Quantum Telecommunications Networks

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BT has a long history of innovation...

including significant optical transmission firsts

**World Firsts**

- **1846**: Telecommunications company: Electric Telegraph Company
- **1926**: Two way transatlantic telephone conversation by radio
- **1943**: Programmable computer: Colossus
- **1962**: Telephone call via satellite
- **1968**: Digital exchange
- **1980**: Purpose-designed optical fibre submarine cable
- **1984**: 140 Mbit/s commercial single mode optical fibre link
- **1989**: Satellite telephone system: Skyphone
- **1999**: GPRS live data call over a mobile network
- **2014**: QKD + 40Gbit/s data Field Trial
- **2014**: 3 Tb/s optical fibre link in the core network
3 Terabit/s trial

• Summer 2014, successfully demonstrated error-free transport of up to 3Terabit/s over 359km, over a fully managed Flexgrid 3T (15 x 200G 16-QAM) super channel.

• 3T superchannel co-propagates with conventional 50GHz 100G channels.

• 33.5GHz subcarrier spacing giving a spectral efficiency of 5.97bits/s/Hz, more than 49% improvement over conventional 50GHz grid.

• Real time, production grade hardware and software, 359km field installed fibre and WDM system.

• Configured and managed from BT’s live Transport Network Operations Centre (TNOC) in Cambridge.
World First field-trial configuration of 10Gbit/s transmission secured by QKD

Client traffic (Ethernet, IP phone)

VOA= variable attenuator
Mux= multiplexer

26km (loop back configuration)

9.8dB loss → 0.38dB/km loss @ 1550nm
(Equivalent of 50km of lab fibre)

BT Labs
Ipswich
So why Quantum?

...a path towards ultimate network security

- Increased security requirements for networks
- BT committed to providing foolproof security
  - Decades of contracts to security-focused customers
- Company ID Quantique selling systems
- Toshiba demonstrating years of world leading QKD technology
- Other quantum spin-offs
  - Quantum-ID, Timing, Synchronisation
  - Entanglement, Data teleportation
But why Adastral Park?
Adastra Park – ‘a key UK engineering centre’

- BT’s Global engineering HQ
- 3100 BT people
- 700 partner people
- 70 high tech companies
- Focal point of BT R&D
- BT is No1 UK ICT sector investor in R&D*
- Source of key IPR
- Hosted 1400 VIP customers, civil servants and policy makers through 241 events in 2013/14
- Largest test & integration facility in Europe
- UK operations centre
- 4500 students and 920 teachers engaged from 190 schools in 2013/14

*Source: EU Industrial R&D Investor Scoreboard 2014
Customer Centre & Innovation Showcases

- Innovation showcases based on BT sectors
- BT Portfolio, new BT developments and 3rd party innovations
- Around 150 – 200 BT customers per year across all sectors
- Influencers and stakeholders: press, regulator, government
- Aim: test Innovations with customers; generate/win new business
- Relevance: demonstrate quantum applications in context
Innovation Martlesham

- **ICT Cluster**
  - Collaborative environment for ICT companies co-located with some of the world’s leading ICT companies including Alcatel-Lucent, BT, Cisco Systems, Fujitsu, Nokia Siemens Networks and Huawei Technologies

- **Business Incubator**
  - Nurtures technology companies in their early stages, providing rent free office space, comms, and expert commercial advice by a group of mentors to help develop their businesses

- **Mentor Group**
  - Domain experts who provide free advice to companies in the business Incubator, and can also be contacted by other companies under normal commercial terms

- **Networking Opportunities**
  - IM hosts regular networking/speaker events, as well as more informal networking events

- **Business Club**
  - Another entry level option

For more information please visit:  
[www.innovationmartlesham.com](http://www.innovationmartlesham.com)
BT’s commitment to this Hub

• BT will advise on applying quantum communications to telecommunication applications and next generation networks. BT experts will work directly with the Hub to promote and support early trial / adoption of Quantum communications technologies.

• We will continue the field trials we have already conducted at BT’s research headquarters at Adastral Park and offer continued access to our installed fibre testbed. The LEANET fibre testbed will be used to extend the National Fibre Infrastructure Service fibre from Adastral to Cambridge and other locations.

• We will enable connection of companies from the Adastral Park Tech cluster as early adopters and champions of quantum communications for their own supply chains and clients – in the ICT industry and beyond.

• We will host a permanent QKD showcase as an additional attraction to businesses wishing to be at the heart of leading-edge advanced telecommunications systems and services.

• We are also keen to support the Quantum Engineering Skills Training Hub (QUEST). BT can host Post-Doctoral Research Associates and PhD students at Adastral Park, providing industrially-relevant research projects, guest lectures and world-class facilities.
In the future:
Quantum Communications could be at the heart of...

- All security-critical network transport
- All remote identity verification
- An ultra precise timing and synchronisation network
- Novel entanglement based data teleportation
- Many other applications not yet thought of

BT is proud to be a partner of this Quantum Communications Networks Hub and committed to its success.

GOOD LUCK!
Bringing it all together