



BIDI TF CHANNELS MONITORING

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GÉANT Infoshare Management and monitoring of time & frequency services

- CESNET's T/F infrastructure
- Living with infrastructure
- Monitoring stack's architecture
- Dashboard examples
- Low level performance measurements



- 5 regular lines (Prague→{Pecný, Brno}, Brno→{Vídeň, Ostrava, Temelín})
 - Prague–Pecný: 1 EDFA, 72 km
 - Prague–Brno: 5 EDFAs, 267 km
 - Brno–Vídeň: 4 EDFAs, 175 km
 - Brno–Ostrava: 4 EDFAs, 214 km
 - Brno–Temelín: 6 EDFAs, 334 km
- Special R&D purpose: 8 EDFAs; over 550 km
- In total:
 - 20+8 Bidi EDFAs: in regular service 1062 km; 1600 km total
 - 122 boxes and 3800 km monitored in total
- Powered by *legacy CzechLight™* amplifiers devices.
- The monitoring is about **BiDi lines**, but not limited to BiDi.



■ more or less heterogeneous environment

- the oldest devices in operation since 2011
- BiDi devices a little bit younger – 2012
- two generations of OS (CLD) in boxes

■ division of roles and responsibilities

- CESNET: Network infrastructure department (service dep.; 24/7 surveillance service)
- CESNET: Optical networks department (R&D dep.)
- telco operators; some lines are in the LaaS mode – Lightning as a Service
- *staff turnover, available manpower*

■ long-, middle-, and short-term roadmaps

■ not only BiDi devices; also 94 other CzechLight monitored boxes in operation with different purposes, connectivity, operators, ...

- Whole monitoring stack is a living organism, continuously developed with all consequences. . . ;-)
- What we need in general (at least)?
 - be informed on events on various levels of importance
 - take an action (appropriate) in response to the event

What is *nice-to-have* (at least some time)?

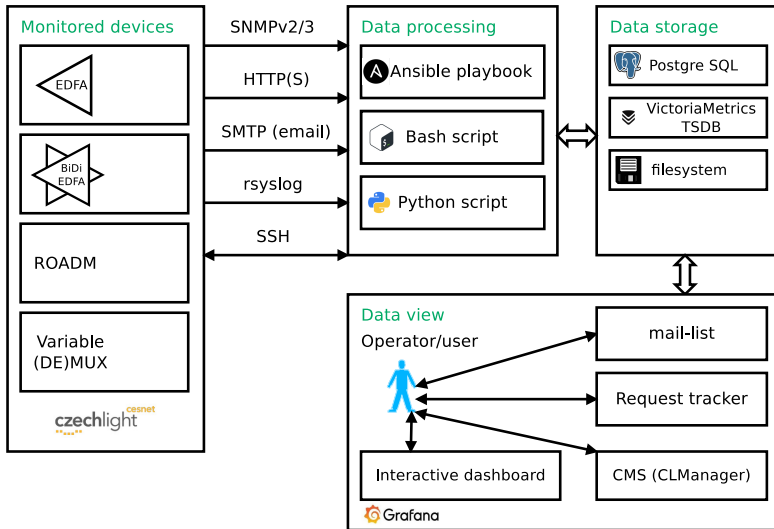




■ What is *nice-to-have* (at least some time)?

- monitoring tool with clear uniform frontend
- as little as possible protocols/channels for backend feeding
- detailed on-demand *view* to T/F infrastructure
 - in the current state
 - in any point in the past
 - in selected detail (granularity)
- automated deployment of monitoring frontend & backend
- both push and pull data acquisition
- automated responses to predefined type of events...
- ...as a prerequisite to SDN (software defined network)
 - new SDN devices from *CzechLight* family (ROADM, EDFA, BiDi EDFA) – <https://czechlight.cesnet.cz/en/>
- utilized an on-the fly monitoring of fibers environment (SOP, DAS) and low-level performance indicators (SNR, *LQI*)

cesnet Monitoring stack's architecture



cesnet Monitoring stack's architecture

■ Data acquisition protocols

- SNMPv2/3 – many data from optical layer & system (own MIBs)
- SSH – some system data (CMOS battery, FW config., OS version, ...) by Ansible playbooks
- HTTP(S) – marginal data (web GUI build version)
- SMTP (email) – urgent alarms notifications (1 channel)
- rsyslog – remote system logging (boxes runs with RO FS)

■ Data processing tools

- linux CLI tools: Bash, Python, Ansible, CRON scheduled tasks, wget, CURL, psql, smokeping, ...
- scripts (when possible) are versioned in private git repo
- *quick&dirty* approach; **verified become permanent**

cesnet Monitoring stack's architecture

■ Data storage

- Postgre – historical purposes, no need to change
 - stores data for CMS (boxes, lines, locations, service)
 - small engancement in DB structure over time
- VictoriaMetrics – lightweight powerfull time series database:
 - possitive experience (6 months)
 - 436 M datapoints; 59 MB space on disk
 - for actual and **historical** data (optical power levels, attenuations, wavelengths, ...)
- filesystem – mailboxes, dynamic cofigurations (Ansible inventories), exports, backups, rsyslogs

■ Data view

- CLManager – in-house developed CMS for CzechLight boxes
- Grafana – interactive, powerfull and highly customizable dashboard system



Fig.: Grafana – sensors: CPU_{temp} , V_{in} , V_{bat} , LD_{temp} , $EDFA_{internal\ temp}$



Fig.: Grafana – optical power levels in dual stage EDFA

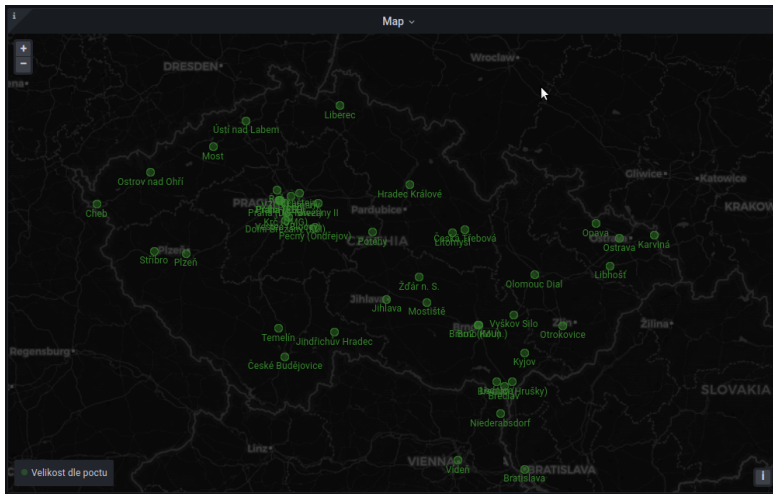


Fig.: Grafana – CzechLight boxes' locations on map panel

czechlight cesnet CLmanager – Detail zařízení slapak@cesnet.cz

Device details

Base info

ID 135

Výrobce [redacted]

Servis [redacted]

Umístění Brno (MU)

Projekt ⓘ

Trasa [Brno - Jihlava - JH - ČB - Tem~](#)

Typ CLAQ-BiDi1222-C-NPC-M-AC

S/N CLAQ6006

IP adresa [redacted]

Netmaska [redacted]

Gateway [redacted]

Actual state

Last scan 2022-06-20

Uptime 39 days (13:10)

Ping ● (13:20) [smokeping_details...](#)

SNMP ● (06:10)

Firewall ● (13:07)

Battery █ OK (13:02)

Hardware

Board AMD-GX3

Drive Axiom 2016-03-02 | 7.47 GiB

RAM 1 G

Software

CLD 5.6-dev

Webmin 2021-04-07 | CI 138 / 273

Python 2.7

Fig.: CLManager – box in detail (part 1)

[illegible]

Fig.: *CLManager – box in detail (part 2)*



Fig.: CLManager – line details with box overview

- SNMPv3 is slow due to the authentication & authorization
 - 103 boxes: **98 s** (v2c) versus **225 s** (v3)
 - If you can, use v2c!
- aliens' firewalls
 - Make and update evidence of all firewalls in path to your box!
 - Ensure that the FW administrators inform you on change.
 - Also important ports are sometimes blocked (161, 22, ...).
- ansible without python on hosts
 - *raw* command is inconvenient but essential and powerfull.
 - You master yourself in bash oneliners. ;-)
 - There are no parsers for *obscure* config formats – e.g. NEON (used as default in Nette framework).

- SSL (https) on ancient devices
 - During the ages, some ciphers/hash functions become obsolete. Client and server did not find a common subset.
 - You have to dig deep into the ssh/wget/curl documentation.
- It would be nice to design, develop/build, test, and configure everything from scratch – but that's not what life is about.
- Temporary solutions (when working) become permanent.

- For BiDi transfers is crucial to **minimize the reflections**.
- Any **reflection** adds to the undesired lasing (**is amplified**).
- It could be handy to be able to inspect optical spectrum in the line (OSA – expensive, OCM – *low* resolution).
- It could be helpfull to log the SNR or another matrices from transponders in long-term scope.
- In case of free channels in spectrum, you can utilize the CW laser and watch on its beat-note parameters over time.
 - Link Quality Index (LQI) proposed for balancing the EDFA amplifiers cascade.
 - The goal of LQI is to determine the state of the link before undesired lasing emerge.
 - You are limited by a laser's coherence length.

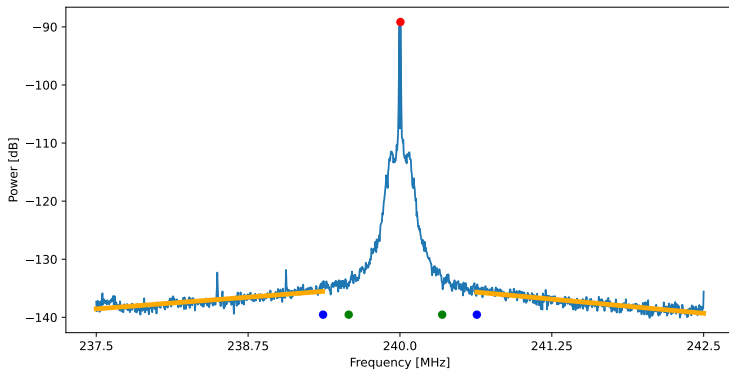


Fig.: *LQI – the CW laser beat note, acquired by AirSpy SDR device. Key points and segments are marked by dots (peak – red, base – green, base tolerance – blue) or lines (noise slope) respectively.*

LiPoBa2 - GridSearch - LQI v3
CLA1=BRNO (ID148) - CLA2 = OL (ID149)
Limit 65-200 mA

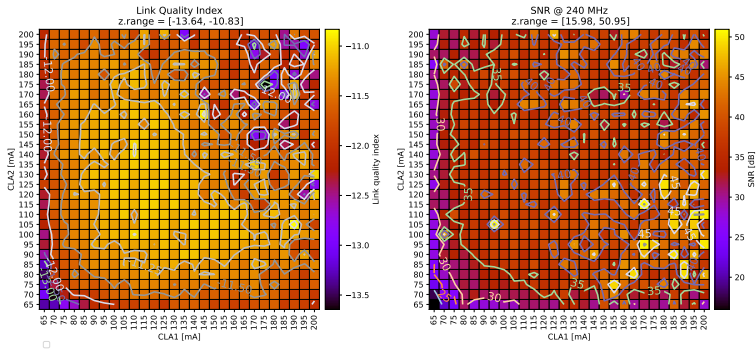


Fig.: Gridsearch of LQI and SNR – surface of LQI function value in whole state-space of two BiDi EDFA amplifiers.

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"...."

Thank you for your attention.



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