

# A Quantum Community in the UK

Professor Philip Nelson, CEO EPSRC

UKNQT Showcase 2015



UK NATIONAL  
QUANTUM  
TECHNOLOGIES  
PROGRAMME

# A Quantum Community in the UK

- ❖ An **extensive science base** with recognised excellence
  - Diverse approaches towards quantum technology ‘platforms’ explored
    - atoms/ions/molecules, solid state, photonics *etc*
- ❖ An **industry base that is interested** – *intrigued*, perhaps?
  - Vital core skills in technology design, development and systems integration.
  - End users that want to better understand the potential capabilities
- ❖ An **aligned public sector** that can and will support the community
  - An early-stage adopter and demonstrator of technology.
  - New and existing routes to research and innovation funding and facilities

# A Quantum Community in the UK

32

Universities initially applied for Technology Hubs

More than

150

Doctoral students will be trained by CDTs

10

Fellowships awarded

Over

160

Companies supported Hub applications

22

Companies submitted applications to the first round of innovation funding

**£120m** invested to establish a network of **Quantum Technology Hubs** involving **17 universities** and **132 companies**.

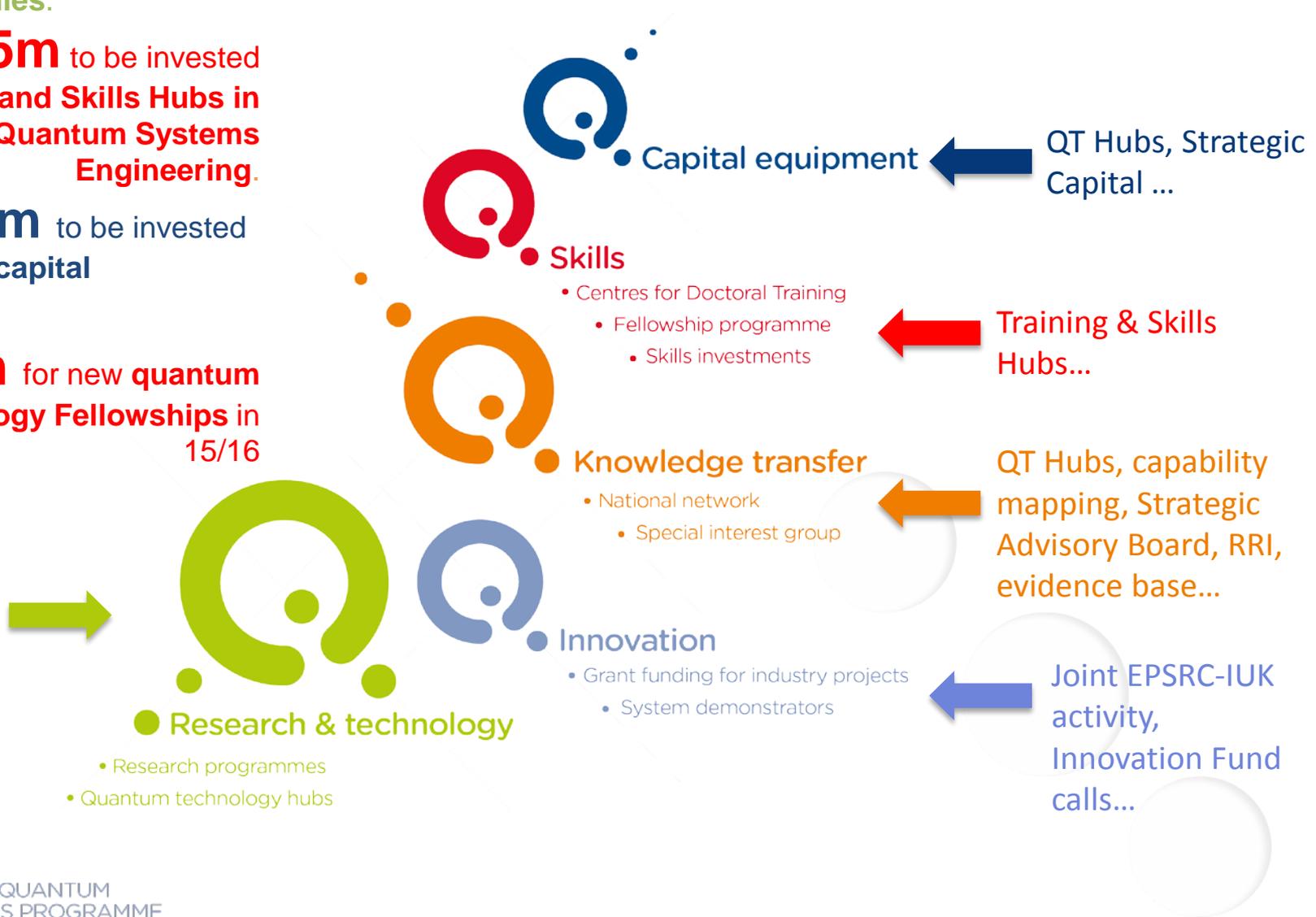
Up to **£15m** to be invested in **Training and Skills Hubs in Quantum Systems Engineering**.

Up to **£25m** to be invested in **strategic capital equipment**.

**£15m** for new **quantum technology Fellowships** in 15/16

QT Hubs, Fellowships, Strategic Capital...

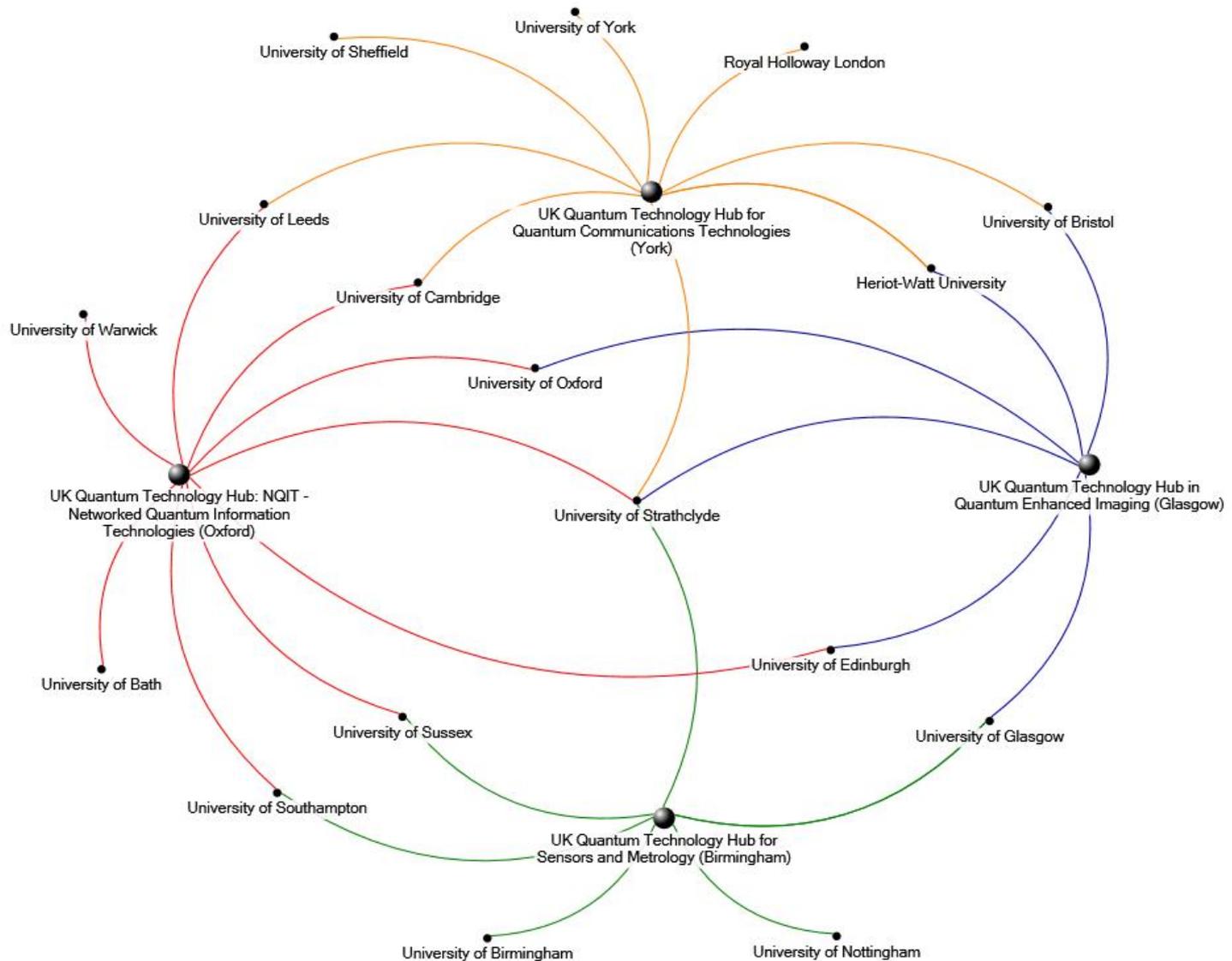
# What is EPSRC doing?



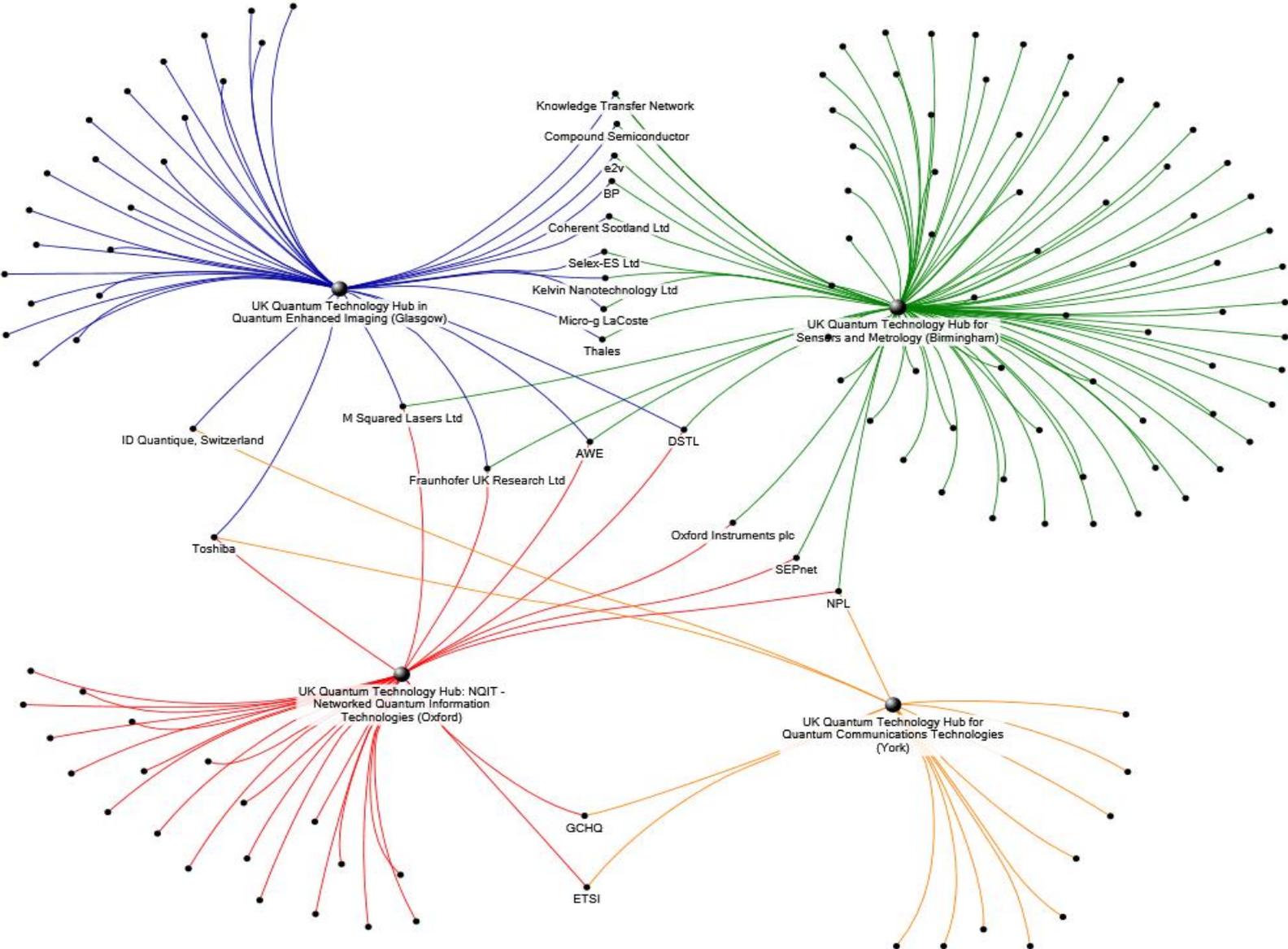
# UK National Quantum Technologies Hub Network

- £120 million investment in four hubs to explore the properties of quantum mechanics and how they can be harnessed for use in technology
- Started in December 2014 and initially involves 17 universities and 132 companies
- The four hubs were selected after a competitive peer review process and are led by the universities of Birmingham, Glasgow, Oxford and York

# UKNQT Hubs: University Interactions



# UKNQT Hubs: Industry Interactions



# UK National Quantum Technology Hub in Sensors and Metrology

- Led by the University of Birmingham and incorporates the universities of Glasgow, Nottingham, Southampton, Strathclyde, and Sussex
- Aims to develop a range of quantum sensor and measurement technologies that are ripe for commercialisation by UK businesses
- Quantum sensors have the potential to be cheaper, lighter, smaller, more sensitive and more energy-efficient than existing, classical sensors
- Advances in this area have applications across the board, from healthcare to navigation, to archaeology, and everything in between

# UK National Quantum Technology Hub in Imaging

- Led by the University of Glasgow and incorporates the universities of Bristol, Edinburgh, Glasgow, Heriot-Watt, Oxford, and Strathclyde
- Aims to develop exciting new types of ultra-high sensitivity cameras with capabilities far beyond the current state-of-the-art
- Applications of quantum cameras include visualising gas leaks, seeing through smoke, and even looking round corners or underneath our skin
- Quantum imaging techniques include single-photon visible and infrared cameras, single-pixel cameras and imaging beyond line-of-sight

# UK National Quantum Technology Hub in Computing

- Led by the University of Oxford and incorporates the universities of Bath, Cambridge, Edinburgh, Leeds, Southampton, Strathclyde, Sussex, and Warwick
- Aims to develop networked quantum information technologies that will put today's supercomputers to shame in terms of the complexity of task they can execute and their processing speed
- Creating systems that can be connected to each other to form flexible, scalable solutions for a huge range of applications, such as accelerating drug development, analysing "Big Data", ultra-fast generation of quantum random numbers, secure communication between many parties, and enhanced distributed sensing

# UK National Quantum Technology Hub in Communications

- Led by the University of York and incorporates the universities of Bristol, Cambridge, Heriot-Watt, Leeds, Royal Holloway, Sheffield, and Strathclyde
- Potential use in a wide range of functions and applications where security is vital: from encryption of communications, passwords and identification, to financial transactions
- Developing market-ready technologies and exploring ways of making smaller, lower-cost devices which can be integrated into existing systems and infrastructure including for use with secure mobile banking
- Building the UK's first Quantum Network to provide access to quantum secure communications on different scales: within buildings, within cities, and between cities

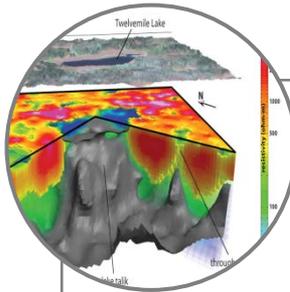


# Applications of Quantum Technology



## Accurate Financial Trading

The speed of modern financial trading is such that transactions must be audited to the microsecond level or beyond – ‘quantum timing’ via chip-scale atomic clocks makes this a possibility.



## Sensitive Sub-surface Sensing

Development of ‘gravity sensors’ could facilitate the detection of previously unknown fossil fuel deposits, or enable more accurate mapping of buried civil infrastructure such as pipes and cables.



## Secure Information Protection

Advances in quantum key distribution technology will enable a new generation of secure electronic communication, applicable to personal finance, online shopping, and secure industrial communication.

# Applications of Quantum Technology



QT-based imaging systems could **improve the safety** and variety of Royal Navy mine sweeping operations



Flood damage cost the UK £4Bn in 2012 – gravity sensing can more effectively monitor the water table to **aid prevention**



4 million holes are dug in UK roads every year – nearly 20% erroneously hit **unknown or forgotten buried utilities**

UK National Quantum Technology  
Showcase Exhibition is now open!