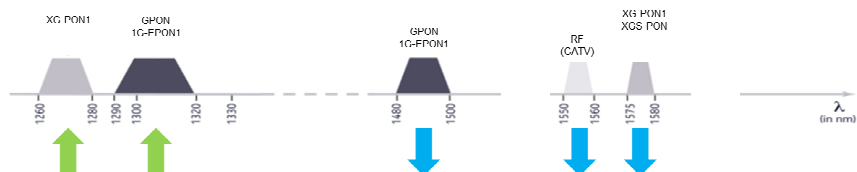
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IEEE P802.3av 10 Gb/s Ethernet Passive Optical Network (10G-EPON) –2009
ITU XGPON (10Gbit/s) – 2010



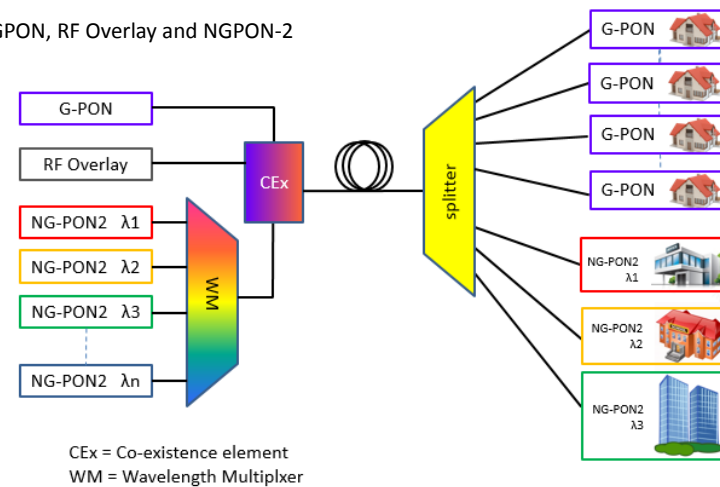
Legacy and Current

	GPON	1G-EPON1	XG-PON1
PON Rate (down/up)	2.5G/1.25G	1.25G/1.25G	10G/2.5G
Downstream λ (nm)	1480-1500	1480-1500	1575-1580
Upstream λ (nm)	1310 +/-20	1310 +/-50 Or 1310 +/-20	1280-1290
Split Ratio	1:128	1:64	1:128



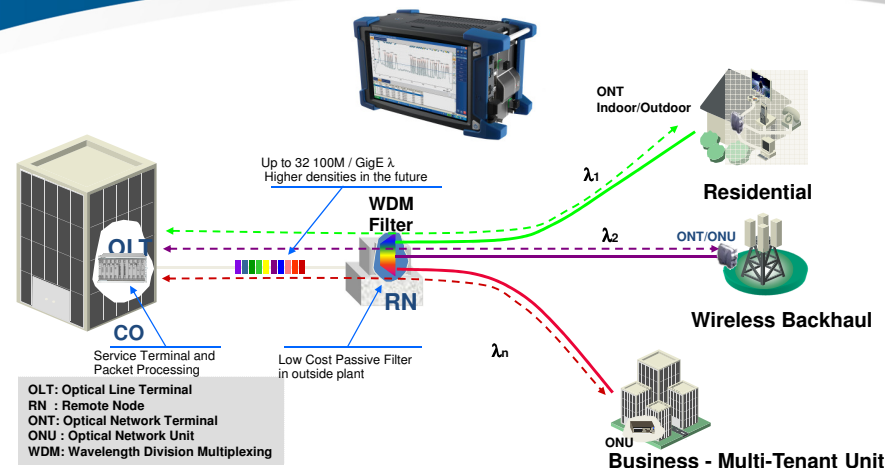
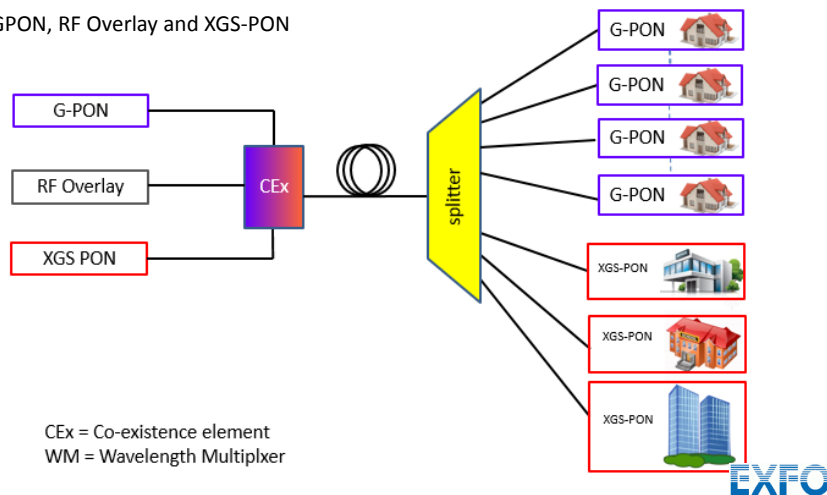
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GPON, RF Overlay and NGPON-2

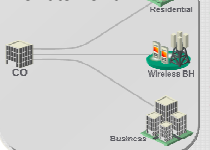


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GPON, RF Overlay and XGS-PON

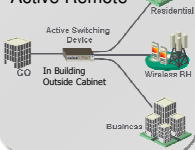


Point to Point



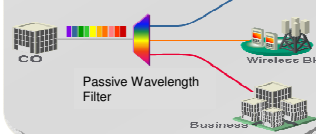
- + Future Proof architektura
- + Škálovatelnost
- + Nezávislost (Protokol/Bit rate)
- + CO fiber management
- + Dostupnost vláken
- + MTTR při přerušení kabelu

Active Remote



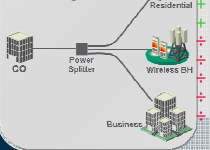
- + Jednoduchý návrh
- + Flexibilita (uživatel vs. Bit rate)
- + Jednoduchý upgrade
- + Sdílená šířka pásma
- + Aktivní prvky v OSP
- + Spotřeba el. energie

WDM Fiber Access



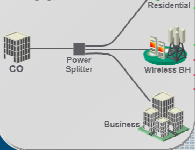
- VÝHODY všech zmíněných technologií
- + Bezpečnost, Dosah, Škálovatelnost, Eliminace „Wavelength“ plánování, Jednoduchý návrh

TDM PON



- + Jednoduchý fiber management
- + Pasivní řešení OSP
- + Nízká spotřeba el. energie
- + „Zrající“ technologie
- + Sdílení šířky pásma (DS & US)
- + Real time SW
- + Přechod na jinou technologii
- + Bezpečnost

RFoG



- + Integrace se stávajícím DOCSIS systémem
- + Pasivní OSP řešení
- + Nutný DOCSIS systém
- + Sdílená šířka pásma (DS & US)
- + Bezpečnost

- Using a standard power meter is no longer possible
- Using current PON power meter is no longer possible
- Measuring multiple transmission « types » is confusing for installers
- Testing a mix of legacy and next generation PON using the same instrument



- Compatible with next generation PON technologies
GPON, EPON, XG-PON, XGS-PON, NGPON-2, 10G-EPON, ALT-PON
- Compatible with triple layer networks carrying legacy & next generation PON as well as RF video overlays
- Can measure upstream ONT burst light levels even at speed up to 10 Gbit/s
- PON-Aware™ Technology automatically assess the P/F status of the network under test

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Stand alone

- › All essential features embedded in the instrument
- › Touchscreen operation
- › P/F assessment based on standards
- › Data storage in instrument



Connected

- › Connection via Bluetooth™
- › Storage in smart devices or into the cloud
- › Process compliance
- › Ready for future integration with TestFlow, EXFO Connect or customer applications

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