



## Poznan Supercomputing and Networking Center

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Piotr Rydlichowski

## WP6 QKD Framework Proposal



cesnet  
"...."

# GEANT QKD EQUIPMENT

Feb 16th 2022  
Josef Vojtech



# INTRODUCTION

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## PRESENTATION OUTLINE

- **WP6 T1 QKD activities**
- **Procurement of QKD equipment at PSNC and related challenges**
- **Framework procurement proposal**
- **Summary**

# QUANTUM COMMUNICATION ACTIVITIES

## GÉANT 4 WP6 T1 activities

- WP6 T1 - QKD task
- Prepared plan, activity proposal for GÉANT and NRENs
- Presentations on QKD technology for NRENs
- A survey was conducted among the NRENs on QKD technology to develop a strategy. Common activities, projects, plans and problems were identified
- TNC18/21 conference presentations
- Talks with suppliers of QKD devices: on wider cooperation with NRENs and GÉANT networks
- QCI strategy
- Quantum networks simulators testbed
- White paper, infoshares for NREN community



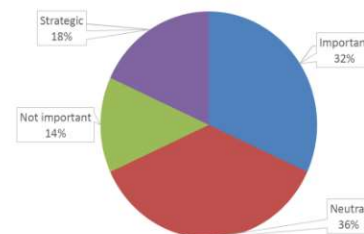
- 1/2 of NRENs interested in QCI and QKD in Mar 2020
- Topic is of high importance now, DEP call for national QCIs deadline 29th Mar 2022
- WP6 QKD is planning trial 2022

Přechod na určité stránky pomoci

#### Survey results 1/4

- 28 NREN responses (from the APM contacts)
- The importance of quantum cryptography and communication technology in your organization?

Importance of Quantum for NRENs



- Other hand, only one NREN owns commercial QKD set
- Some NRENs has experiences: provided fibers, service channels and other support for QKD
- For serious long term trial set ownership preferred (our feedback from national project Cybersecurity Safety in post Quantum Era)
- With price tag of low multiples (



# QUANTUM COMMUNICATION ACTIVITIES

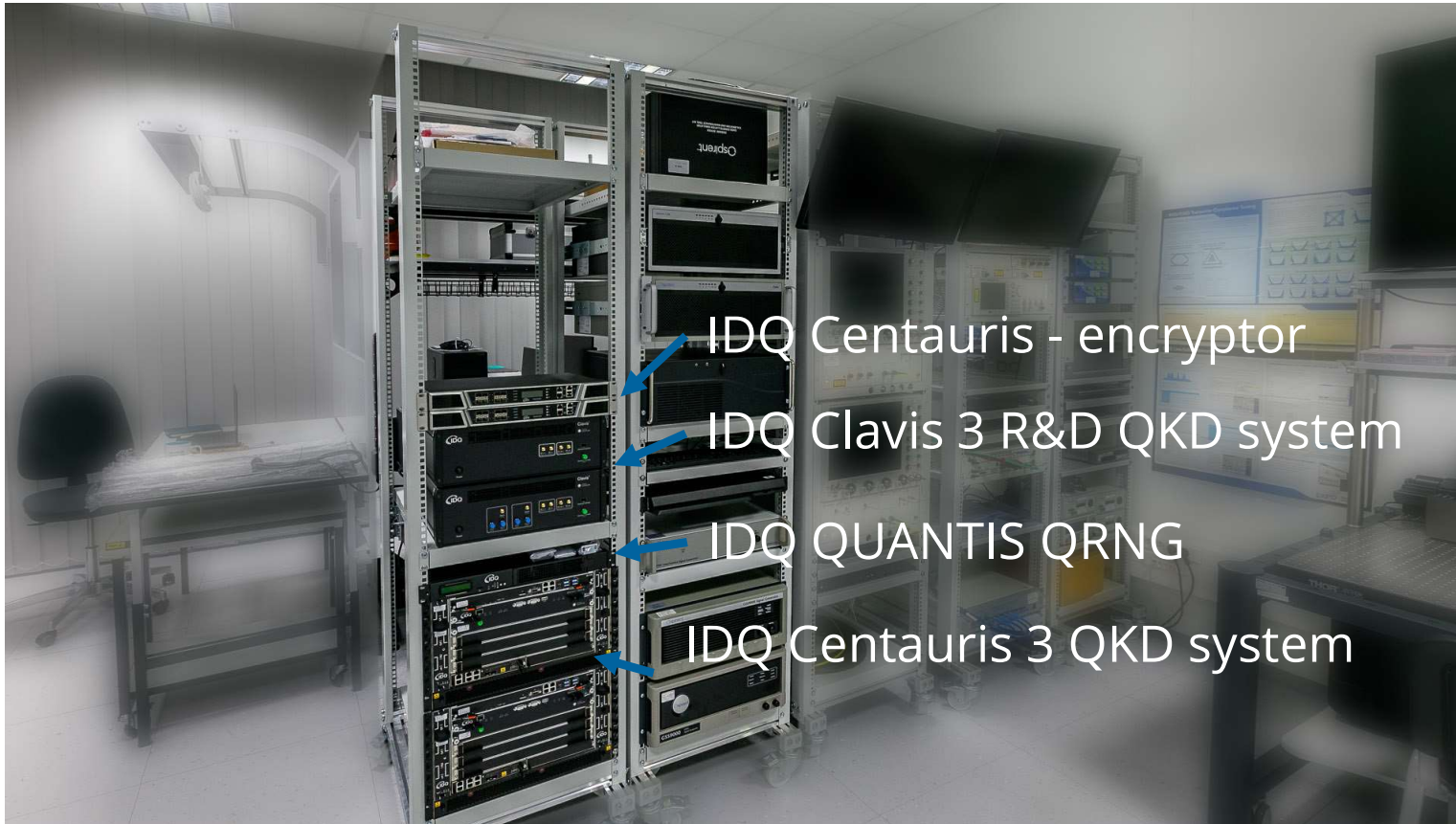
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## PROJECTS WHERE QKD EQUIPMENT WAS PROCURED

- PSNC takes part in the following projects and activities connected with Quantum Communication and QKD Technologies:
  - OPENQKD (HORIZON2020) – public procurement
  - NLPQT, National Laboratory for Photonics and Quantum Technologies (NCBiR) – long term loan agreements



## QKD TESTBED – QKD and QRNG equipment (NLPQT)



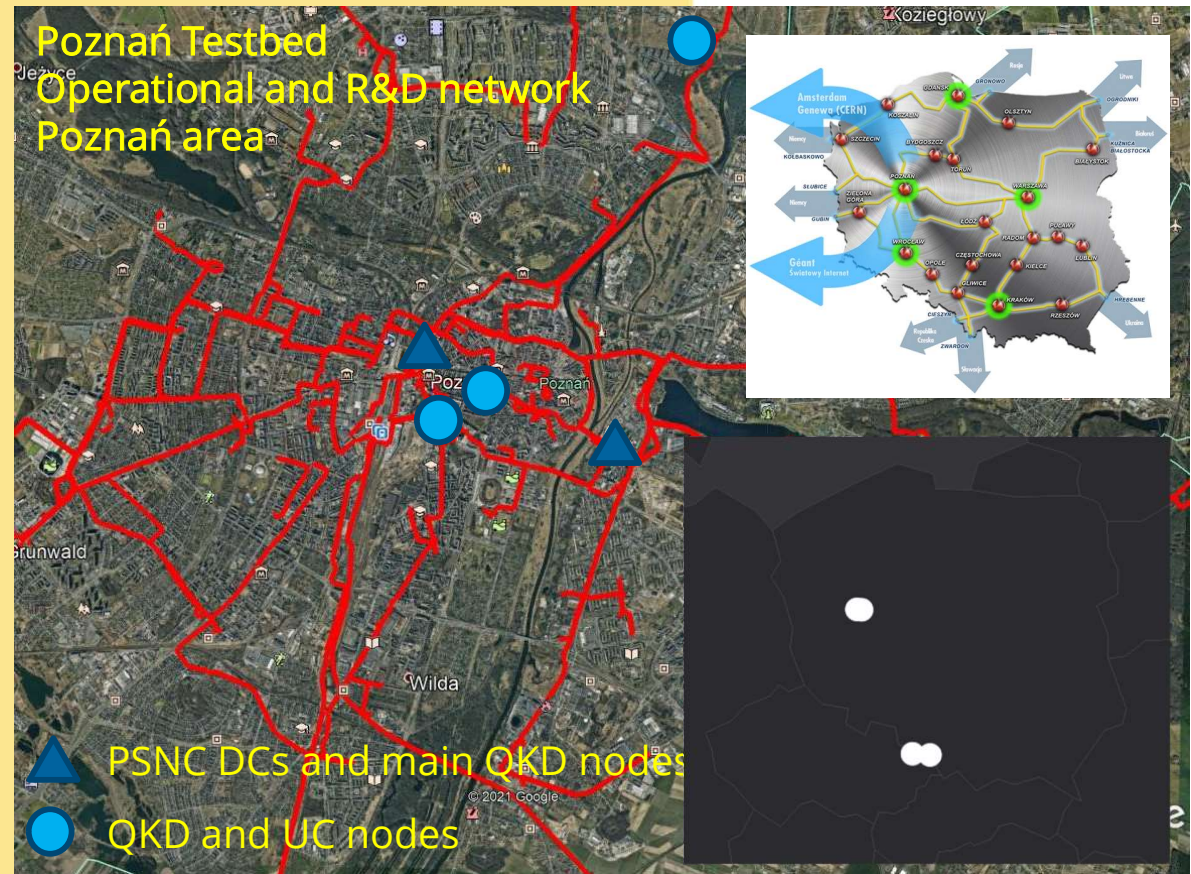
## QKD TESTBED – QKD equipment (OPENQKD)



- TOSHIBA QKD system capable of quantum and classical signals copropagation

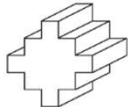
# Testbed Poznań

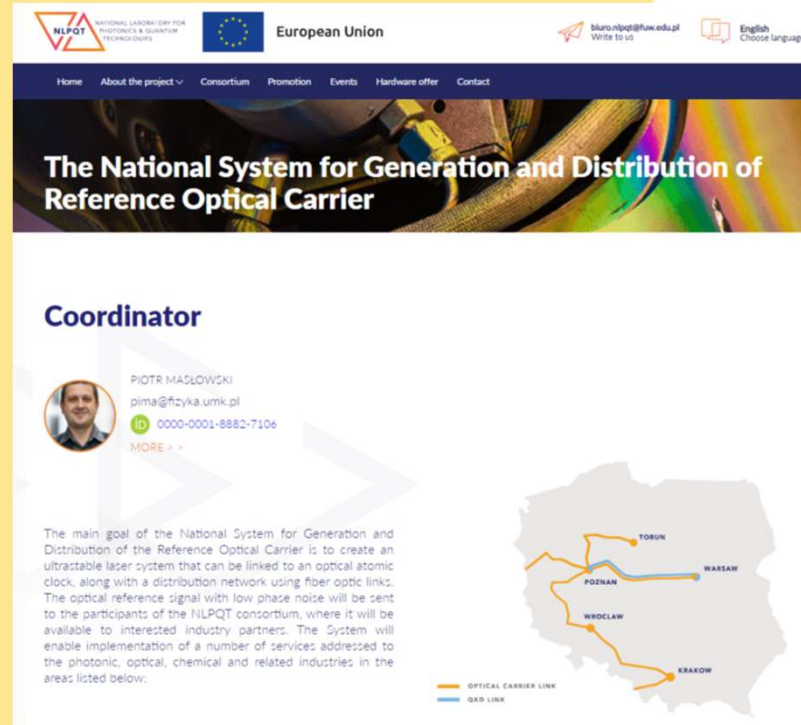
- **Infrastructure in place as PSNC** is owner and operator of the infrastructure and network
- **Two QKD links installed and running tests** before the final deployment and use cases implementation
- **Various use cases are being prepared:** UC-06, UC-07, UC-08, UC-09, UC-10, UC-11 based on existing services and network. UC with VSB involves **QKD cross-border connection**. Reference Time and frequency use case involves long distance connection.
- **PSNC NOC** is working on implementing the monitoring and logging services for QKD infrastructure and services
- **SDN solutions currently analyzed**
- **Real world operational network** with shared infrastructure for quantum and classical communication and services. Connection point with other operators and several types and manufacturers of transmission equipment and encryptors
- **Direct connection with GEANT** node in Poland, network and services.
- **QKD equipment installed at PSNC DC nodes** and under preparation for use cases
- **QKD equipment installed on Ostrava – Cieszyn crossborder line** for HPC use cases with VSB
- **Joint activities with National project NLPQT – National Laboratory for Photonic and Quantum Technologies**



# Testbed Poznań

- Testbed has one IDQ system deployed between PSNC primary and backup data centers in Poznań
- TOSHIBA O-band system under testing and preparation
- First use cases will focus on HPC applications, medical services and reference time and frequency transmission

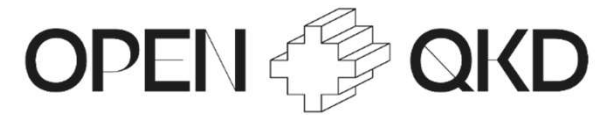
OPEN  QKD



The screenshot shows the website for the National System for Generation and Distribution of Reference Optical Carrier. The header includes the NLPQT logo, the European Union flag, and contact information. The main heading is "The National System for Generation and Distribution of Reference Optical Carrier". Below this, the "Coordinator" section features a profile for Piotr Masłowski, with his email (pima@fizyka.umk.pl) and phone number (0000-0001-8882-7106). A map of Poland shows the distribution network with cities Toruń, Poznań, Wrocław, Kraków, and Warsaw. A legend indicates that orange lines represent "OPTICAL CARRIER LINK" and blue lines represent "QKD LINK".



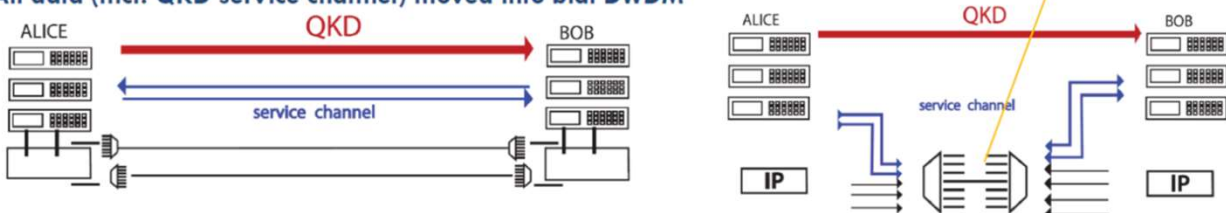

# PSNC – VSB crossborder testbed



- White paper for NRENs under preparation.

**cesnet** TRIAL PREPARATION

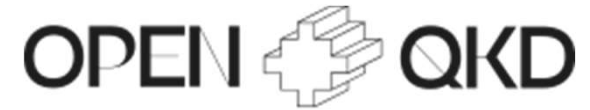
- First intercity and international trial in CZ
- Ostrava Cieszyn line – fibre itself 75km, 16 dB
- QKD channel in 1550 nm band, will be disturbed by parallel traffic
- Line is very close to maximum system performance
- QKD system „fibre hungry“, service OOK channel will consume 2 additional optical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



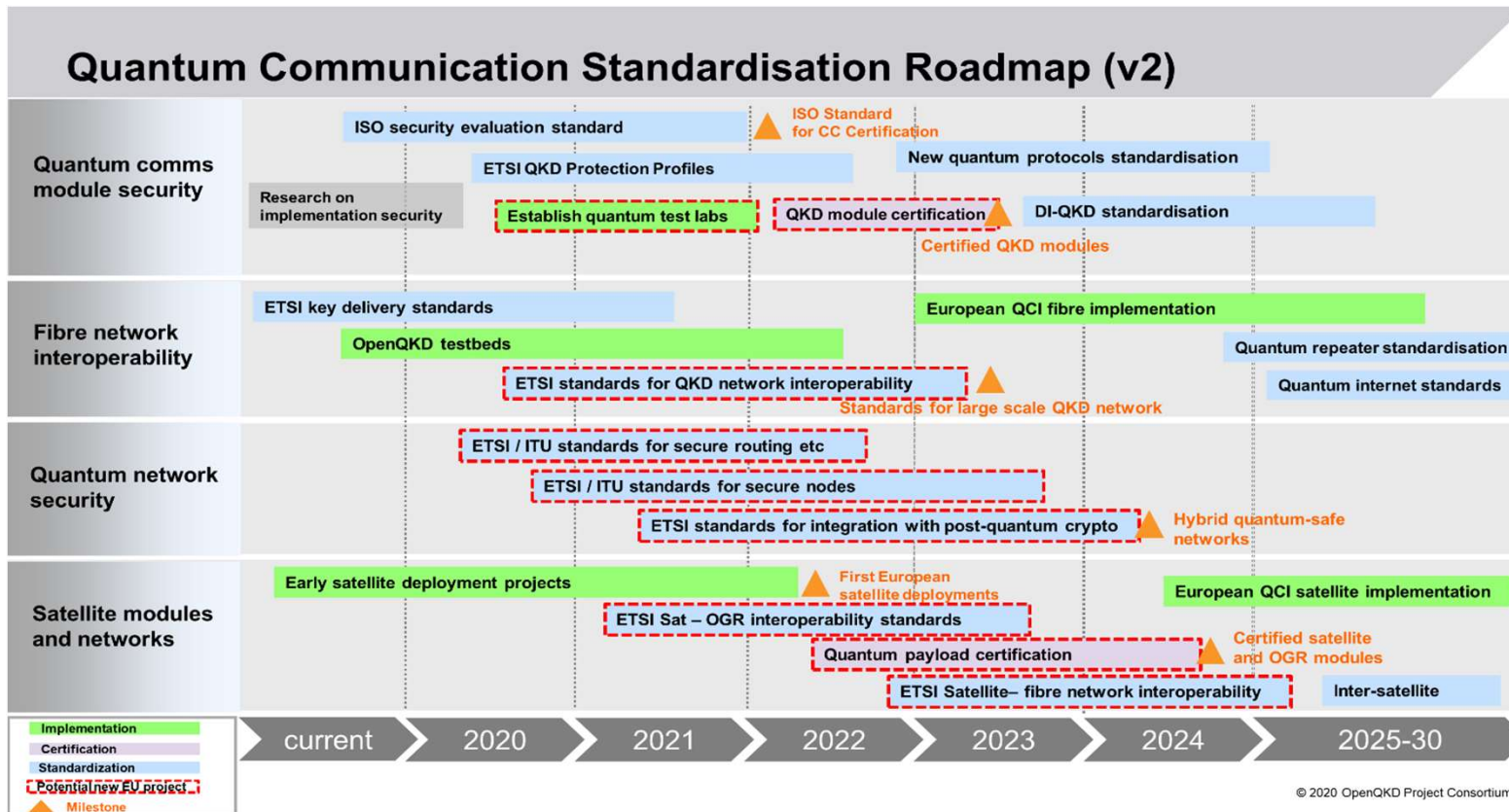
The diagram illustrates the trial setup. On the left, Alice and Bob are connected via a QKD channel (red arrow) and a service channel (blue arrow). On the right, Alice and Bob are connected via a QKD channel (red arrow) and a service channel (blue arrow). Below this, IP traffic is shown being moved into a bidi DWDM system.



# QUANTUM COMMUNICATION ACTIVITIES



## STANDARDIZATION AND CERTIFICATION – pending and equipment subject to change



<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/29227>

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# QUANTUM COMMUNICATION ACTIVITIES



NARODOWE LABORATORIUM  
FOTONIKI I TECHNOLOGII  
KWANTOWYCH

## NATIONAL LABORATORY FOR PHOTONICS AND QUANTUM TECHNOLOGIES

- Construction of metro QKD research and operational infrastructure, integration of QKD solutions
  - QKD infrastructure (operational and R&D QKD devices, encoders and quantum random number generators)
- Construction of the QKD Poznań - Warsaw link
  - 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 entanglement)



# QUANTUM COMMUNICATION ACTIVITIES

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## Procurement challenges

- Equipment access restrictions – strategic technology, NDAs
- Operational equipment available from companies outside EU - logistics, distributors, customs
- EU startup companies slowly introducing the equipment for testing and use in operational environment
- Lack of detailed specification to prepare detailed public tender
- Standardization and certification pending – difficult to prepare detailed and open tender specification
- Detailed loan agreements – difficult intellectual property handling, customs, access restrictions



- Tendering can be bothersome
- NDA required
- Price tag for QKD set in multiples of 100 kEUR (depends on performance and support)
  - Might be over limit of €215,000
- Framework can be useful for NRENs seeking purchase



# QUANTUM COMMUNICATION ACTIVITIES

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## Framework Proposal

- Under DEP QCI calls each Member State will procure or build QKD equipment for the first testing phase. NRENS are directly or indirectly involved in these activities.
- DEP QCI calls activities are a chance to create framework for other interested NRENS that are outside of QCI call
- Member States created its own national quantum programs where quantum communication infrastructure will be build or procured
- Startups, companies involved in QCI can be interested to add new partners and programs

## SUMMARY

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- Projects are focused mainly on the implementation and integration aspects
- Support for the whole NREN and GEANT community in Europe
- Possible support regarding procurement within QCI initiative
- Cooperation with vendors and R&D partners



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