Wireless Communications and Mobile Computing

Special Issue on
Quantum Communication Networks

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Telecommunications networks have been evolving from the original circuit-switched paradigm to the packet-switched paradigm, originally suggested for the internet. As time has progressed, the previous and existing generations of mobile communication networks moved from the store-and-forward paradigm to the future compute-and-forward approach. This means that computing is the upcoming main pillar of future communication networks thanks to the full softwarization of the network stack, protocols, and procedures. The characteristics of future generation networks predict an unprecedented rise in demand for storage and computing capacity. The implementation of intelligent and adaptable networks will need considerable resources for secure data mining/processing, and distributed computing for decision-making. Additionally, machine learning applied to big data will require network performance and network infrastructure awareness for prediction of future network states.

However, network virtualisation and future networks in general present some intrinsic limitations as they are based on technologies relying on classical physics. Therefore, these limits are inherently present in the classical design methodology. To overcome these limits efficiently, quantum computing and communications have been proposed. These two paradigms are part of a unique quantum mechanical network, often called the quantum internet. This new quantum-mechanical internet is then integrated with classical mobile communications to realise a full classical-quantum network infrastructure. Another concern is the design of future classical-quantum communication networks, which requires reliable and accurate network simulators. However, standardised quantum hardware still does not exist. This implies the simulation and evaluation of quantum mechanical phenomena (e.g., entanglement) via simulators based on classical hardware and software. Finally, use cases within quantum communication networks are still investigated. Thus, identifying new use cases for classical quantum communication networks could subsequently reveal their full technological and business potentials.

The aim of this Special Issue is to collate original research articles aiming at providing the latest theoretical fundamental, algorithmic, and experimental advancements in quantum computing, information theory, and communications, whilst also considering security (e.g. cryptography, key distribution, etc.). As we want the Special Issue to highlight the importance of future communication and computing, we also welcome submissions from multidisciplinary fields, such as quantum machine learning and game theory. Research focussing on the latest developments in the design of classical software and simulators to accurately represent quantum phenomena in future communication networks are particularly encouraged. Review articles discussing the state of the art are also welcome.

Potential topics include but are not limited to the following:

- Architecture of quantum networks and computers
- Distributed Quantum Computing
- The Quantum Internet
- Quantum communications and protocols
- Quantum information theory
- Quantum error correction and channel coding
- Theoretical advancements in entanglement theory and techniques for entanglement distribution
- Satellite-based quantum key distribution and integration between terrestrial and satellite quantum communications
- Quantum tensor networks and graphical representation of quantum processes
- Quantum machine learning
- Quantum game theory
- Experimental results, prototypes and testbeds
- Quantum network simulators
- Use cases for quantum communication networks: quantum distributed sensing, quantum clocks, and exchange of Cartesian reference frames

Authors can submit their manuscripts through the Manuscript Tracking System at https://review.hindawi.com/submit?specialIssue=923028.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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