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Piotr Rydlichowski

**Hybrid CPU, GPU, QPU  
infrastructure for hybrid  
quantum-classical computing  
use cases development with  
secure QKD/PQC links.**

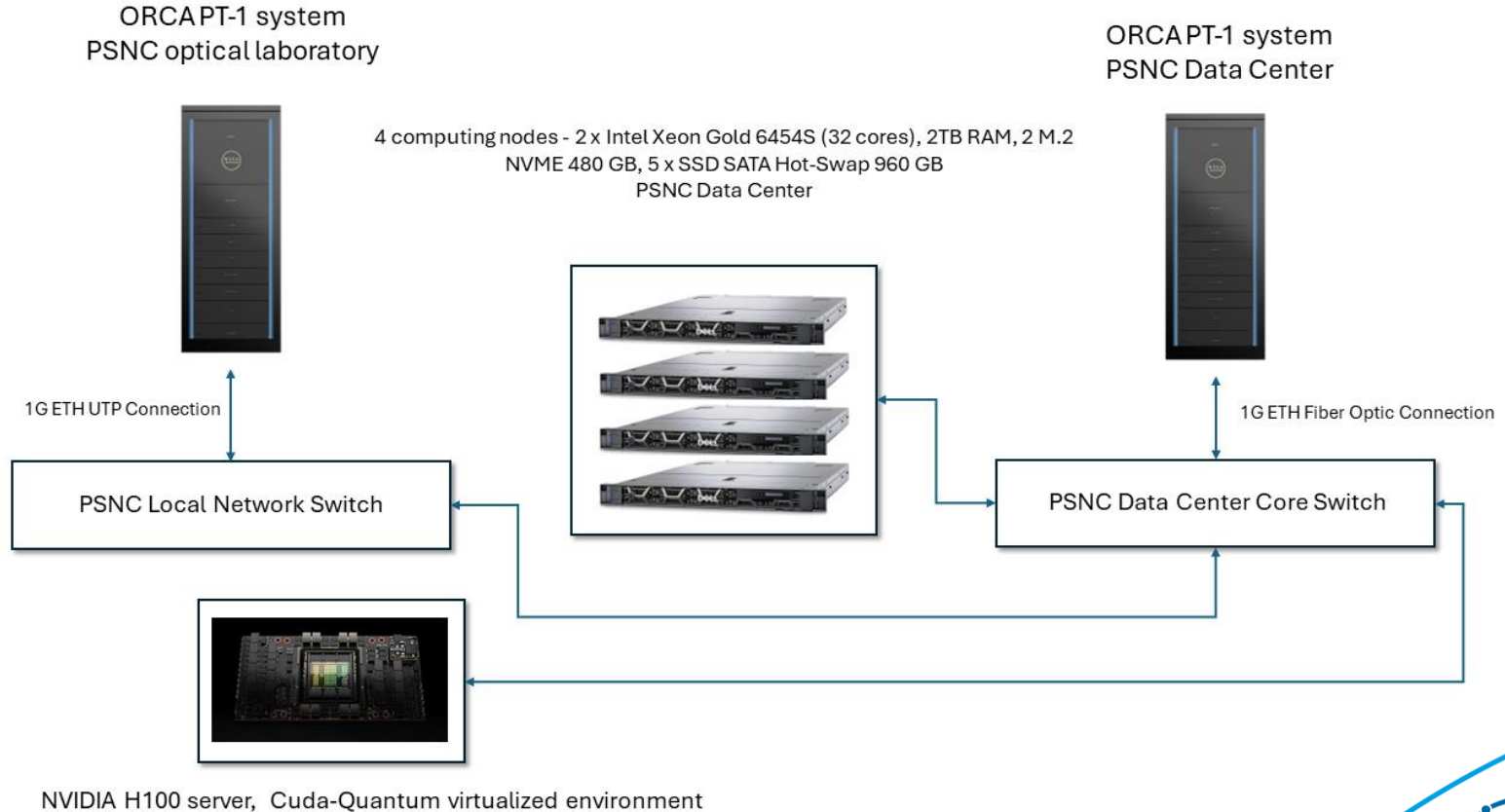
# Main Assumptions

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- Hybrid quantum-classical computing infrastructures are interesting scenario for research use cases and investigation for possible best use of existing, current quantum hardware
- Quantum communication links cannot span currently over long physical links
- For existing Quantum Key Distribution networks, testbeds (such as under EuroQCI initiative) and infrastructures it is impossible to span over long distance quantum links
- Solutions have been proposed to overcome this limitation in the form of hybrid solutions where long distance QKD links are “emulated” using classical links and encrypted using PQC solutions.

- Present multiple QPU + CPU +GPU hybrid quantum-classical testbed, integration and uses cases.
- This hybrid testbed and infrastructure can be distributed and as proof of concept the network traffic in the system can be secured by the QKD technology (QKD + MACSec integration). The setup at SC24 uses ATLANTA and PSNC locations as end nodes. To interconnect two different Key Management Systems for QKD infrastructure PQCS secured link is established that relays and exchanges QKD keys over long distance classical communication link

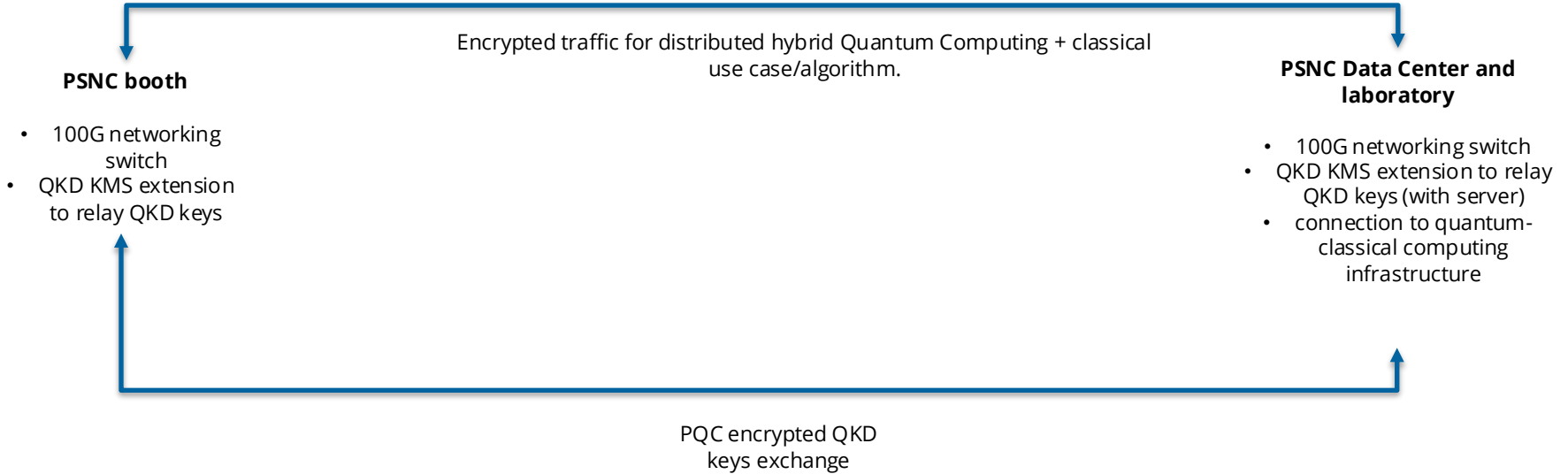
# Hybrid quantum-classical hardware setup



SC24 venue  
Atlanta, USA

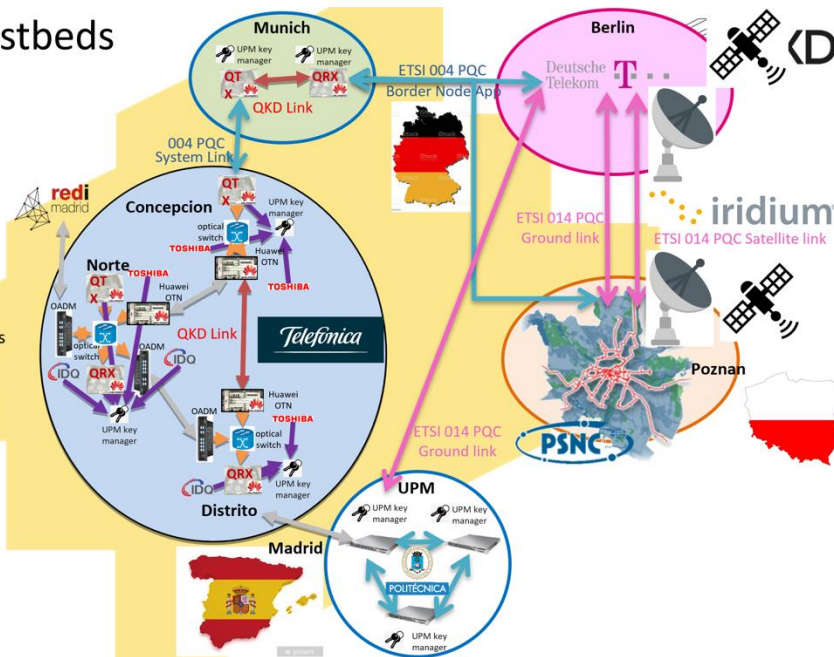
## *Hybrid quantum-classical communication demo*

Poznań,  
Poland PSNC



## OpenQKD testbeds interconn

- 014 PQC is a direct E2E testbed interconnection
- PQC Border Node App transport QKD keys protected with PQC algorithms
- Experiments
  - High throughput of PQC keys based on 014 PQC REST API Calls
  - Iridium link key interchange
  - Full QKD key transport on different link types from on testbed to another
    - Distrito-Concepcion-Meera-Jojen-[Berlin|Poznan]
- Multiple border nodes on the same network



Article

### Linking QKD testbeds across Europe

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**Abstract:** Quantum-key-distribution (QKD) networks are gaining importance and it has become necessary to analyze the most appropriate methods for their long-distance interconnection. In this paper, four different methods of interconnecting remote QKD networks are proposed. The methods are used to link three different QKD testbeds in Europe, located in Berlin, Madrid, and Poznan. Although long-distance QKD links are only emulated, the used methods can serve as a blueprint for a secure interconnection of distant QKD networks in the future. Specifically, the presented approaches combine, in a transparent way, different fiber and satellite physical media, as well as common standards of key-delivery interfaces. The testbed interconnections are designed to increase the security by utilizing multipath techniques and multiple hybridizations of QKD and post quantum cryptography (PQC) algorithms.

**Keywords:** Quantum networks; Quantum communications; QKD; Quantum cryptography

# Thank you for your attention

## Questions?



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More information available at <https://pionierq.pionier.net.pl/>.

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