PSNC

Poznan Supercomputing and Networking Center

61-139 Poznań
ul. Jana Pawła II 10
phone: (+48 61) 858-20-01
fax: (+48 61) 852-59-54
office@man.poznan.pl
www.psnc.pl

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ul. Jana Pawła II 10
phone: (+48 61) 858-20-01
fax: (+48 61) 852-59-54
office@man.poznan.pl
www.psnc.pl

Piotr Rydlichowski

QKD linie implementation between Poznań and Warsaw

Poznań Supercomputing and Networking Center

Center of e-Infrastructure

- National Research and Education Network PIONIER
- Research Metropolitan Area Network - POZMAN
- HPC Center
- Data repositories and Digital Libraries Federation

Center of Research & Development

- New Generation Networks
- HPC, Grids & Clouds
- Grand challenge applications
- New media and visualization technologies
- Knowledge Platforms
- Future Internet - Technology, Applications and Services for IS
- Cyber Security
- Quantum Communication and Computing – use cases, practical scenarios and connecting/building community

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PSNC LOCATIONS

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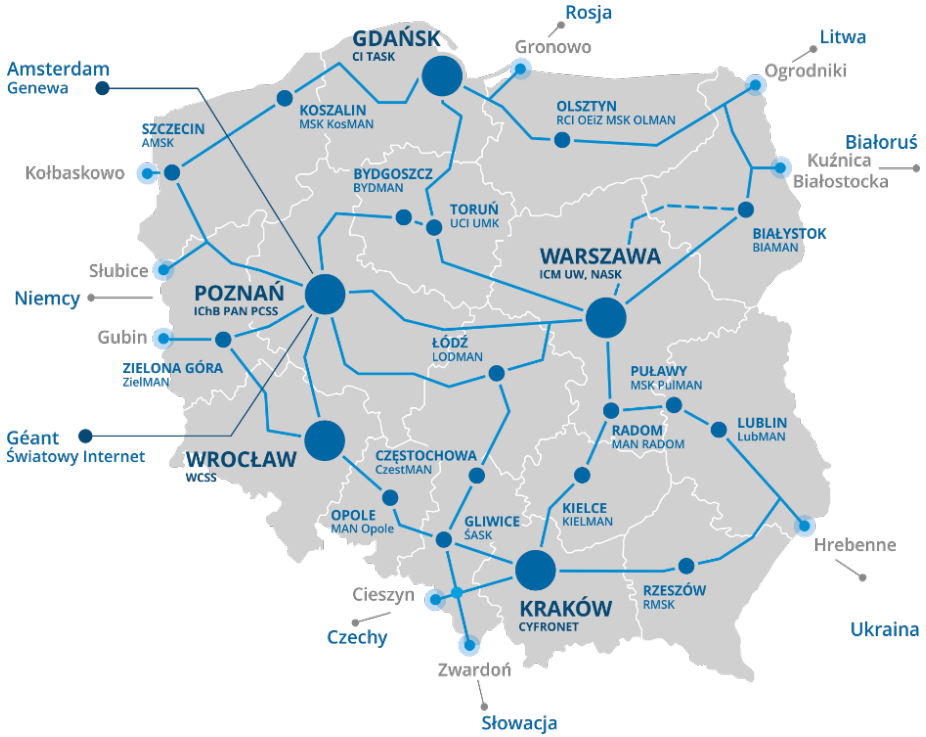
The PIONIER Consortium brings together 21 MAN Networks and 5 HPC Centers



Type of connected unit	Number of units
Research institutions	221
Universities	196
Post-secondary schools	21
High schools, secondary schools, primary schools and vocational schools	234
Healthcare	59
Public safety	27
Goverment administration	27
Provincial administration	59
District, municipality and city administration	73
Other administration	9
Court and public prosecutor's office	26
Cultural institutions	104
Other educational	27

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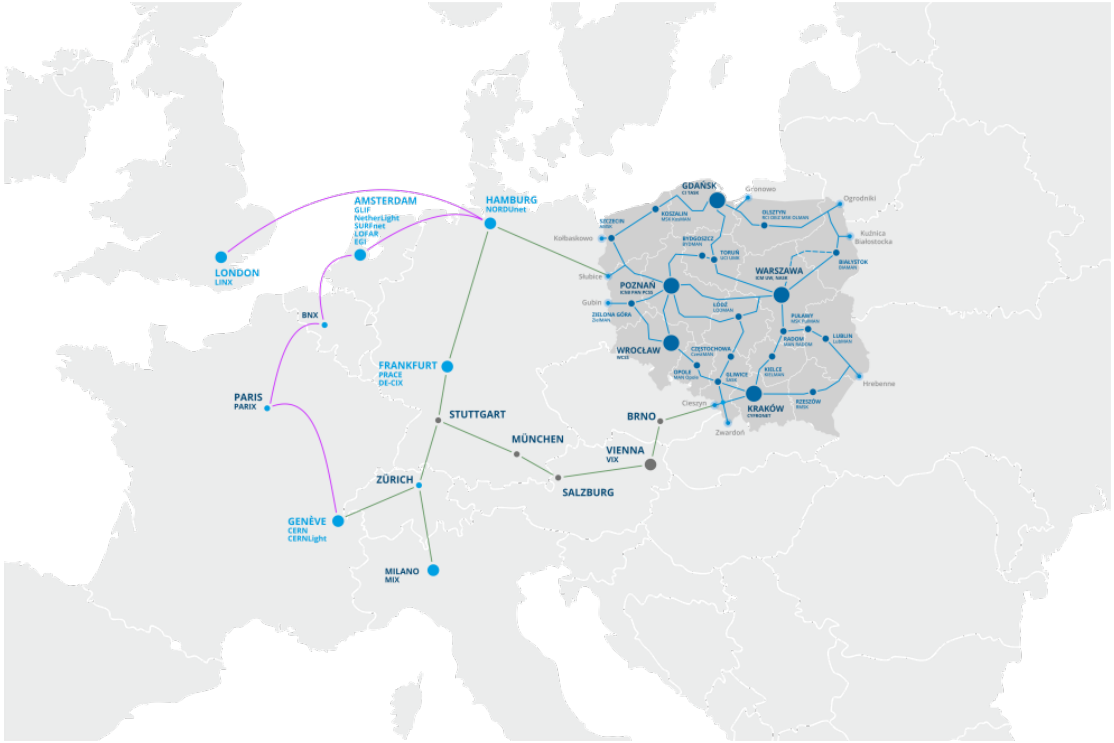
PIONIER NETWORK - EUROPE



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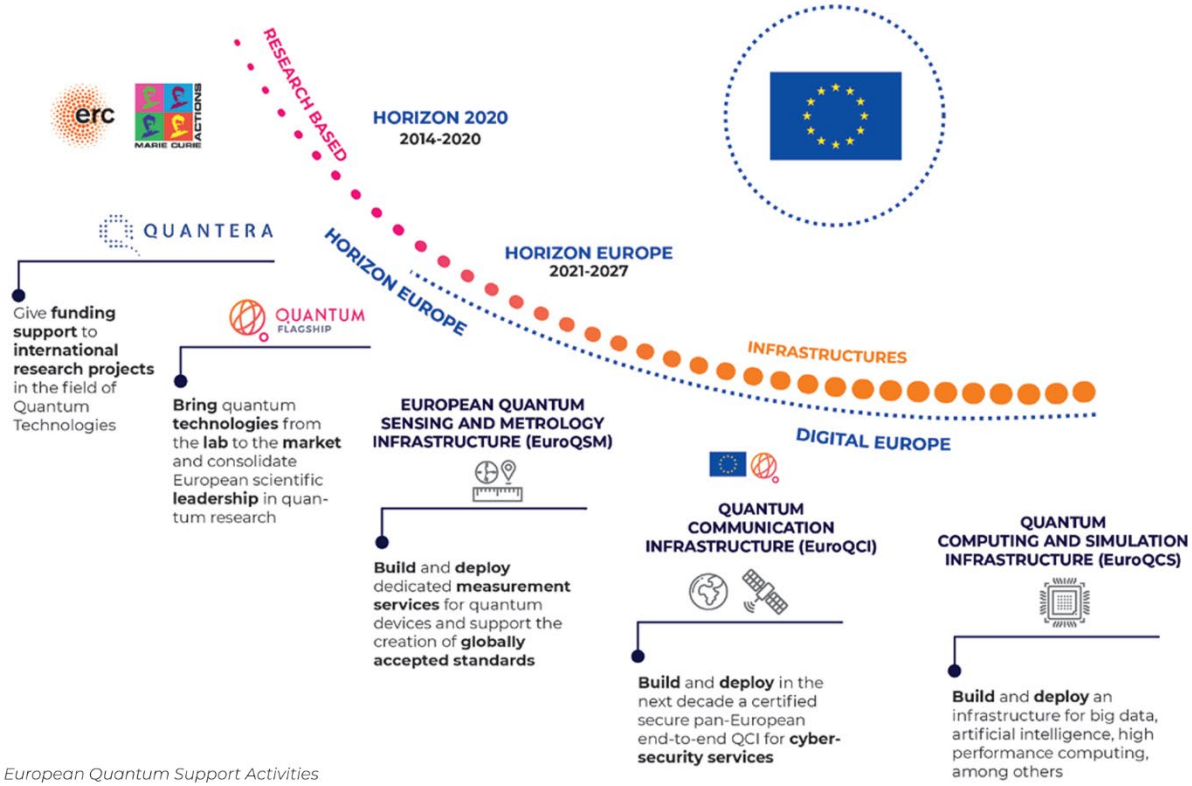
QUANTUM FLAGSHIP



European Quantum Support Activities

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NLPQT PROJECT

News: The NLPQT project was awarded the Symbol 2022 [...] **Read More...**

Photonics is a well-established yet still thriving field of research and technology. It is also behind many innovations which have transformed our lives. Lasers, optical telecom fibres, cameras in our phones, LED lighting in our homes, computer screens & TV sets are just a few examples of how photonics has changed technology. As photonics has the potential to enhance innovations across several industries, it is included in Europe's Key Enabling Technologies (KETs) of the 21st Century.

As part of the project, they will be built

The National System for Generation and Distribution of Reference Optical Carrier

Photonic Technology Laboratories

Quantum Technology Laboratory

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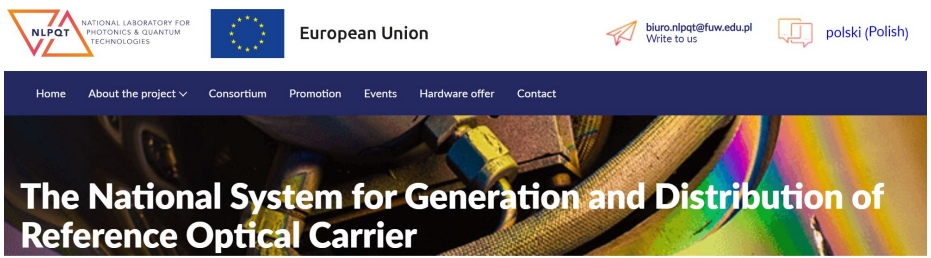
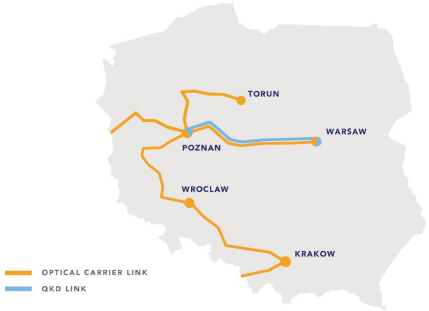
NLPQT PROJECT



Coordinator

PIOTR MASŁOWSKI
pima@fizyka.umk.pl
0000-0001-8882-7106
MORE > >

The main goal of the National System for Generation and Distribution of the Reference Optical Carrier is to create an ultrastable laser system that can be linked to an optical atomic clock, along with a distribution network using fiber optic links. The optical reference signal with low phase noise will be sent to the participants of the NLPQT consortium, where it will be available to interested industry partners. The System will enable implementation of a number of services addressed to the photonic, optical, chemical and related industries in the areas listed below:



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NLPQT PROJECT

NATIONAL LABORATORY FOR PHOTONICS & QUANTUM TECHNOLOGIES

- **Metro QKD** research and operational infrastructure, integration of QKD solutions
  - QKD infrastructure (operational and R&D QKD devices, encryptors and quantum random number generators)

- **Construction of the long distance QKD Poznań - Warsaw link** – June 2022
  - experiments related to quantum communication between University of Warsaw nodes and PSNC in Warsaw.
  - Experiments related to sources and detectors of single photons
  - Integration of the infrastructure with the optical carrier infrastructure
  - Next generation QKD prototypes testing (based on enatnglement)

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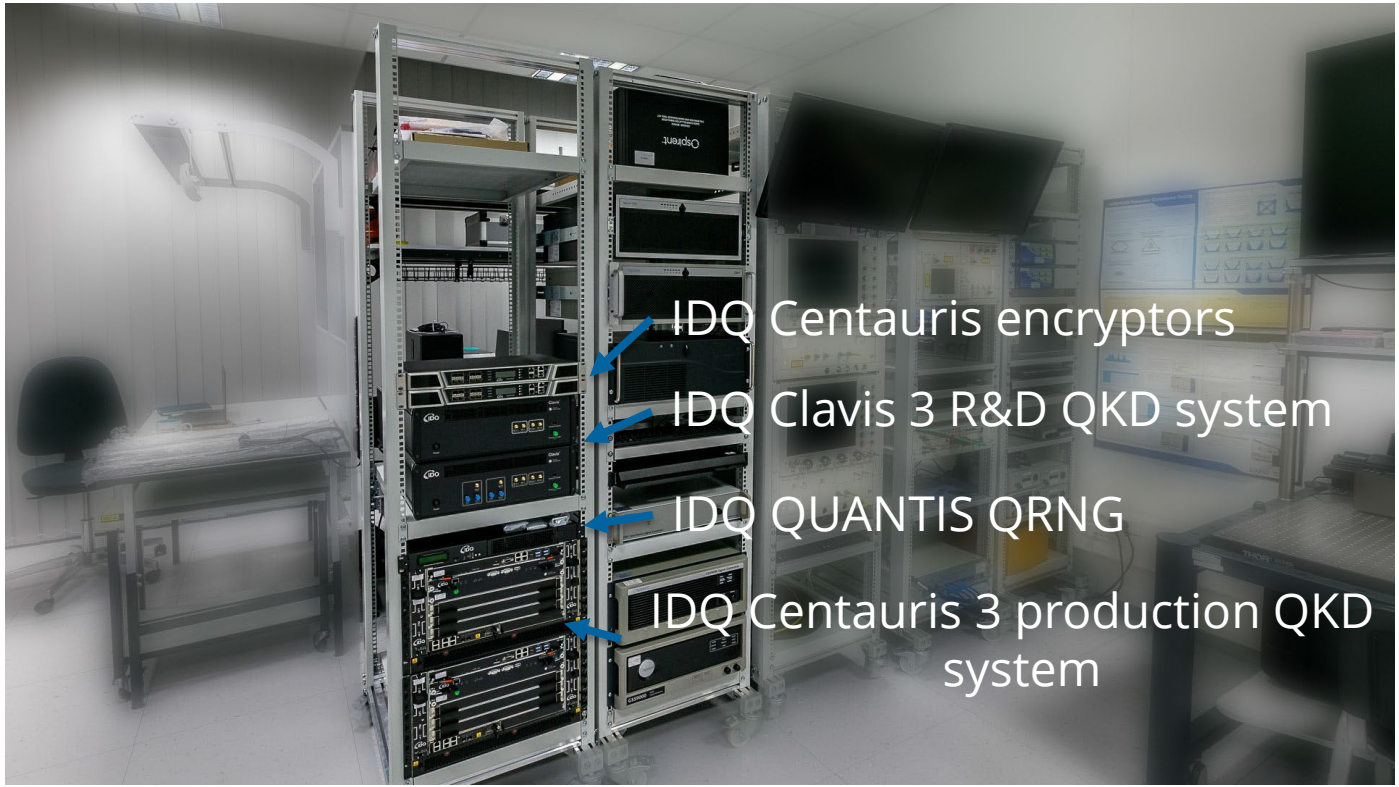
NLPQT PROJECT – METRO QKD SYSTEMS

NATIONAL LABORATORY FOR PHOTONICS & QUANTUM TECHNOLOGIES



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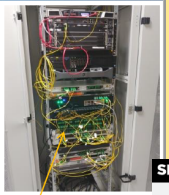
PSNC – VSB crossborder testbed

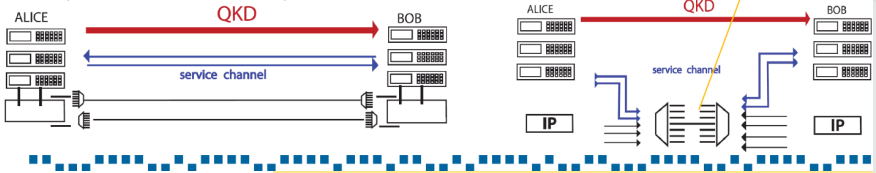
OPEN QKD

cesnet

TRIAL PREPARATION

- First intercity and international trial in CZ
- Ostrava Cieszyn line – fibre itself 75km, 16 dB
- QKD channel in 1550 nm band, will be disturbed by parallel traffic
- Line is very close to maximum system performance
- QKD system „fibre hungry“, service OOK channel will consume 2 additional optical channels
- Offer for aditional fibre pair uncompetitive
- All data (incl. QKD service channel) moved into bidi DWDM





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CONFERENCE PROCEEDINGS

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Presentation + Paper

Wybierz język

Translator Disclaimer

4 October 2022

First cross-border trial of quantum key distribution sharing fiber line with data and accurate time transmissions

Josef Vojtech, Rudolf Vohnout, Ondřej Havliš, Petr Pospíšil, Martin Šlapák, Radek Velc, Lada Altmannová, Tomáš Horváth, Jan Kundrát, Michal Hažlinský, Elisabeth Andriantsarazo, Piotr Ridlichowski

Author Affiliations +

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https://doi.org/10.1117/12.2633616
Event: SPIE Optical Engineering + Applications, 2022, San Diego, California, United States

ARTICLE CITED BY

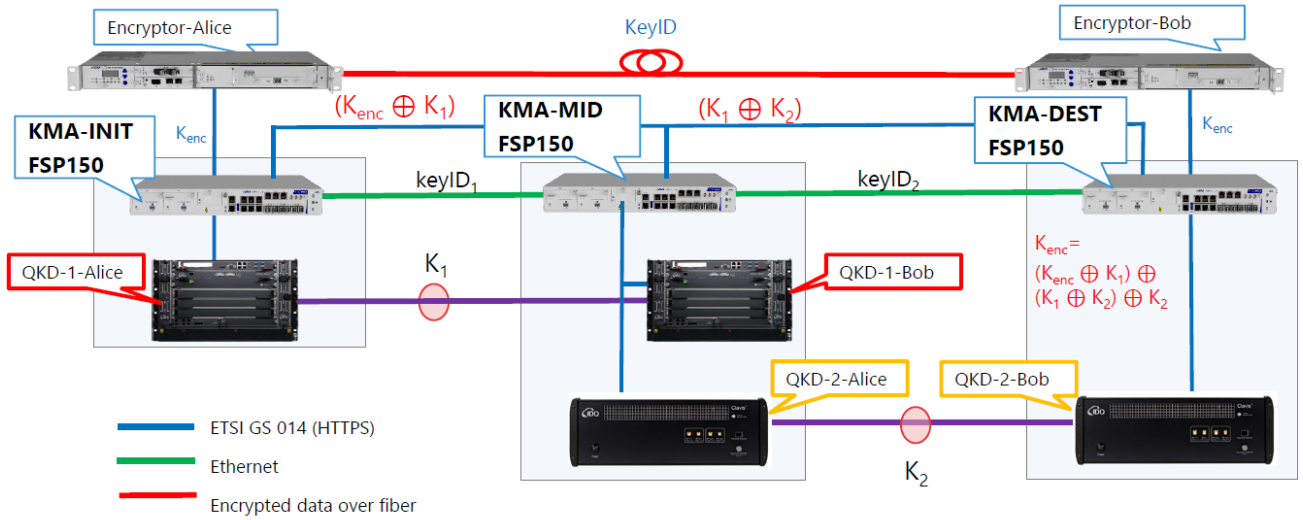
Abstract

This contribution focuses on experimental verification of the QKD system deployment in a multi-domain network environment managed by Czech and Polish National Research and Educational Network (NREN) operators. We demonstrate full functionality of such a solution for transmission of secret keys in boundary conditions, and with this we open up new possibilities for further use of extremely secure communication between two neighboring network entities, and the services built upon it. Moreover, we have shared the cross-border link among strong QKD service channels, accurate time, and classical data channels together with weak quantum channel to reduce the total number of optical fibers needed for transmission. To our

QUANTUM COMMUNICATION ACTIVITIES

TNC21 conference demo – Secure Key Management for Multi Vendor Interoperable Quantum Key Distribution Network

Key Relay using ADVA FSP150



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QUANTUM COMMUNICATION ACTIVITIES

TNC22 conference demo

Machine·Learning·based·Optical·and·QKD·Network·Monitoring

ADVA·and·PSNC

[1]ADVA·Optical·Networking,·Fraunhoferstrasse·9a,·Martinsried,·Germany,·82152

[2]Christian-Albrechts-Universität·zu·Kiel,·Kaiserstr.·2,·Kiel,·Germany,·24143

[3]PSNC,·Wieniawskiego·17/19,·61-704,·Poznań,·Poland

mwenning@adva.com

Abstract:·We·demonstrate·a·fiber·network·monitoring·system·based·on·machine·learning·which·can·detect·and·diagnose·fiber·faults·and·hardware·failures·in·an·optical·network.·Our·system·also·has·the·capability·of·monitoring·the·performance·of·QKD·links.

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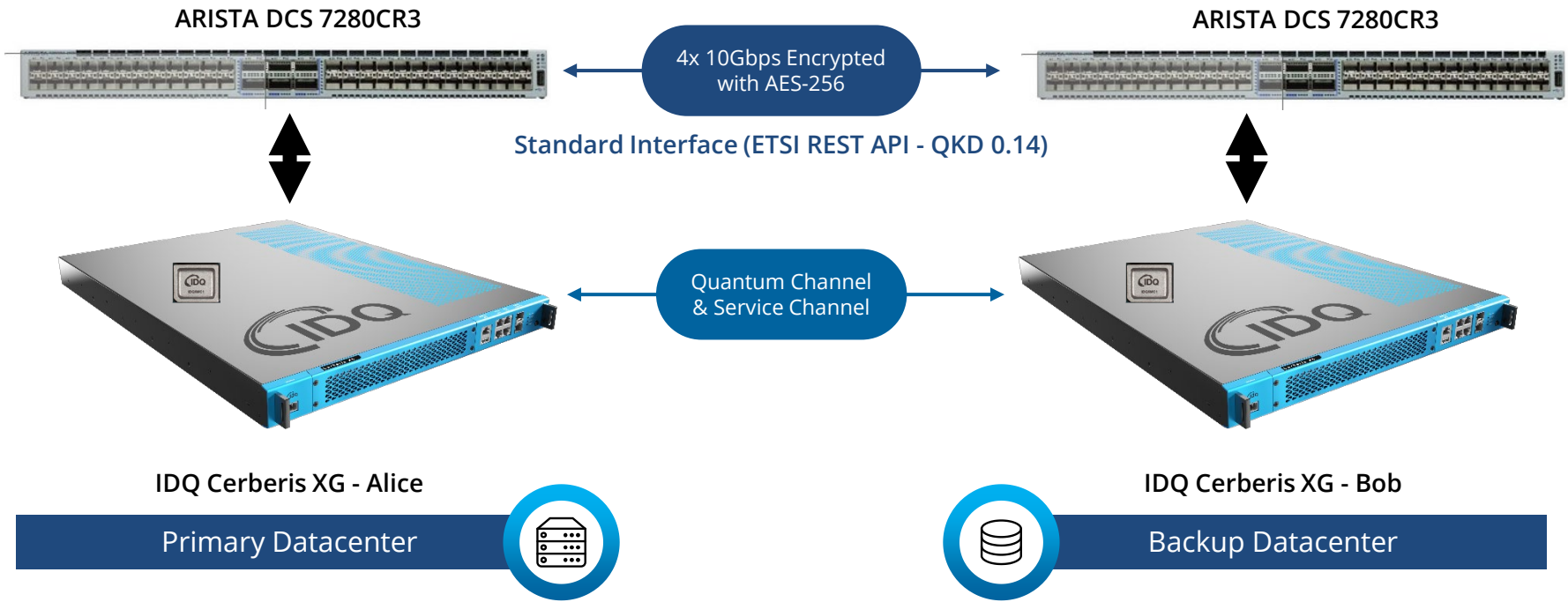
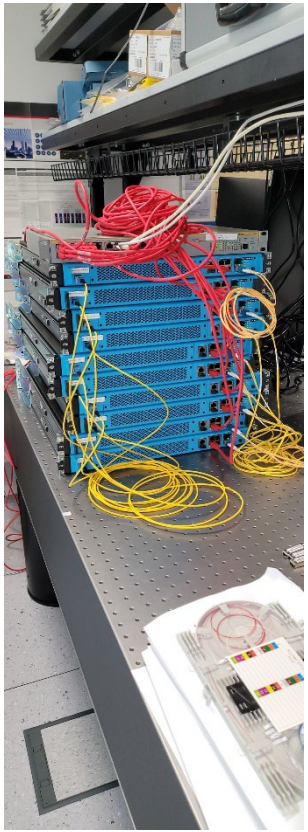
Quantum-Safe communication solution



NLPQT PROJECT – POZNAŃ WARSAW QKD LINK



- The demanding links from the distance point of view were tested first using existing metro QKD equipment
- Procured IDQ Cerberis XG tystem tested and configured in the lab
- Deployed on sites over 3 days
- ISK (Initial Shared Key) required to start QKD exchange needs to be set manually and physically over each node
- Network addressing scheme to integrate Key, KMS and MGMT services
- At the first stage only point to point links were deployed
- At the second stage trusted node approach and key relay mechanism was implemented.

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NLPQT PROJECT – POZNAŃ WARSAW QKD LINK

- Monitoring services implementation with NOC.
- System under constant adjustment and modification (new software, new consumers)
- Measures to improve budget margin on two longest, critical links.
- System uses COW 4 states protocol
- System uses four different channels – quantum, service, KMS, managements. Apart from that we have key and encrypted traffic services. All these elements can be potentially multiplexed and with different combinations

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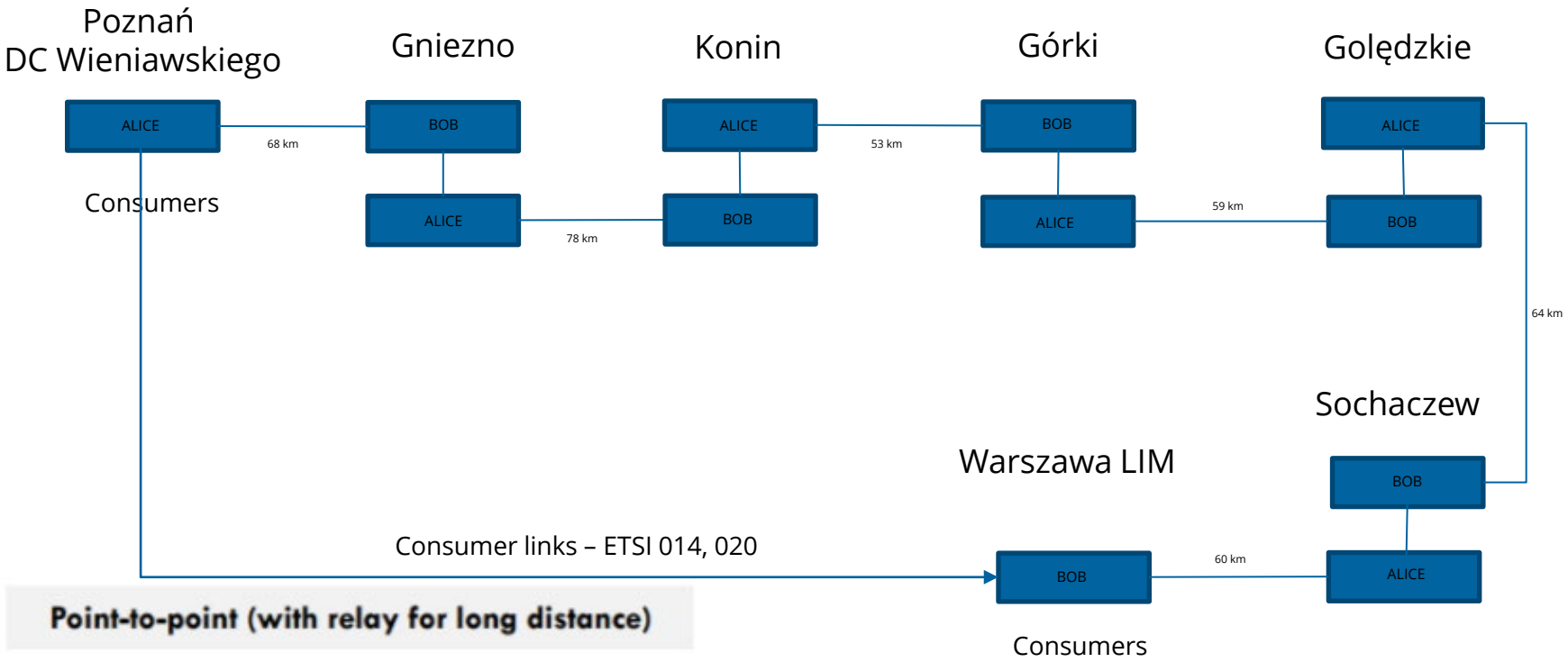
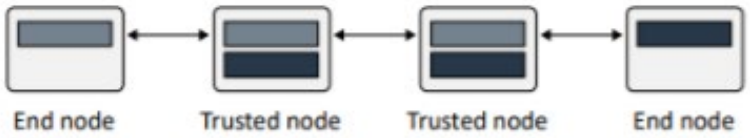
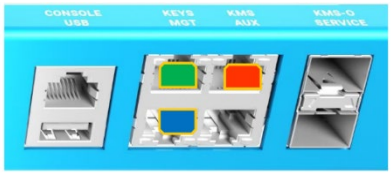


Point-to-point (with relay for long distance)

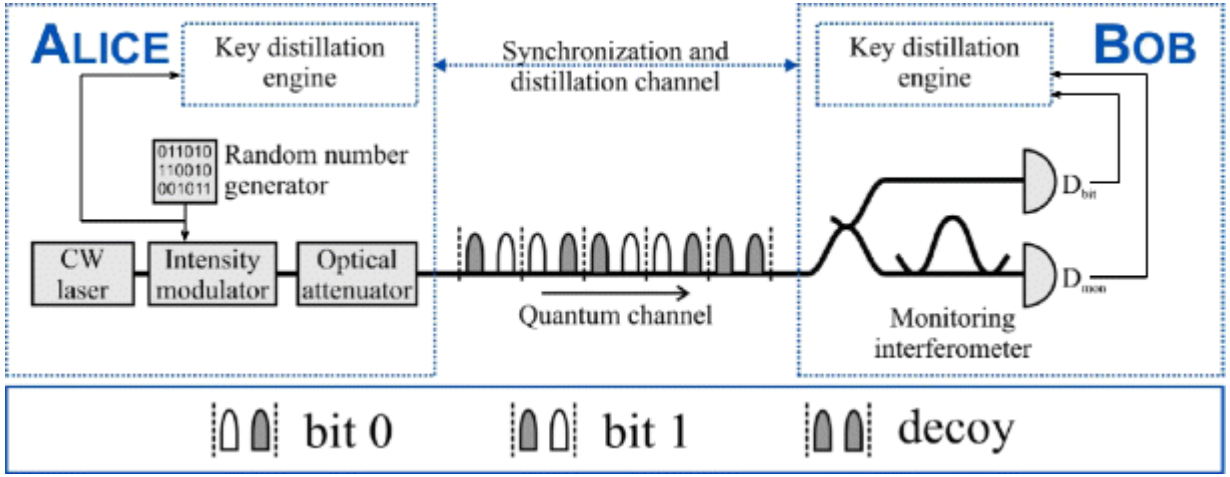




Keys, KMS, MGT services can be implemented on different physical interfaces

System uses **three** dedicated fibers – one fiber for quantum channel and one pair for service and sync channel (can be multiplexed with existing traffic and systems)

NLPQT PROJECT – POZNAŃ WARSAW QKD LINK



- Does not need perfect single-photon devices
- Uses phase-randomized weak coherent pulses
- Decoy states help deal with PNS (Photon Number splitting) attacks but limits performance
- Systems during initialization need time to align monitor and data timebins
- Bits are encoded using pair of coherent and vacuum pulses
- Monitoring line (MZ) checks coherence between pulses
- Bob measures TOA of coherent pulses and reports to ALICE clicks but without exact timeslot. Alice discloses if it was key generation or decoy state.
- **QKD protocols and its implementation are still under theoretical analysis**

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SUMMARY

- Implementation of Metro and long distance QKD links
- Infrastructure supports various research activities
- Possible support for EuroQCI and EuroQCS initiatives
- Cooperation with vendors and R&D partners
- Integrating and supporting communities

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