Development of a Global Network for Secure Communication based on Quantum Cryptography
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Development of a Global Network for Secure Communication based on Quantum Cryptography

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On behalf of the EU-Integrated Project SECOQC
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- **EU-Integrated Project (FP6)**
  April 2004 – September 2008
- **Scientific and Technological Objectives:**
  - Improve Quantum Key Distribution (QKD) technology
  - Develop Network Concept
  - Develop Interfaces (for Customers, QKD-Providers)
- **SECOQC has iniciated QKD standartization**

More Facts...

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- **41 Participants:**
  25 Universities
  4 National Research Centers
  8 Multinational Enterprises
  4 SMEs

- **From 11 European Countries**
  A, B, CH, CZ, D, DK, F, I, RU, S, UK

- **Budget:** 16,5 million Euros
- **Funding:** 11,3 million Euros

Quantum key distribution

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- Quantum physics solves the problem of the distribution of cryptographic keys – “unconditional” security
- Information in encoded into non-orthogonal states of quantum systems (e.g. photons)
- Any interaction with a quantum system which can lead to information leakage disturbs its state in general
- Eavesdropping can be detected – it affects quantum states of the carriers of information and causes detectable errors
- If eavesdropping is detected the key is not used
- Any “technological” errors must be treated as if they were caused by eavesdropping – privacy amplification is necessary

Limitations of QKD

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- Point to point links
- Limited distance (today: ~ 100 km in fibers)
- Limited data rate (mainly due to detectors)

Solution:

Network with trusted nodes (main goal of SECOQC)

- Any users can be interconnected
- Nodes serve as classical repeaters
- Parallel links; key can be generated in advance

A Trusted repeater QKD-Network: Abstract Architecture

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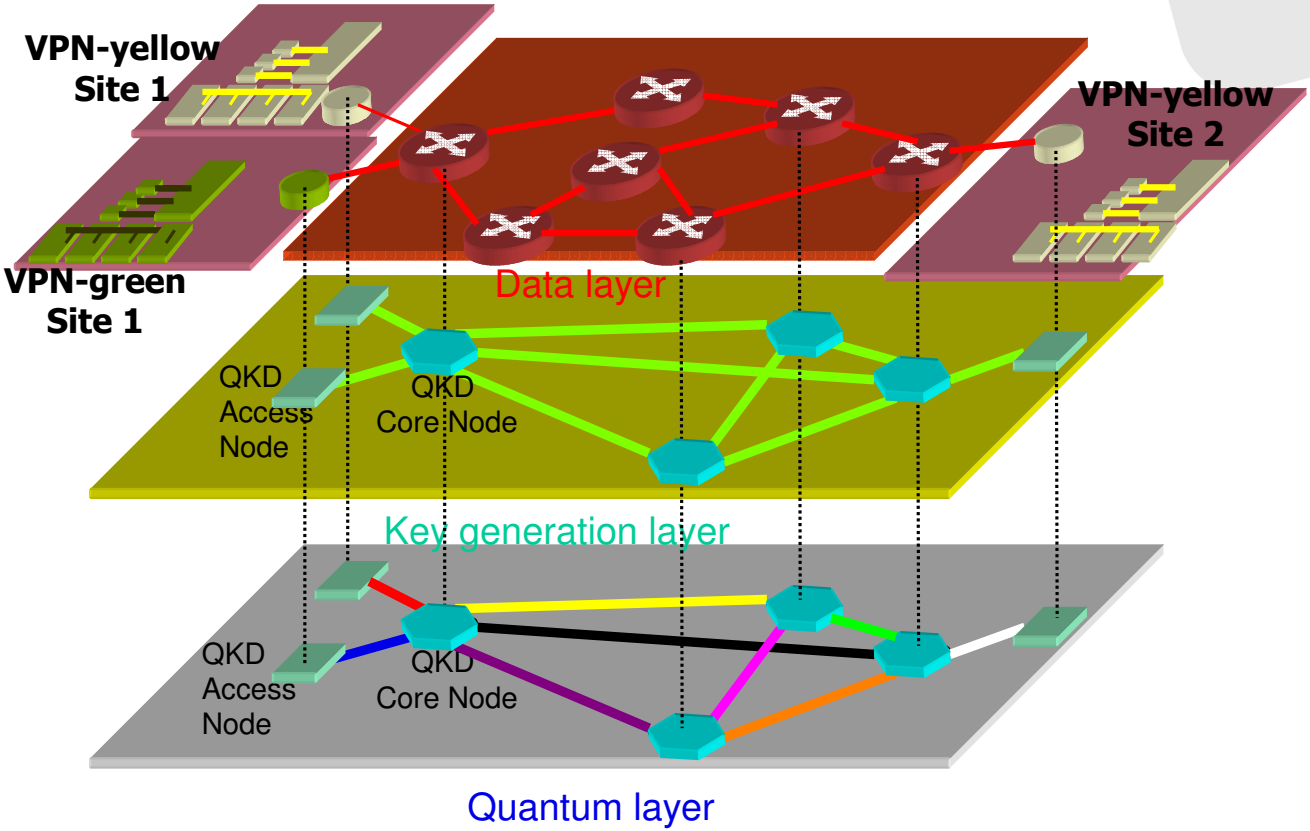

SECOQC Prototype - principle layout

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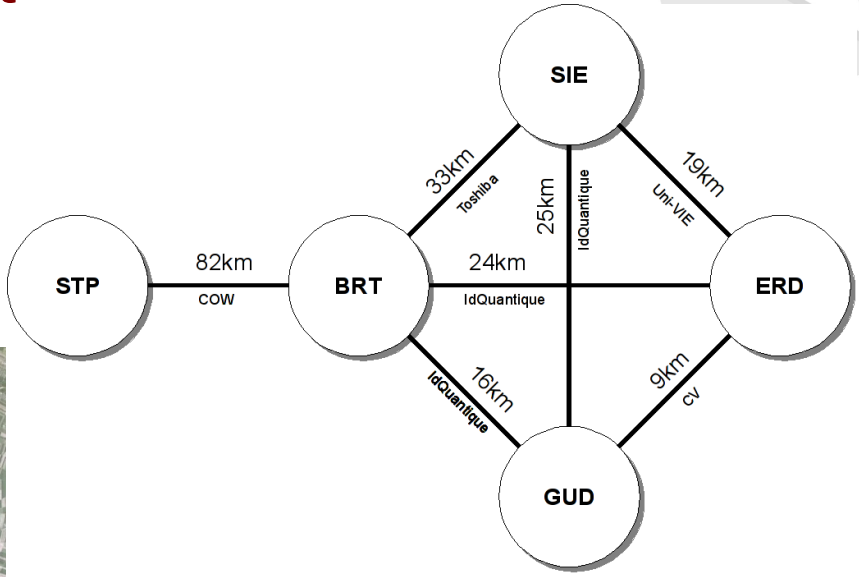

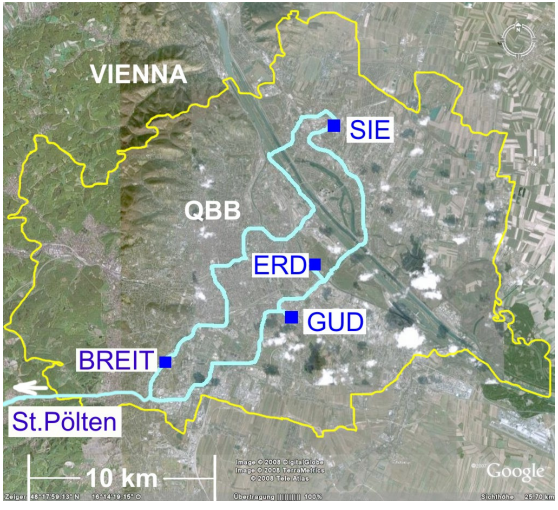

QKD links - standard optical fibers

QKD Links

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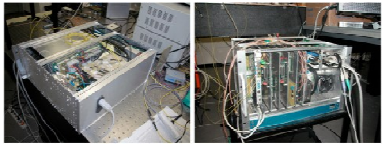
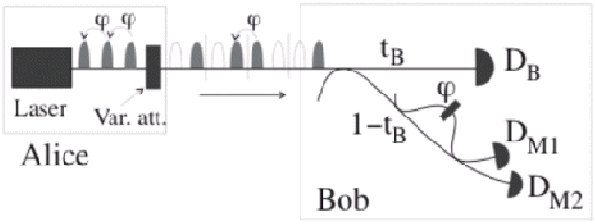
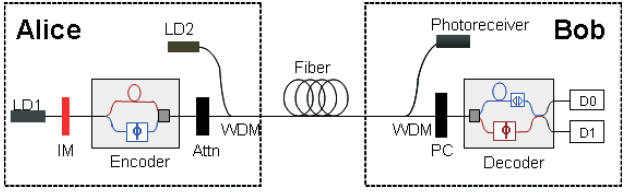
- **Coherent One Way System** (Univ. Genève)

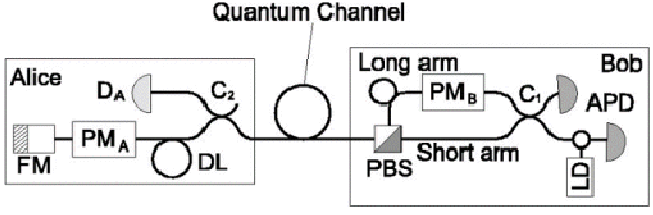




- **One Way Weak Pulse System** (Toshiba)



- **Autocompensating Plug&Play** (id Quantique, Genève; 3 links)



QKD Links

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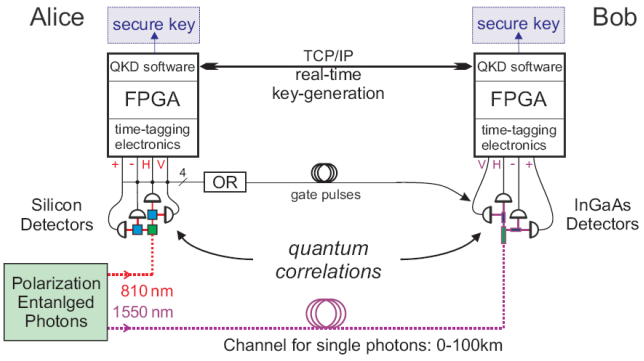
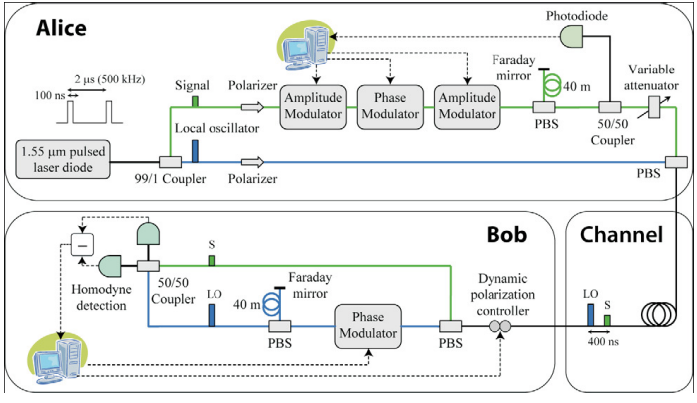
- **Entangled Photons**
  (Univ. Vienna / ARC)



- **Continuous Variables**
  (CNRS / Thales)



Palacký University & SECOQC

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Department of Optics of Palacký University in Olomouc participated in the work of the Quantum Information Theory group

- Evaluation of security and performance of the experimental platforms
- Security proofs for practical QKD devices

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Thank you for your attention

Review article on quantum cryptography:
V. Scarani, H. Bechmann-Pasquinucci, N.J. Cerf, M. Dušek, N. Lütkenhaus, M. Peev:
The Security of Practical Quantum Key Distribution,
to appear in Rev. Mod. Phys.; arXiv:**0802.4155**v2 [quant-ph] (52 pages)
This paper has been written within the European Project SECOQC