Chapter 10
Quantum Internet and E–Governance:
A Futuristic Perspective

Manan Dhaneshbhai Thakkar

U. V. Patel College of Engineering, Ganpat University, India

Rakesh D. Vanzara

https://orcid.org/0000-0002-6629-350X

U. V. Patel College of Engineering, Ganpat University, India

ABSTRACT

We are leaving in the era where almost everyone in the world uses internet for the communication over social media site, shopping, E-commerce, online transaction and many more. The exponential growth in usage of internet resulted in security related challenges. Since last several years, traditional cryptography algorithms are found working well. Evolution of quantum computer and its high computing capability can break existing cryptography algorithms. To handle the security constraints, this chapter provides details on evolution of quantum cryptography, components involved to design network architecture for quantum internet, quantum key exchange mechanism and functionality wise stages for quantum internet. This chapter also includes challenges involved in evolution of quantum internet. Further, chapter also contains the details on e-governance, challenges in e-governance and solution using quantum cryptography.

INTRODUCTION

Quantum cryptography, is the way of encrypting messages by applying principles of quantum mechanism, in contrast with the traditional cryptography mechanism to encrypt the messages by applying the mathematical function over actual message (Maria Korolov, Doug Drinkwater, 2019). Main purpose of this quantum cryptography is to encrypt message in such a way that no outsider recipient can even read that message. Quantum communication is to be considered more secured than any existing information relay

system. If quantum communications were like sending a letter, entangled photons are like the envelope, they carry the message and keep it secure. It is expected that by 2030 (Sophia Chen, 2017), quantum communications will spread almost in all countries and that would be an era of quantum Internet. It means, all kind of communications (i.e. multimedia, text, voice) would happen by means of quantum signals compared to traditional digital signal (i.e. 0 and 1).

Quantum Internet provides new Internet technologies to us to solve the tasks which are impossible to achieve over classical Internet (Kimble, H. Jeff, 2008). As it's a new technology which is yet to explore fully, thus we cannot expect all the sectors making its usage initially. But, it provides good enough applications containing security related concern over Internet, to justify its importance. Basic elements of quantum Internet do not look much different from a classical one (Vesna Monojlovic, 2017). The way classical Internet is having one of component as end node, this quantum Internet also needed end node. But, that end node should support quantum Internet. So, as a node we cannot use normal laptop, phone or computer, but we need to make use of quantum computer. The way we have switch type of component in classical Internet as an intermediate point to establish connection, for the quantum Internet we need kind of switch which is capable to transmit qubits. Table-I depicts the comparison of classical and quantum Internet.

Table 1. Comparison between classical internet and quantum internet

Classical Internet	Quantum Internet
● End node: traditional computer, phone, laptop	● End node: Quantum system
● Switch	● Quantum switch
● Repeater	● Quantum repeater
● Data in the form of digital signal with combination of 0 and 1	● Data in the form of qubits
● Threat of cyber attack	● Secure

Electronic governance (E-governance) playing an important role in integrating information, science and technology within the administrative and management systems of an organization (Das, S. R., & Chandrashekhar, R., 2007). E-governance is the key to organize everything in public domain to increase the accessibility, efficiency, transparency and openness to the stakeholders. E-governance concept was basically designed to improve citizen's access to government information and services (Faraj, Sufyan T., M. Sagheer Ali, 2011). The concept of E-governance has found its wide range of applications by including several governmental domains like education, health care, security, power, citizen services and many more. In order to make information excessive and open for all, security threat is a major concern and information must be protected from unauthorized access (Faraj, Sufyan T., M. Sagheer Ali, 2011). Security is a major concern for successful implementation of E-Governance and transaction based services. Some of the security issues in E-Governance are: Authenticity, Confidentiality, Non-repudiation, Integrity. The important thing to understand is, how to solve security related challenges by using the concept of quantum cryptography and quantum key exchange. Many industries and government sectors are currently trying to build the quantum computer which will avoid many computing and security related problems (Faraj, Sufyan T., M. Sagheer Ali, 2011).

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