EVOLUCE SYSTÉMŮ DOHLEDU OPTICKÝCH VLÁKEN

Vratislav Blažek

EXFO

Obsah:

1 architektura monitorovacích systémů

co se změnilo za posledních 25let

2 kam se dostaly systémy dohledu

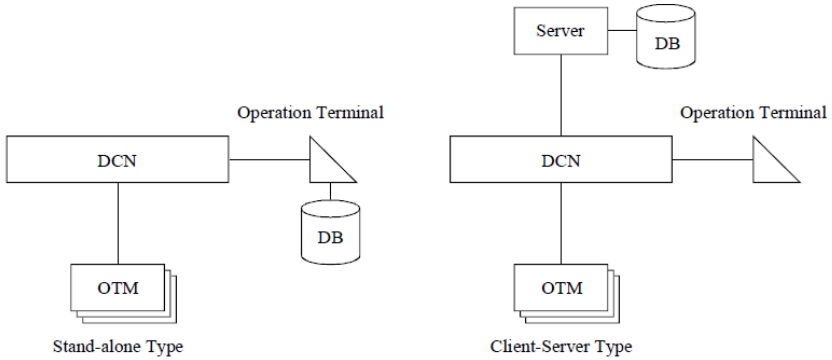
od pouze monitorovacího systému” k efektivnímu řešení při výstavbě optických sítí

3 kam dál rozvíjet,

které další paramety sledovat a jak

RFTS /FMS architecture

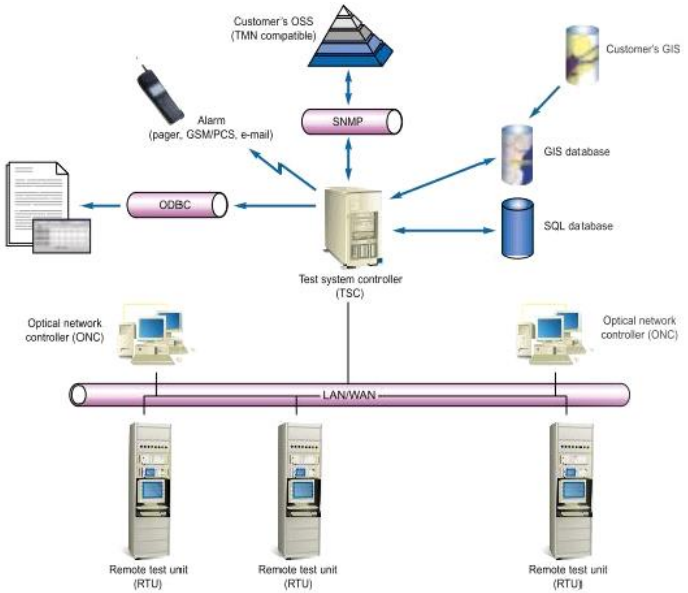
BellCore/Telcordia GR-1295-CORE
ITU-T L.40 10/2000 =>L.302 2016



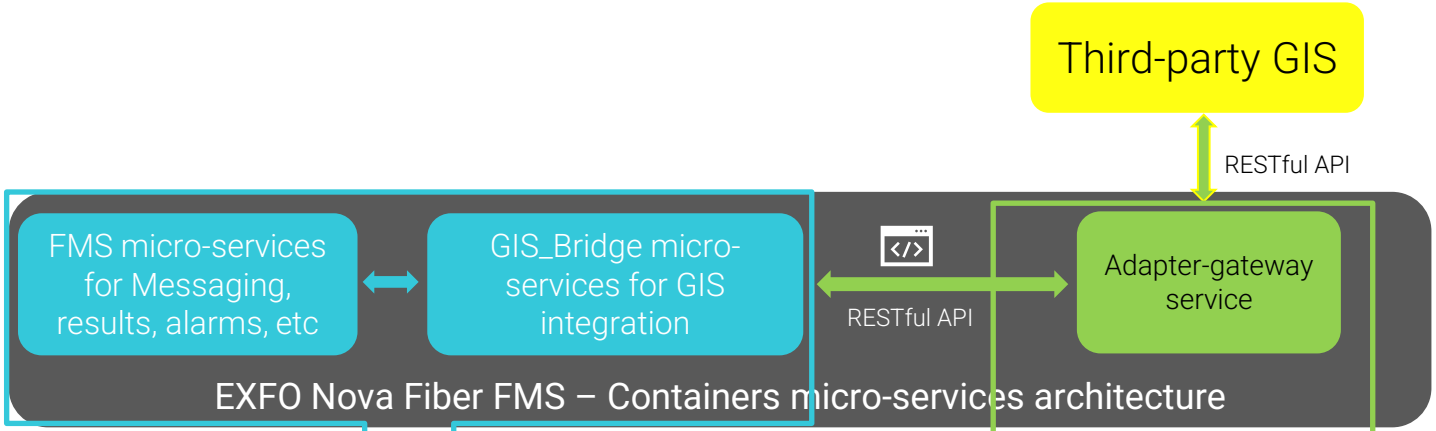
DB Database

T0604740-00

Figure 1/L.40 – System architectures



RFTS /FMS architecture

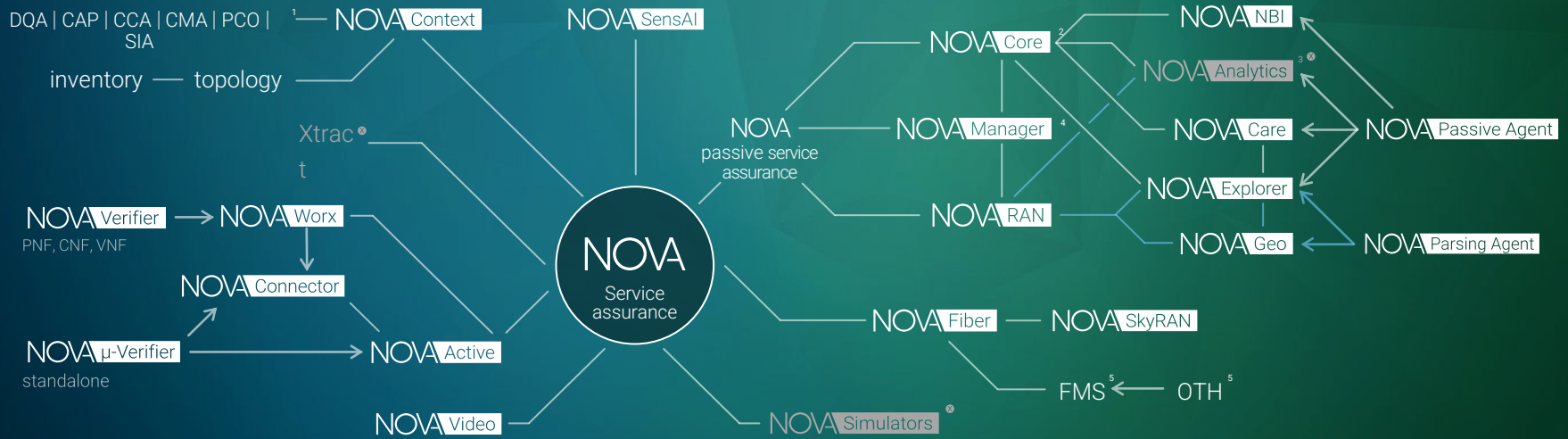


- FMS micro-services are part of standard product.
- They are supported and maintained by product program (R&D)

- Custom-based service supported by Professional services

docker

NOVA service assurance › solution components



[1] Modules: DQA – data quality analysis | CAP – change analysis & planning | CCA – common cause analysis | CMA – config management audit | PCO – path compute | SIA – service impact analysis
[2] Includes Nova Alerter [3] Applications include: Core & RAN performance | Customer management | Advanced use cases | SQM | Roaming [4] Includes Nova Portal & Nova Cockpit
[5] FMS – Fiber management system (EMS) | OTH – Optical test heads Approaching EOL

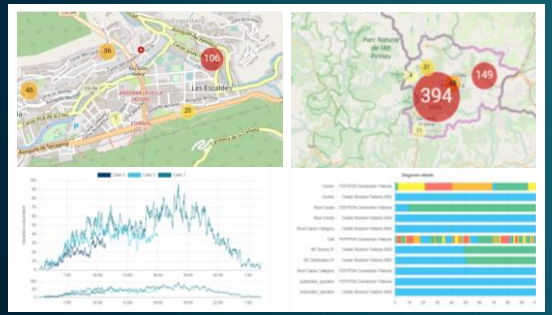
Cloud | Core | Transport | Edge | Customer

Service

Network

Fiber

NOVA SensAI



Automated AI-troubleshooting

Detect / predict and diagnose customer-impacting events

Analyzes diverse data streams in near real-time

Autonomously identifies QoE-impacting events

Classifies, correlates and groups events

Rapidly reports customer impact

Performs automated root cause analysis

Extracts insight and value from existing systems

Only EXFO

NOVA Fiber

Continuous physical layer monitoring

The fastest, most precise fiber optic network benchmarking, analytics and reporting.

- Most automated fiber monitoring available
- Automated thresholding
- Fastest fiber scanning (3 sec)
- Segmented loss monitoring
- Most precise fault localization
- Anomaly detection / prediction: SensAI integration

Only EXFO

Fiber Guardian FG-750

Remote Fiber Testing System – P2P

- Up to 46 dB dynamic range on dark fiber and 43 dB on lit fiber
- Narrow-band CWDM OTDRs
- Redundant and hot-swappable power supply modules
- Scalable from one to 96 ports in **2U** height
- Local storage on solid-state disks
- IPV4- and IPV6-compliant

Specification Sheet

Product video

OTH-7000

Remote Fiber Testing System – P2P

- Smallest footprint in the market (Up to 16 ports in **½ U**)
- Scalable (up to 1024 ports)
- Ease to integration with third party SDN controllers, and OSS solutions
- Multi-vendor capability
- Complete REST API to be integrated as remote OTDR
- iOLM-ready: intelligent and dynamic application for simple OTDR use

Specification Sheet

OTDR / iOLM

RTU-2

Remote Fiber Testing System – P2P & PON

- Smaller and denser. RTU : **1U**; Optical switch (256ports) : **½ U**
- Recognized EXFO quality: FTBx-735C high-end OTDR module
- Optional 1x4 FTBx-9160 optical switch for dual-stage scaling of test ports
- MPO connectors: Less connectors, less issues. 16x less connections than other vendors
- Scalable up to 1024 ports per RTU-2
- iOLM-ready: intelligent and dynamic application for simple OTDR use

Specification Sheet | **Product video** | **How it works (Build)** | **How it works (Monitor)**

Build & Connect - Solution Flow

RTU-2

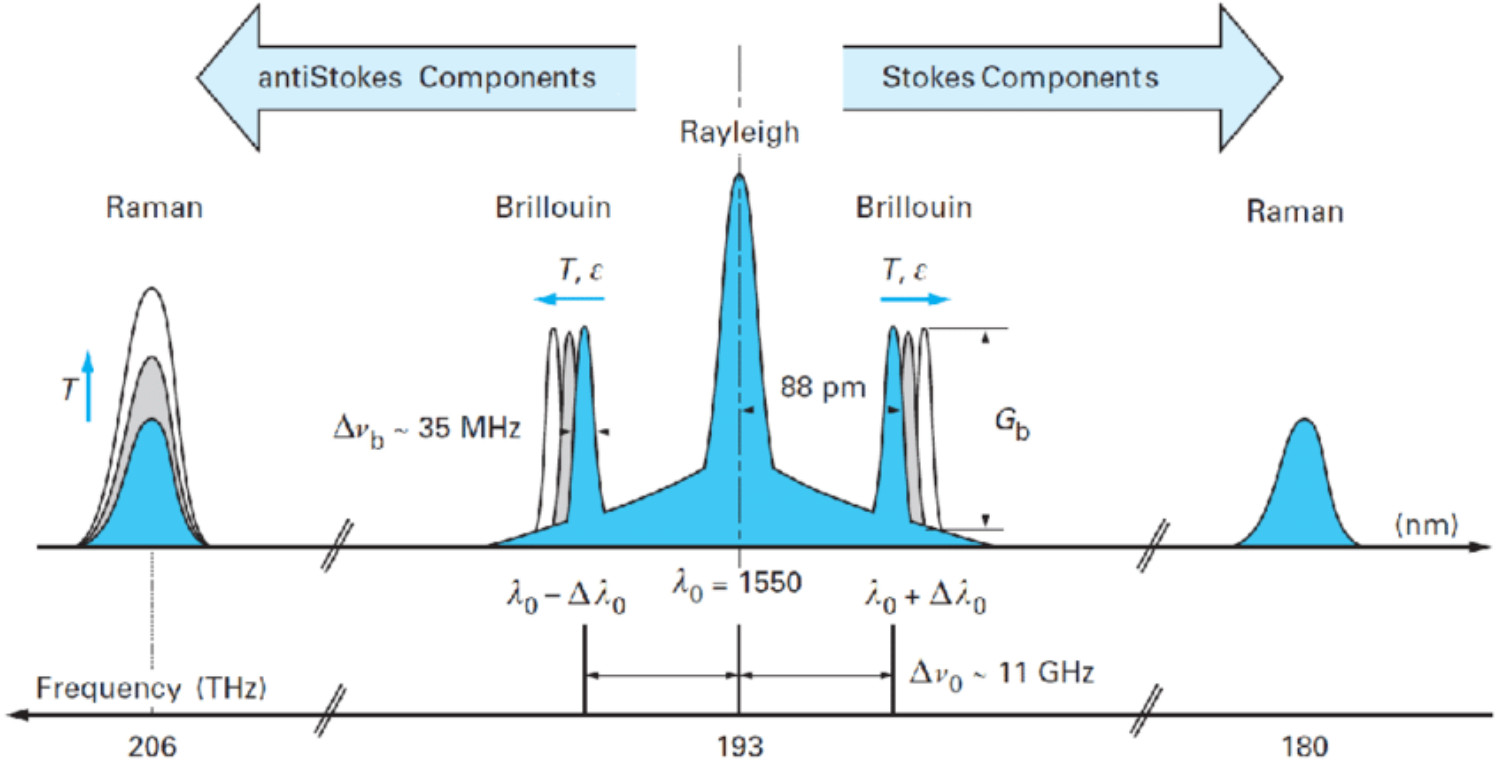
Test 1 F1

Test 2 Splitter splice

Test 3 Distribution to Drop termination

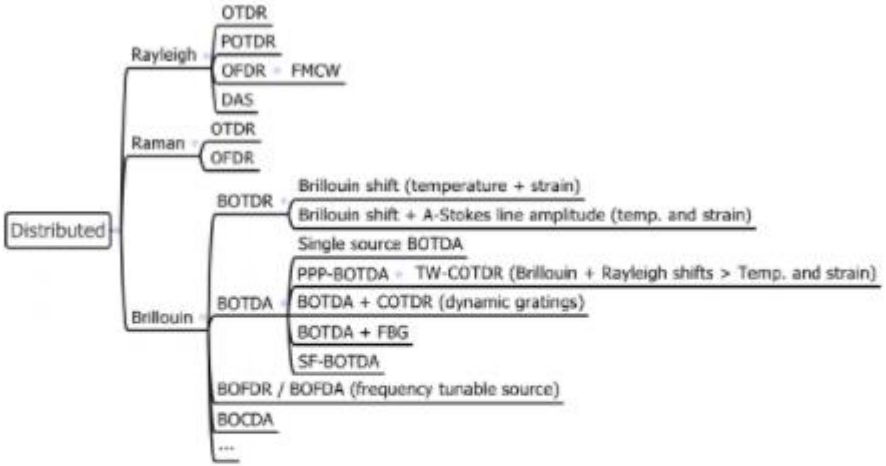
Test 4 Drop cables to ONT

Rayleigh, Raman and Brillouin scattering



Source: researchgate.net

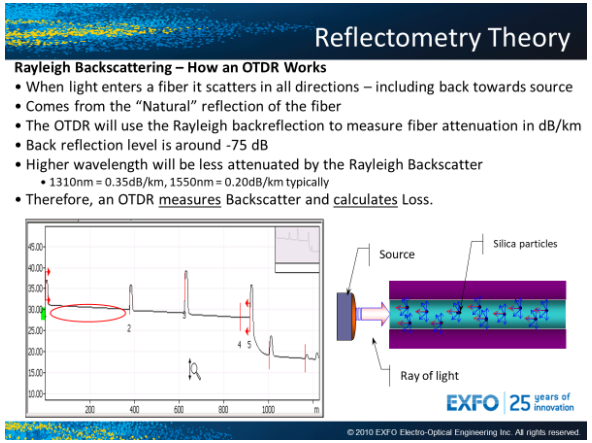
Distributed optical fiber sensors

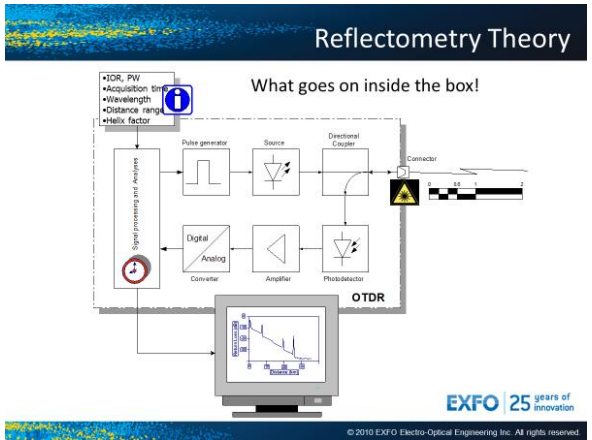


OTDR: Optical Time Domain Reflectometry; POTDR: Polarization OTDR; DAS: Distributed Acoustic Sensor; OFDR: Optical Frequency Domain Reflectometry; FWCW: Frequency Modulated Continuous Waves; BOTDR: Brillouin OTDR; BOTDA: Brillouin Optical Time Domain Analyzer; PPP-BOTDA: Pre–Pulse-Pumping-BOTDA; COTDR: Coherent OTDR; TW-COTDR: Tunable Wavelength-COTDR; SF-BOTDA: Sweep Frequency-BOTDA; BOFDR: Brillouin OFDR; BOFDA: Brillouin Optical Frequency Domain Analyzer; BOCDA: Brillouin Optical Correlation-Domain Analyzer.

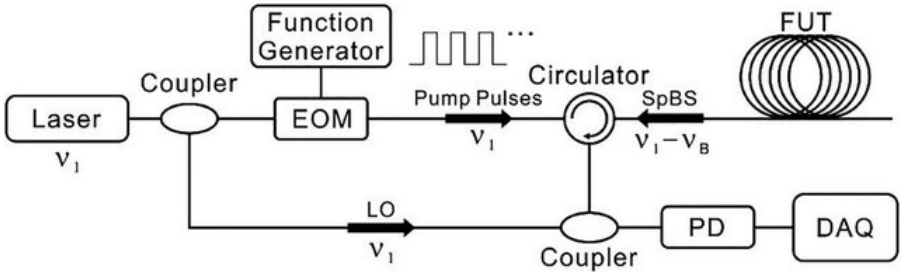
Source: European Workshop on Structural Health Monitoring
July 8-11, 2014. La Cité, Nantes, France

Rayleigh, Raman and Brillouin scattering

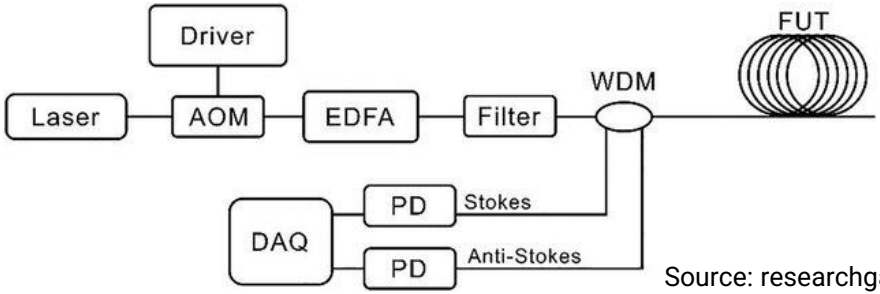




Brillouin OTDR

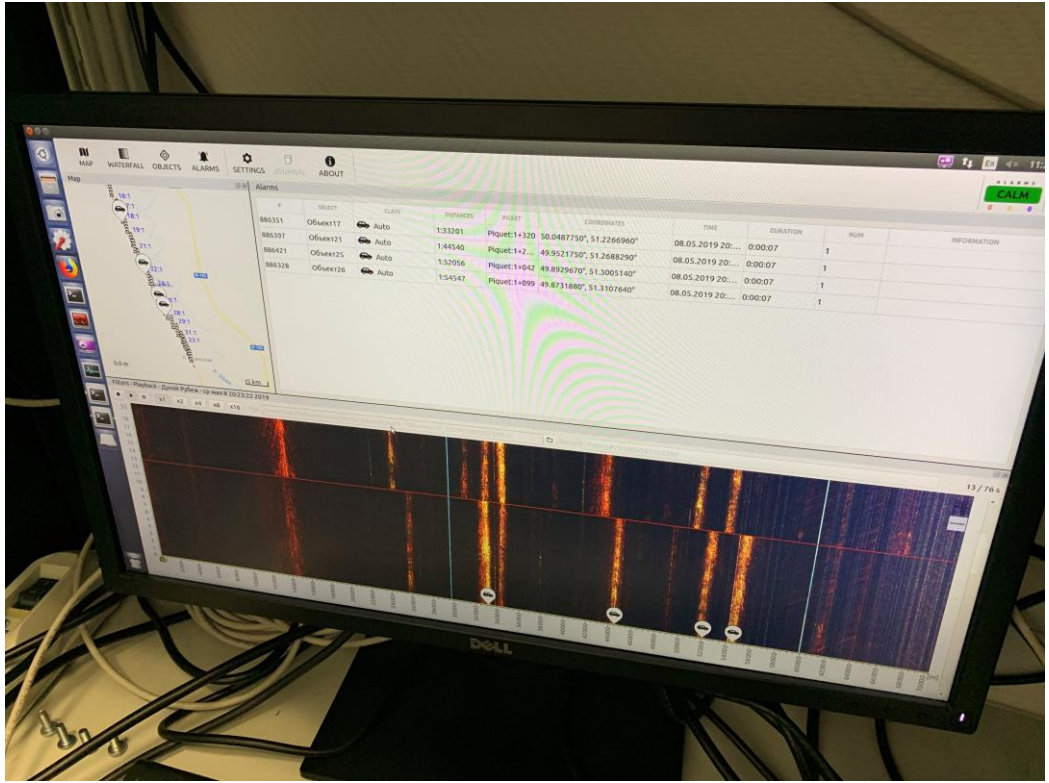


Raman OTDR

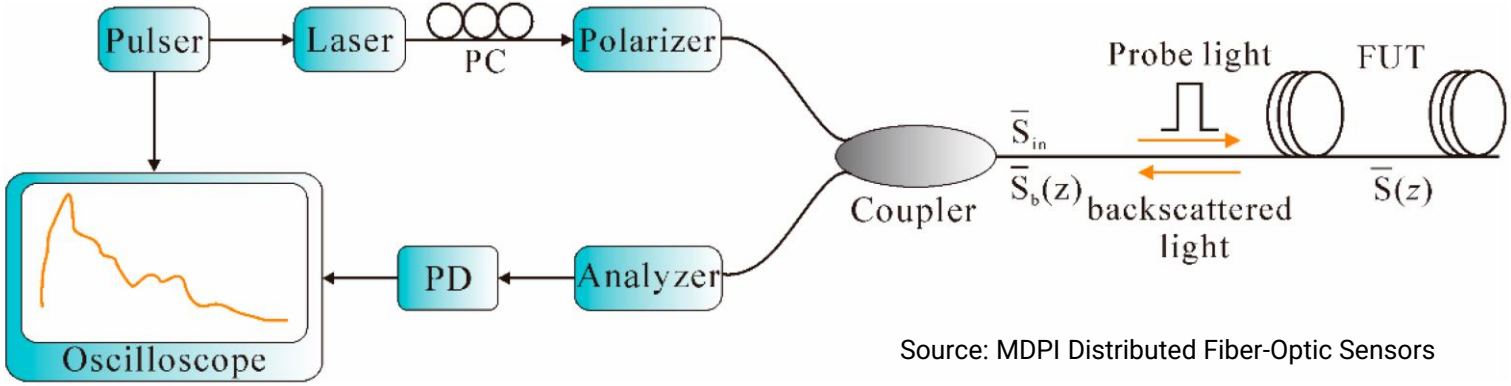


Source: researchgate.net

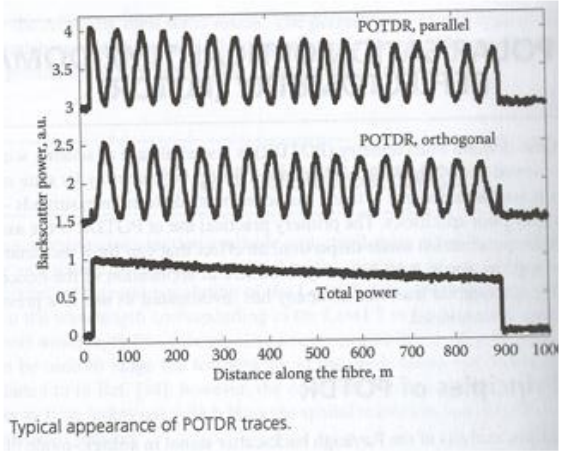
Rayleigh, Raman and Brillouin scattering



Polarized OTDR (Rayleigh scattering)



Source: MDPI Distributed Fiber-Optic Sensors

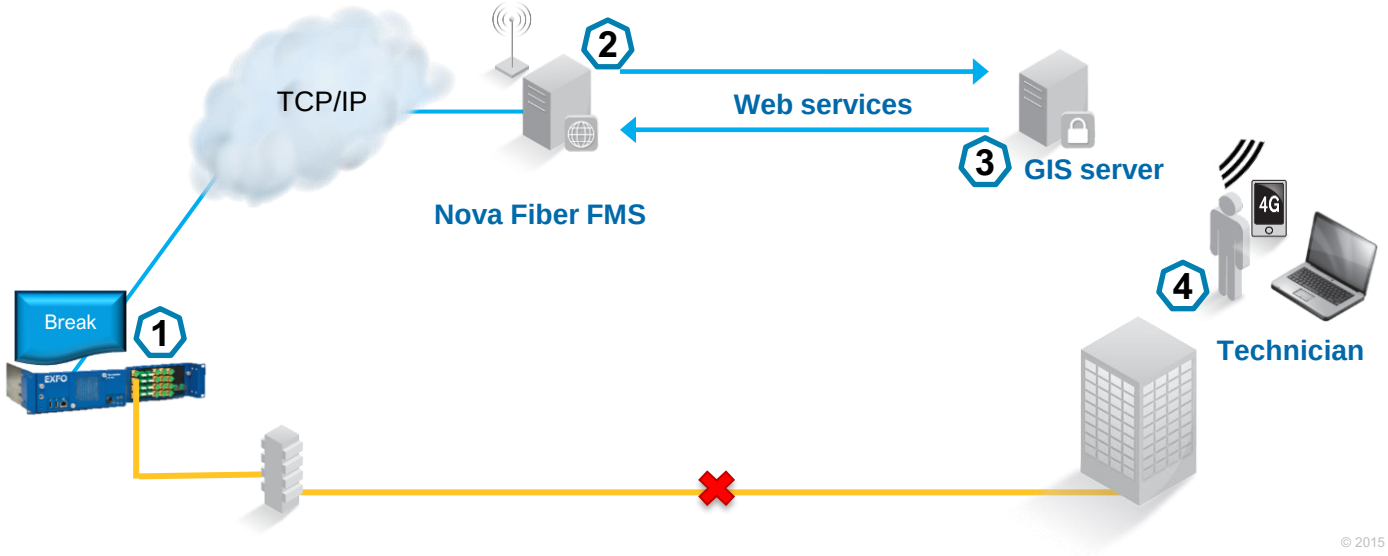


Typical appearance of POTDR traces.

Source: Distributed Optical Fiber Sensors /A.Hartog

How it works - Get Fault Position web service

1. RTU sends a break or degradation alert to Nova Fiber FMS
2. Nova Fiber FMS calls GIS application sending Optical Route ID and OTDR Length – GET FAULT POSITION web service
3. GIS application sends back GPS coordinates.
4. sends notifications including fault coordinates from the beginning



Závěr

1. RFTS se nestaví na 5let
2. Nechte si popsat architekturu systému od dodavatele včetně bezpečnosti systému
3. Kde jsou v telekomunikačních sítích peníze, businesscase
4. Dohled provozovaných vláken!
5. Které další parametry kromě útlumu sledovat a jak

Děkuji za pozornost!

Vratislav Blažek
M 420 720 592 592
vratislav.blazek@EXFO.com

EXFO Europe
Winchester House
School Lane
Eastleigh SO53 4DG

EXFO