



CESNET

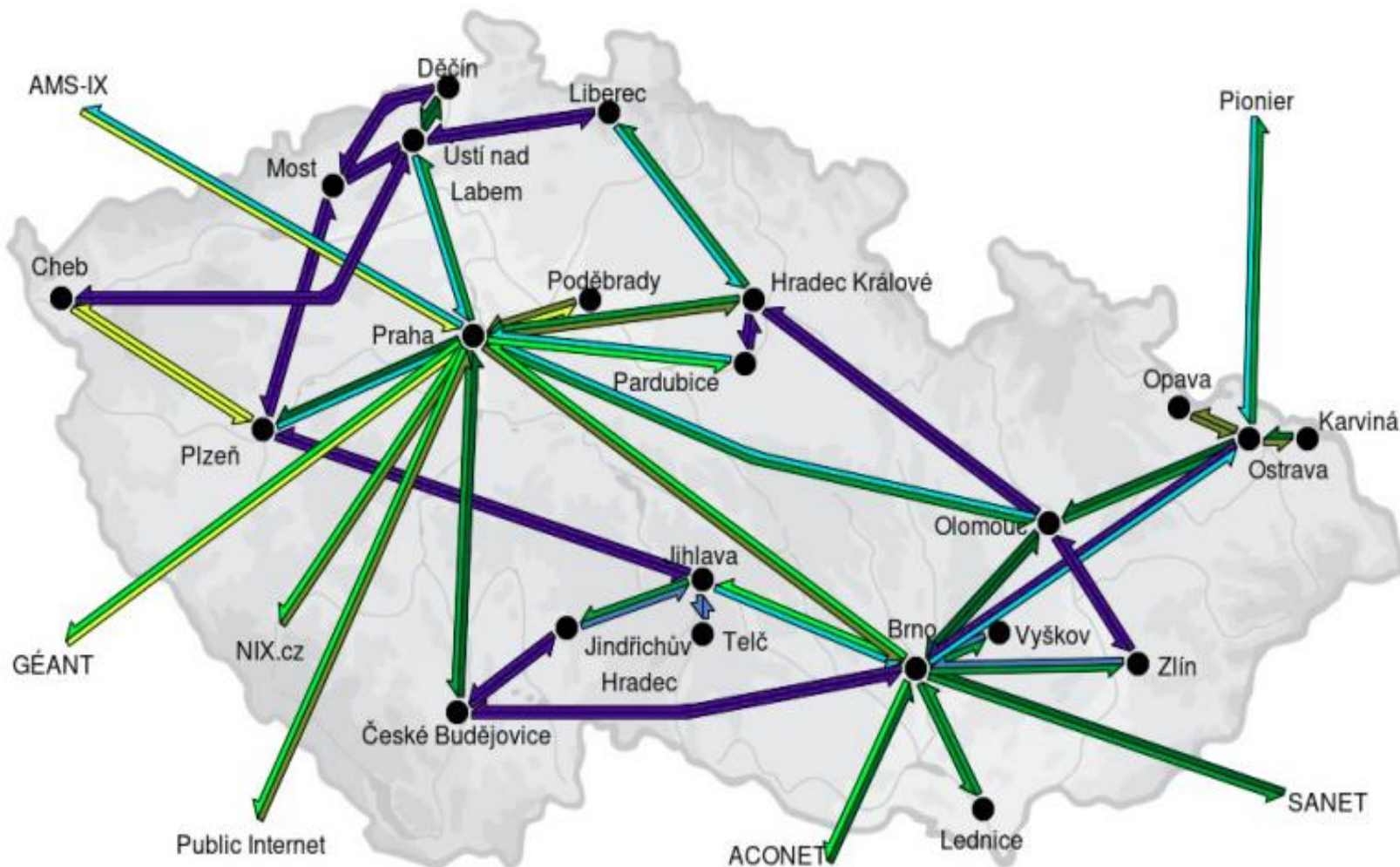
AND OTHER CZECH ACTIVITIES

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CESNET

5th GRP, 20124
Osaka

- **eInfrastructure**
 - Network for local researchers and universities
 - Link to international activities
- **Services and Applications**
 - Grids and Clouds, Storage, Security, Multimedia
- **Optical research**
 - CzechLight family devices
 - Remote sensing
- **Quantum activities**



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CZECHLIGHT FAMILY



- **Started in 2004**
- **Principles**
 - Research and development until prototype
 - Then license design to third party subjects
 - Use of them in our infrastructure
- **Device types**
 - Common management platform



- Everything is remotely configurable

- NETCONF
- RESTCONF YANG-push
- Web dashboard (R/O)
- Local console
 - SSH, USB

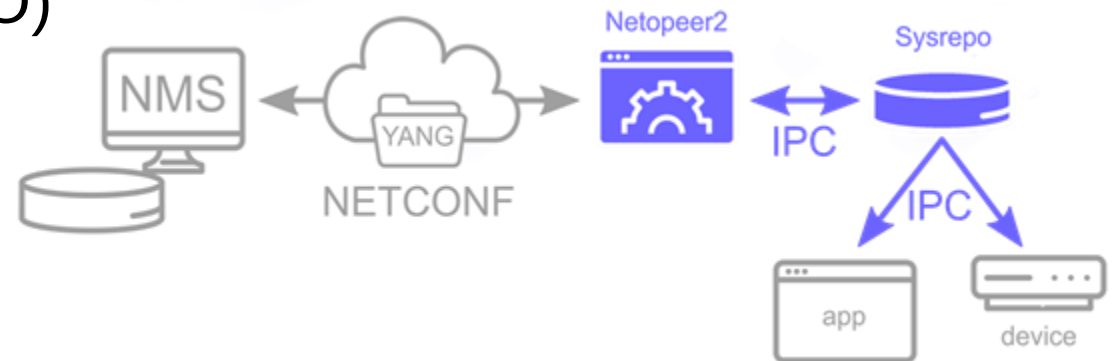
- Optics (DWDM)

- Spectrum routing and monitoring

- System management

- HW monitoring

- Ideal for prototyping



- **1U pizza boxes**
- **Scalability**
 - Up to 8-degree ROADM
 - Redundant Add/Drop
 - Limit: 10 boxes per site
- **Element-level control**
 - SDN northbound APIs
 - One NETCONF server per box



Scalable, Modular,
Open

Flexgrid, Colorless,
Directionless,
Contentionless

SDN Spectrum Control
and Monitoring

Optical amplifiers



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REMOTE SENSING



- **Applications**

- Detecting acoustic-mechanical vibrations and disturbances in fibre and its neighbourhood.
- Physical perimeter intrusion detection.
- Long-term SOP acquisition for later analysis or on-the-flow processing.

- **What can we detect?**

- Mechanical and acoustic vibrations of the surroundings and the fiber itself by monitoring changes in polarization.
- Artificial disturbances (tampering, manipulation, tapping, closing the rack, etc.).
- **It cannot:** specify where the event occurred.



- **Measure small changes of the optical path**

- ...or (indirectly) in the environment
- Phase of light
- Polarization
- Reflections



- **Polarilog – developed in CESNET**

- ready-to-use solution for the long-term continuous state of polarization (SOP) acquisition in compact 1U rack-mountable chassis
- Input: -35 to +5 dBm @ 1520–1610 nm (S, C, L)
- Could use existing traffic/signals as an input (tap or inline). No need of special laser sources.
- Recorded SOP data are stored locally in HDF5 format with metadata
 - could be synchronized to remote storage (approx 6-13 GB daily depends on the type of input signal)

- **Where is Polbox deployed?**
 - Longyearbyen, Svalbard, Norway since 04/2024
 - Ny-Ålesund, Svalbard, Norway since 04/2024
 - Completed and finished monitoring of the OSC channel on the production line Prague – Beroun
 - Poznań/PSNC, Poland since 04/2024 (time-tagging) – in lab
 - The first undersea link GÉANT (Greece-Italy) is in preparation
- **Open Issues to be addressed**
 - Who owns measured data
 - How to process measured data (patterns)
 - How to operate in the interconnected architecture





WIDER SCOPE OF SECURITY

- **FPGA cards**

- Research & development of unique HW accelerated technology
- Open source platform - Intel and AMD/Xilinx cards
- First 400G monitoring card developed together with Reflex CES (Intel Agilex HW)
- Development of 800G already started
- Guaranteed wirespeed processing and feature extraction for ML

- **DDoS protector**

- **Datasets**



- Open source monitoring probe for production use and experiments/research
- DPDK support allows to export IPFIX flows in 400GE NICs
- Can use commodity (i.e. Mellanox), high end and special NICs (FPGA)
- Plugins for extraction and computations of features of the network traffic
- Output are used as input vectors for machine learning models (classifiers) → (encrypted) traffic classifications (on collectors)

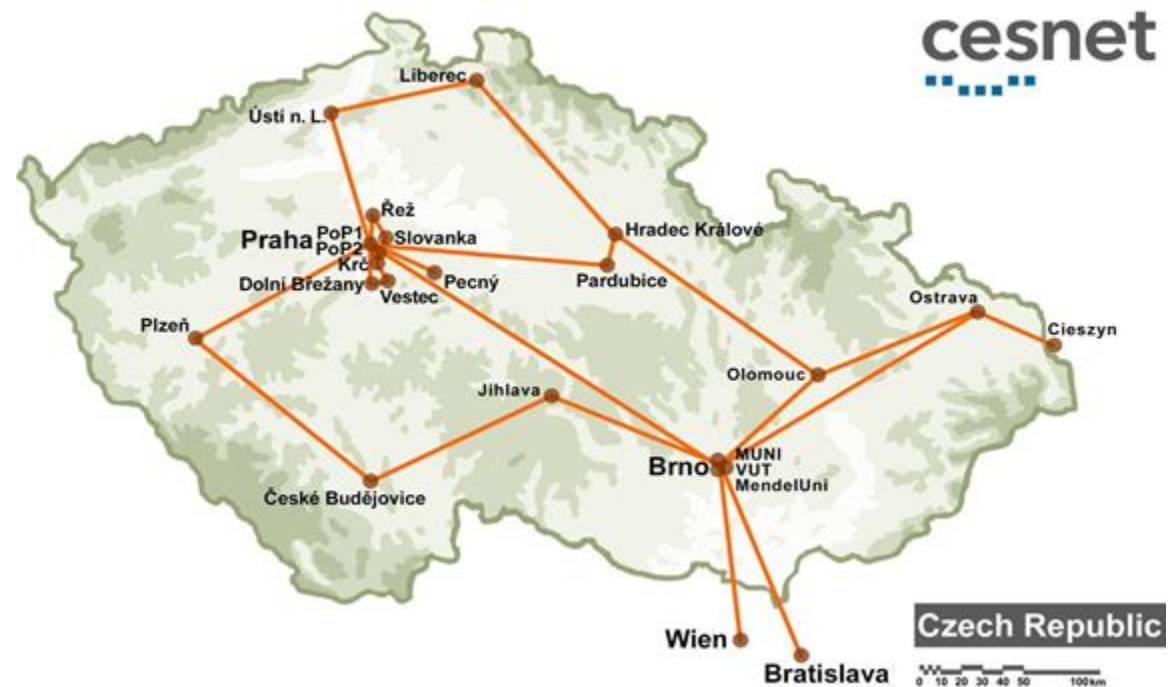




TIME & FREQUENCY IN CESNET NETWORK



- Deployment of White Rabbit switches in 20 POPs
- 43 bidirectional optical amplifiers (CzechLight BiDi EDFAs) for inline amplification
- Sharing production fibres with regular traffic in CESNET
 - Deployment alongside DWDM systems from Cisco and Ribbon over shared fibres
- Over 2000 km of fibre footprint

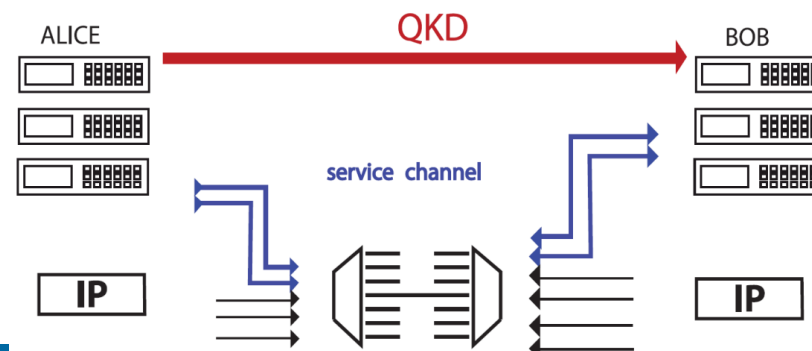


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QUANTUM



- Our aim is to do QKD on same fibres as IP
- Plan to use dark spectrum shared with T/F
- **QKD Trial Ostrava – Poznan (PL/PSNC)**
 - CZ side was 75 km (16 dB) over dark spectrum
 - PL side over dedicated DWDM channel
- **QBER 2.19%, secret key rate 2kbps**



- Lab based BBM92 Protocol with entangled photons in polarization
- first steps to interconnect of quantum computers
- future: time-bin QKD system, hyperentanglement (pol. & time-bin), entanglement swapping node.





NATIONAL REPOSITORY PLATFORM (EOSC CZ)

CONSORTIUM

- **Czech part of EOSC EU**
- **Established 8 thematic working groups**
 - covering broad scientific fields
- **Compliance conditions on individual repositories**
 - obvious ones, the must part
 - fulfilling the FAIR conditions, containing citable objects,
 - connected to EOSC AAI, exporting metadata to NMA
 - but also governance related
 - owner/responsible person/institution, data curator(s), admin(s), ...

- **NRP as an infrastructure service**
 - distributed, multi-tenant system for (data) repository instantiation
 - able to instantiate a repository according to user group's needs
 - repository: a technical, personal, and process solution for long-term storage
 - and publication of citable digital objects
 - object-oriented low-level layer (Ceph)
 - three major implementations of repository systems
 - CESNET Invenio, CLARIN Dspace, ASEP/ARL
 - National Metadata Directory: metadata aggregator, search, compartmentalization, statistics





PERFORMANCE PORTABILITY ON GPUS

- Users tend to run their code into newest available GPUs expecting performance boost
- The aim was to measure the boost on unmodified code
- **Selected 6 computing kernels (CUDA)**
 - BiCG, Convolution, 3D Coulomb summation, GEMM, N-body, Transpose
- **Outcome is set of Matrices that shows effectiveness**
- **Results TB published at**
 - <https://fondrozvoje.cesnet.cz/Public/DetailProjektu/899>

- <https://www.cesnet.cz>
- <https://www.liberouter.org/>
- <https://czechlight.cesnet.cz/cs/>
- <https://www.liberouter.org/technology-v2/tools-services-datasets/datasets/>



QUESTIONS?

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