Quantum Technologies - Principles, Challenges and Applications

Introduction

https://events.geant.org/event/353/

Xavier Jeannin, *GN4-3 WP6 T1 task leader*
Piotr Rydlichowski, *QKD technical leader*
Susanne Naegele-Jackson, *GN4-3 WP6 T0*

GÉANT Infoshare, 20 January 2021

www.GÉANT.org

GÉANT Infoshares are intended to create a space to engage, improve knowledge sharing and discussion about services and strategic topics, and to build a human network across the Research and Education community.

Co-organised by Network Technologies and Services Development Work package (WP6), together with GÉANT Partner Relations Team, within the Community Programme

Public Infoshares are on Wednesdays and are recorded

Other Infoshares will be ‘invitation only’ events on other weekdays

Go to the main Infoshares Wiki page to suggest future topics

Recordings are available in the e-Academy, GLAD website and on Wiki pages after the event

Questions: partner-relations@GÉANT.org

Why Quantum in the Research and Education context?

Second quantum revolution

- The first revolution enabled inventions such as transistor laser and these followed rules of quantum mechanics
- The second revolution is about controlling individual quantum systems and using the quantum principles: **Superposition, Entanglement**, …
- Maybe a new **technological and industrial revolution**
- How to transform quantum research into an industrial innovation?

Quantum wave

- A lot of countries prepared strategic quantum technology development plans
  - EC: Strategic Research Agenda on Quantum technologies
- Create an ecosystem in Europe that allows this quantum revolution emerging in European industry
- Research and Education community, **a key role in this phase**

Network Technologies and Services Development approach

- **Make European NRENs “quantum aware”**
  - dissemination activities: Infoshares, workshops
  - White paper**: Quantum Technologies Status Overview for the GÉANT NREN community** (https://www.geant.org/Resources/#white)
  - Training, if NRENs are interested
- **Technology testing:**
  - Collaboration with NRENs, Research projects and industry
- **Exploring QT solutions for GÉANT**
- **Standardisation**

WP6 - Quantum Key Distribution Team

- Contact us at **gn4-3-wp6-qkd@lists.GEANT.org**

- **Piotr Rydlichowski**, PSNC - **QKD work group leader**
- Rudolf Vohnout , Josef Vojtech, Pavel Skoda, CESNET
- Peter Kaufmann, Susanne Naegele-Jackson, DFN
- Guy Roberts, Domenico Vicinanza, GÉANT
- Andor Jeszenszky, KIFU

- Xavier Jeannin , task leader
- Ivana Golub, Work Package Leader
- Tim Chown, Work Package Leader

Your input is crucial

- An interactive infoshare
  - Please **use the Zoom chat** to submit your questions
  - Open discussion at the end of each session

- Catch your feedback to lead our work

- Go to **www.menti.com** and use the code **45 45 0 44**

Describe Infoshare structure

- Infoshare is divided into two main sessions
- Two talks per each session, 3 invited talks in total
- At the end of each session there will be Open Discussion with also some questions to answer on the **mentimeter** service
- Please ask questions and the goal is to have interactive meeting.

Introduction Speaker Session 1

Dr. Eleni Diamanti

Senior researcher /
Directrice de Recherche
CNRS

Quantum Information Team
Laboratoire d'Informatique de Paris 6
Sorbonne Université
Paris Centre for Quantum Computing

Research interests

- Quantum cryptography, including continuous-variable quantum key distribution (QKD) and protocols beyond QKD
- Experimental quantum communication complexity
- Entanged resources for quantum communication networks

Introduction Speaker Session 1

Sebastian Neumann

SEBASTIAN NEUMANN

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OUR CURRENT FIELDS OF RESEARCH

- Sources of Entanglement
- Fiber-based Quantum Communication
- Free-space Quantum Communication
- Quantum Sensing
- Quantum Effects and Gravity

ÖAW ÖSTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN
INSTITUTE FOR QUANTUM OPTICS AND QUANTUM INFORMATION VIENNA

IQI Vienna

Open Discussion

- Topics:
  - Questions to the speakers?

- Your feedback at **www.menti.com** and use the code **45 45 0 44**

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Quantum Technologies
Principles, Challenges and Applications

Coffee Break

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Next GN4-3 WP6 Network Technologies and Services Development Infoshares

- 9 March GÉANT Infoshare: European Time and Frequency Services - Principles, Challenges and Use Cases
- 17 March GÉANT Infoshare: Quantum Key Distribution - Practical implementations
- 24 March Workshop on Network Management and Monitoring Tools
- 14 - 15 April European perfSONAR User Workshop (Online)

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Quantum Technologies
Principles, Challenges and Applications

Session2

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Introduction Speaker Session 2

Dr. Tommaso Calarco

Professor of Institute for Theoretical Physics, University of Cologne

Director, Institute for Quantum Control of the Peter Grünberg Institute

Tommaso Calarco is Director of the Institute for Quantum Control of the Peter Grünberg Institute at Forschungszentrum Jülich and Professor of Theoretical Physics at the University of Cologne. He received his PhD at the University of Ferrara and started to work as a postdoc in the group of P. Zoller at the University of Innsbruck. He was appointed as a Senior Researcher at the BEC Centre in Trento in 2004 and as a Professor for Physics at the University of Ulm in 2007, where he then became Director of the Institute for Complex Quantum Systems and of the Centre for Integrated Quantum Science and Technology. In 2016 he authored the Quantum Manifesto prompting the European Commission's Quantum Flagship initiative.

Introduction Speaker Session 2

Piotr Rydlichowski

- Head of Optical Networking Laboratory, Institute of Bioorganic Chemistry of the Polish Academy of Sciences Poznan Supercomputing and Networking Center Researcher. Focused on optical data transmission technologies and electromagnetic wave theory and propagation simulation.
- Involved in European QKD projects and Quantum Flagship (https://openqkd.eu/)
- Involved in Polish National Quantum Technologies Laboratory (http://nlpqt.fuw.edu.pl/)
- QKD subtask leader in GN4-3 project, WP6 T1

Open Discussion (session 2)

- Topics:
  - Questions to the speakers

- Your feedback at **www.menti.com** and use the code **45 45 0 44**

Thank you

Any questions?

Share with us your feedback at

gn4-3-wp6-qkd@lists.GEANT.org

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Backup slides

Open Discussion

- Topics:
  - Questions to the speakers?
  - Do participants have quantum technologies related requests or expectations from its users?
  - Technological and organisational readiness of NRENs to adopt these technologies and associated research.
  - Quantum Technologies worldwide

- Your feedback at **www.menti.com** and use the code **45 45 0 44**

Open Discussion (session 2)

- Topics:
  - Questions to the speakers
  - Involvement in European and national initiatives
  - Practical implementations and testbeds in NRENs

- Your feedback at **www.menti.com** and use the code **45 45 0 44**