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A Review on Quantum Computing Trends & Future Perspectives

A.A. Laghari[1,*], H. Shah[2], R.A. Laghari[3], K. Kumar[1], A.A. Waqan[1] and A.K. Jumani[4,5]

[1]Department of Computer Science, Sindh Madressatul Islam University, Karachi, Pakistan, asif.laghari@smiu.edu.pk*, kamlesh@smiu.edu.pk, asif.wagan@smiu.edu.pk
[2]University of Eastern Finland, Finland, himat@cs.uef.fi
[3]Nanjing University of Aeronautics & Astronautics, China, rashidalilaghari@gmail.com
[4]School of Information Communication Engineering, South China University of Technology (SCUT), China
[5]Department of Computer Science, ILMA University Karachi, Sindh, Pakistan, awaisjumani@yahoo.com

Abstract

Over the last decade, there has been an exponential growth in high-performance computing. Computing such as cloud and fog computing is gaining popularity, whereas, Cloud computing is a computing organization where a large number of systems are connected to the internet for application, data, and storage services. Quantum computing is the use of quantum-mechanical phenomena such as superposition and entanglement to perform computation. In this paper, we describe the basic concept, history of quantum computing and development in network and cryptography, and future game design based on quantum. Specifically, we present the latest development in quantum networking and cryptography. Finally, we discuss the current research solutions and open issues for future research in quantum computing.

Keywords: Quantum Computing; Network; Cryptography

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*Corresponding author. Email: asif.laghari@smiu.edu.pk

1. Introduction

The rapid growth in high-performance computing began with cluster computing, and after the development of gird, cloud, and fog computing. Nowadays, more research is going on quantum computing, the focus of current research is on how to improve the computing process, speed of the middle network, and security. The researcher believes that the theory of quantum physics will be helping to develop modern computing paradigms to provide quality of service to end-users with reliability and security [1, 2].

Quantum computing is the area of research, which intensive on creating computer innovation established on the principles of quantum theory that clarifies the nature and behaviour of energy and matter on the quantum (nuclear and subatomic) level [3, 4]. The Growth of quantum computing will increase the computing capability if it will become practical, which will then it will change computing forward power from abacus to the latest supercomputer along with execution picks up within the billion-fold domain and past. The basic components of quantum computing were begun by Paul Benioff, working at Argonne National Labs, in 1981 [5]. He gave theory about a classical computer working with a few quantum mechanical standards.

Building a practical quantum computer, requires a holding entity in a superposition state, long enough to carry out numerous processes on them [6, 7]. Once a superposition encounters material that is a portion of a measuring system, then it loses its in-between state, which is known as decoherence, and it gets to be a boring ancient classical

bit [7]. The devices of quantum computing will be intelligent to shield quantum states from decoherence, while still making them easy to read. Diverse processes are undertaking this challenge from different angles, whether it is to use more robust quantum processes or to find better ways to check for errors.
Currently, quantum computing is in under development phase. Researcher's all around the world making efforts to provide proposed models for computing devices, models, and software that will enable computing for end-users [8, 9].
In this paper, we focus on the history of quantum computing, basic concepts, and recent development in quantum networks, and cryptography, and also discuss future quantum game design and development. We try to identify and discuss a set of open issues related to quantum computing, which are not been detailed and discussed, and no research carried out on them.
This paper is divided into six main sections. The first section is about the survey on quantum computing. In section, two quantum mechanisms are given. Sections 3-5 provide details on quantum networks, cryptography, and games respectively. In final section 7, future work and open research questions related to the quantum computer are given.

2. Methodology

This research is based on Systematic Literature Reviews (SLR), where quantum computing is discussed and its future aspects. We have discussed open issues in quantum computing and its future trends. In this study, we have combined the SLR and Systematic Mapping Study (SMS) methods furthermore; it depends upon the complete steps, which are used in this research.

2.1 Research Questions

R.Q.1 Which of the scenario of quantum computing?
Ans: yes, we have discussed the quantum computing network scenario. Inside section 4
R.Q.2 The role of cryptography in quantum computing?
Ans: Yes, we have discussed cryptography in quantum computing. Inside section 5
R.Q.3 What is sci-fic quantum computing?
Ans: Yes, we have discussed it in detail. Inside section 6
R.Q.4 What are the recent issues and solutions related to quantum computing?
Ans: yes, we have discussed the open research issues and solutions. Inside section 7.

2.2 Selection and Non-Selection Criteria

In this systematic review, we have focused on journal and conference papers, which are published in the English language from 2001 to 2021. Given below SLR table.1 depends upon published research papers.

2.3 Search Term Techniques

For the arrangement of SLR, we have used some searching keywords like "Quantum Computing", "Open issues of Quantum Computing", and "Future trends in Quantum Computing" in the Google scholar database, Scopus database, and so on.

2.4 Review Tips

1. This SLR depends upon published articles:
2. Most published articles are extracted from the Google Scholar database.
3. Concerned published papers are used in this research.
4. Non-related published articles are removed from this research.
5. During the searching we have focused on article titles and abstracts.

For conducting this type of research, we have focused on relevant published papers.

3. Quantum Mechanism

First of all, let us know what is quantum? If we will say that the computer can work more than the speed of light then, it will be false [10, 11]. The question arises here the speed of light is faster than anything else; it can be true with the help of QUANTUM. The quantum is a kind of process that can work more, we think let's take an example. For example, you had put the password of your computer as {1 1 1} it is a three-digit number, and you have forgotten what was the password is of your computer.
What will you do now, you will give the command to your computer to find the password and the computer will process the eight procedures to find the three digits password as shown in Table (1). First, it will try 0 0 0 if it's not the right password then it goes for a second then the third one by one it tries all of them then at the end it will find the correct answer and show it to you, that's mean to find the password the computer has to go through eight states to find the correct password.
If you will use the Quantum computer, then it will not last all it will find the password just in a single state that's mean it will read all the numbers at the same time, and it will give you the correct answer without wasting your time.

Table 1. Password Example

0	0	0
0	0	1
1	0	1
0	1	1

1	0	0
1	0	1
1	1	0
1	1	1

These quantum computers are made with the help of Quantum theory, which is used in physics this can also be known as the Future computer. Quantum computers are those computers that use quantum bits and qubits to compute anything.

Sometimes, we use a computer like a desktop, laptop, tablet, or Smartphone. We also called them a binary computers, because all the functions are used by ones and zeros (1, 0) functions. In a single binary computer, to complete any type of calculation the processor uses the transistor, the transistor can b in the on a state or in the off state which means a Yes or No statement. Where 1 represents the on statement & 0 represents the off statement. The next step in the program is only to be known by the ones and zeros (1, 0).

The next step in the program is only to be known by the ones and zeros (1, 0). The amazing thing about computer programs is they can make much software by just using a few simple statements like if, this, then, that, scenario. There are many things to know about binary computers however, the main thing is that all the computers use binary numbers, and these numbers are known as bits.

If we talk about quantum computers it does not use bits it uses Qubits, which are also known as quantum bits. In these qubits, there is an extra function, which the classical bit does not have. In classical bits, the function just works in two statements either zero or one (0, 1), which means when a developer is developing a program he can only use if, this, then, that case during creating a program, however, in quantum it can be in any state like 0 or 1 or both at the same time, which means while creating a logic a developer can use also use, if both conditions at a time, which can increase the computation speed of a computer.

Until we would not observe these qubits, they will be in all possible states, which are also known as the spinning state. The functionality of these qubits is based on the quantum physics superposition phenomena. Quantum computers use the qubits to simulate the surrounding partials by which the speed and the power of these computers increase more than the binary computers.

For example, you had just started to make a coin scrolling; when it stops scrolling in the result you will get whether a head or a tail, our binary computers also work the same like that have zero or one (0, 1). This is the reason binary takes more time to solve a problem, it can be possible that we can get more than one answer at a time because it checks all the conditions one by one, which is given in Table 1.

If we will use the quantum computer instead of a binary computer, it works differently. We will take the same example of the coin. Unless the coin is scrolling, we would not know what will be resulting, whether it will be head or tail, which means at the time of scrolling coin is in both states like zeros and ones.

Unless we won't observe the qubits, it is also in the same state as a coin, which means it can work in many possibilities at the same time. We can say that, while the binary computer is in the process to find the result of a program, the quantum computer will find results before it.

If we will see the quantum computer of Google is much faster than our binary computers, however, we cannot use it in our homes; the reason is that it needs about 0 to -5 Celsius to work [12, 13]. If the temperature goes higher in temperature then the quantum computer may destroy. It does not mean that we will not be able to enjoy these computers. The technology is increasing day by day, and many companies are working on it that how we can enjoy these computers even in our homes & everywhere.

4. Quantum Networking

Quantum networks deal unifying set of challenges and opportunities across exciting intellectual and technical frontiers, including quantum computation and communication [14, 15]. The reality of quantum networks is based on many channels and nodes, which requires new scientific approaches and abilities for the generation and characterization of quantum coherence and entanglement [16]. Quantum sounds so progressed and complex that individuals will, in general, get advertised up about anything joined to it. While not every quantum breakthrough elicits a positive response on account of an alleged quantum web, individuals have the motivation to be energized. In the least difficult of terms, quantum networking would utilize quantum flags rather than radio waves to send data. The working quantum network scenario is given in Figure 1 [17].

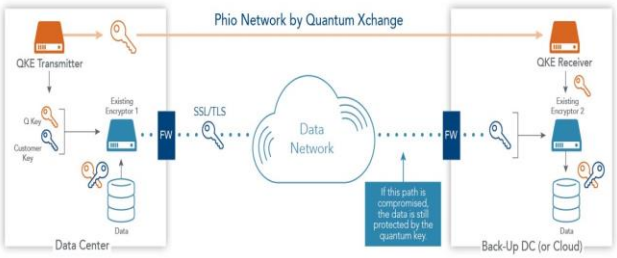

Figure 1. Quantum Network Scenario

Quantum networking as we probably are aware utilizes radio frequencies to associate different PC through a world wide web in which electronic signs are sent to and fro. In a quantum web, signs would be sent through a quantum organize utilizing snared quantum particles [18]. Following what Einstein called creepy activity way off trapped particles exist in an uncommon express that permits data conveyed in one to be quickly reflected in another a kind of quantum teleportation.

Specialists have as of late gained huge ground in building this quantum communication arrangement. China propelled the world's first quantum communication satellite a year ago, and they have since been occupied with testing and broadening the confinements of sending trapped photons from space to ground stations on Earth and afterward back once more [19]. They have additionally figured out how to store data utilizing quantum memory. Before the finish of August, the country intends to have a working quantum communication system to support the Beijing-Shanghai web [20].

The Quantum network allows the transfer of information in the form of bits called qubits [21]. The best quality of quantum networking is a hacker can try to hack its data so users easily understand that its data can be a hack. Example is given in Figure 2.

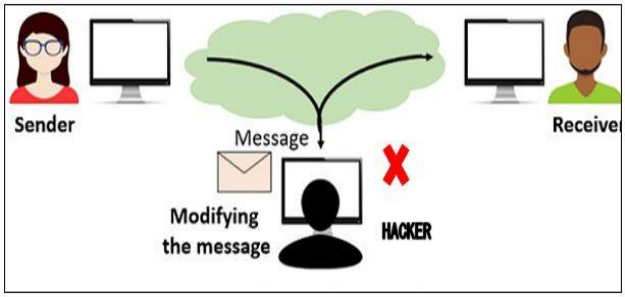

Figure 2. Hacker modifying communication in Quantum Networks

Therefore, if you use qubits to send your friend (receiver) a private message, and a hacker intercepts any of the particles before sending them along to the receiver, you (sender) and the receiver will be able to tell that someone misses with the qubits before he got them.

Wehner et al. provide a roadmap of quantum internet development with existing networks, and he proposed the stage of quantum networks with application in the future. It provides the concept of three necessary hardware that are required for building quantum networks such as the repeater, switches, and end node. Further, this research explains these devices will work and the Implementation status and challenges [22].

Network queuing delay is an important issue in the development of quantum networks. In this regards Dai et al. present a tractable model named quantum queuing delay (QQD) for analyzing queuing delay of data [23]. The proposed model applies a dynamic programming method and measures the finite memory size. This model helps to develop a policy that depends on cognitive memory, which reduces the average delay of queuing according to memory size. The result shows that the model provides a better performance of the developed policy.

Quantum networks would also be superior in sending our data securely from one place to another place. Government agencies like universities, hospitals, schools, offices, and airports, could use quantum network technology, and quantum networks would also be used in the government elections process, where the voters will overlap [24].

There are two kinds of quantum networks;

1: Unentangled Network.
2: Entangled Network.

UNENTANGLED NETWORK

Unentangled network is good only for quantum key distribution (QXD), which assists the longevity of secrecy of encrypted information on classical networks. It is a very limited distance but satellite possible. Weak in multi-hop settings, better for point to point.

ENTANGLED NETWORK

The entangled network is good for many processes you can each get shared, secret random numbers upon measuring shared, entangled states [25]. But that does not give you the ability to send messages long distance using quantum repeaters and strong in networked settings. Quantum networking used qubits; qubits cannot copy, unlike classical bits. Classical bits are either 0 or 1, but qubits can be both at the same time as shown in Figure 3.

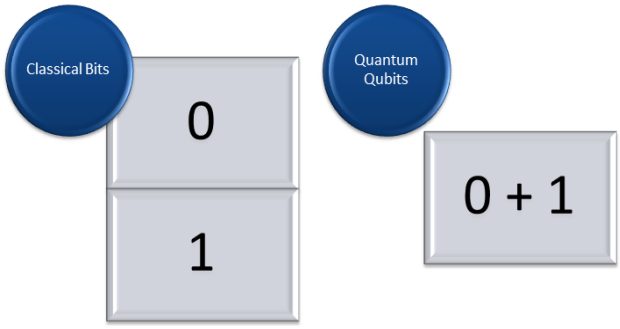

Figure 3. Qubits in Quantum networks

Wilkinson et al. explore the regimes of the butterfly network of classical and quantum networks and other networks, which are built on the blocks of butterfly networks blocks [26]. Multicast data sending and receiving were measured for analysis of the rate of transmitting the quantum and classical information through the networks. Moreover achievable rate of performance of quantum networks (upper and lower bounds) and connected networks and depolarizing and erasure channels were considered. These all components were measured to detect and exceed the capacity of quantum networks. The results show the research by merging butterfly blocks in parallel, found change by increasing of qubit of one bit per receiver to from the sender in case of perfect transmission. The purpose of this research is to analyze the performance of the network and

provide a roadmap for the future development of a quantum network.
Devitt et al. present work is based on the error correction quantum memories installed in the ship to analyze local networks of ships, which enable high-fidelity quantum communication with low latency across globe distances at the maximum bandwidth proposed previously [27]. The results show that the expansion of technology with enough fidelity to permit topological error correction and bandwidth can be increased with the improvement of fabrication and implementation of quantum memories. This approach avoids technical restrictions of repeater deployment in quantum networking and provides a different way for global Quantum Internet.

4.1 Quantum Web Surfing

Things being what they are, what does a quantum network mean for normal web clients to the extent commonplace web surfing goes presumably very little [28, 29]. It's highly unlikely that you will be using quantum networking to refresh your online networking feed, for one. Much of the time it does not bode well to convey quantum precisely as a normal PC could transmit or get to quantum-encrypted data through this cloud-based quantum PC. In any event, you could send messages. Clients might not have any desire to send their data traditionally. Quantum networking would all probability become a particular part of the ordinary networking, one we would just interface with for explicit errands. Be that as it may, regardless of whether the quantum web does not work a similar way the present web does, one thing is without a doubt: the front line innovation can profit everybody.
Huberman and bob proposed a quantum router for web entangled, which is an important part of quantum networks [30]. The mechanism based on entangled pair management and the design of the proposed router depends on teleportation. The proposed model is simulated by using a quantum simulator.

4.2 The Technical Basics of Quantum Networking

The goal of quantum networking is to exchange the transmission of quantum bits (qubits) between any 2 points on earth to solve issues that are determined classically. Qubits are different from classical bits in this they'll be "0" and "1" at the same time, and can't be traced.
Currently, it is now possible to form a transmission over 100km and run one application referred to as quantum key distribution. The main challenge is now to travel these particles over long distances, and by attaching some small quantum processors to change a larger range of applications [31]. Thankfully, these quantum processors now do not have to be massive quantum computers: and we need enough qubits to outperform classical communication. The reason why quantum networking nodes do not want several qubits to be useful (unlike quantum computers) is that a quantum net derives its benefits from quantum entanglement for which even one qubit may be enough. In distinction, a quantum computer forever desires additional qubits than may be simulated on a classical supercomputer to be helpful.

4.3 Security

In general, quantum networking exploits 2 essential options of quantum entanglement: 1st, the quantum trap is inherently personal and private – if 2 network nodes are maximally entangled, then this trap is secure from the rest within the universe in line with the laws of quantum physics. Second, quantum entanglement permits the largest coordination – activity 2 qubits that are entangled continually ends up in an equivalent outcome despite, however, they are apart [32]. It is this feature of excellent coordination that provides advantages in, for example, clock synchronization or maybe winning an online bridge more often by using quantum entanglement.
Is It Physically Tested?
Yes, it is performed by these countries and their organizations.

- DARPA Quantum Networks performed the test in 2001 at Harvard University.
- Chinese hierarchical network also performed the test by sending units to space and becoming the first country to send some quantum information to space.
- Geneva area network (Swiss Quantum) also performed the test at Geneva University.

4.4 Advantages

- Use-cases for quantum networking presently include:
- We can secure our communication with the help of quantum key distribution [33].
- Clock synchronization
- Combining distant telescopes to make one far more powerful telescope.
- Beneficial for some complex classical issues in distributed systems like achieving agreement and agreement concerning information distributed within the cloud.
- Sending experimentally smaller amount of qubits than classical bits to resolve some distributed computing issues.
- Combining two and more than two quantum computers to make a bigger computing cluster.

5. Quantum Cryptography

In computer science, cryptography is the process of encryption and decryption of information, which is the protection of information by using codes so that those can process and read it for which it is sent [34]. It is the mixture of two words “CRYPT” means concealed then “GRAPHY” stands for behalf of writing. It usages towards protecting records from theft or alternation. Quantic encryption is the knowledge that developing quantum manual belongings on the way to wide-ranging cryptographic tasks. It remains impossible for near-copy registers encrypted in a quanta state. If one effort is to read the prearranged data, the major state will be changed. Quantum Cryptography works on the principles of quantum mechanics in which the data is encrypted in the form of key distribution and photons [35]. Quantum cryptography allows two servers to communicate with perfect secrecy under the nose of eavesdroppers who are equipped with unlimited computational techniques [36]. Unlike mathematical encryption, quantum cryptography makes the data virtually unhackable.

Stephen Wiesner and Gilles Brassard were the two who gave the beginning of Quantum Cryptography [37]. In the early 1970s, Stephen Wiesner’s “Conjugate Coding” concept got rejected by the Institute of Electrical and Electronics Engineers (IEEE) [38]. In the early 1980s, a newspaper published it. Through the work of Charles H. Bennett and Gilles Brassard, a method for secure communication was introduced, called BB84. Further, David Deutsch and Artur Ekert worked in more detail on it [39].

As Quantum Cryptography uses the form of photons to transmit data from one server to another both the servers can determine if the key is safe or not. First, a server sends photons through a filter of bit designations, and then the photons travel to the other one who has to arrange the polarizers. Then the other one sends the data back to the first server and tells them the sequence of the polarizers, and in the results, it becomes a key. If the photons are copied by a hacker, they will change their state.

The new approach proposed by Vladimir et al. for secure communication and routing of the quantum network is based on the software-defined networks (SDN) OpenFlow protocol [40]. The work is based on the dynamic switching of SDN between different data encryption methods, classic or quantum, this will make able to arrange virtual encoding channels, which configure the necessary level of quality of service for security. The research will lead to further development of quantum cryptography from a service viewpoint and contribute to bringing them to an industrial scale.

5.1 Usages of Quantum Cryptograph

Photon uses now series data broadcast from one apartment to another done a fiber cable, two beams splitters to deliver the polarity of the separate photon [41]. It is a secure method to traditional cryptography, which depend on math and inadequate computation powers. That is a secure conversation that is established on fundamental physics laws instead of mathematical Analysis techniques and Calculations used today. They cannot be uncheckable and very easy or comfortable to use. Fewer resources are necessary to maintain it. Its technology safeguards cloistered key and never discovered anyone cardinal credentials and digital time earmarks are the secure performance of quantum cryptonym. Encryption answers of the same size as the plain text; it is used as a one-time pad. The insurance of the crypto script is unbreakable.

5.2 Drawbacks Quantum Cryptography

As related headed for the cryptologic aerodynamic slow process. The public secrets crypto phrase is the impersonate attack. The quantum weirdness has not even been fully fleshed clear, in all cases [42]. That conduction of large documents is hard to transfer size of solutions are larger than symmetric crypto grammatical. It is perhaps highly improbable to have such a fiber-based link.

5.3 Vital Propagation Purpose

The predilection is that one with the two collaborating participants to infer the proximity of a certain foreign entity who tries to authenticate crucial evidence is a fundamental and rare manifestation of the quaint key exchange. Everything always originates around a critical component concerning quantic mechanics intermission of the monolithic kernel through a quantum platform's assessment method. Therefore, a service provider intending could spy on people on both the key might look up anything, forming recognizable anomalies. Secure navigation systems including one that helps prevent espionage could be adhered to custom quantum entanglement or dark energy as well as using the gearbox of monetary figures in subatomic particles.

5.4 Reputation of Coding Quantum

Enterprises also international organizations are frequently the combat to reproduce the very first operational fusion reactor now a quantum arms battle. The innovation threatens to make several tremendous amounts, significantly easier to alleviate many other varieties with technical problems than it was with today's conventional equipment. A few of those specific problems have always been cracking down on certain methods of coding, principally its approaches used within contemporary blockchain implementation, which typifies a few of history's online communications. America's industrial transistors are far from getting able to do somewhat of this. "The knowledge moved across tech," explains William Hurley, prominent IEEE associate, owner, and CEO of Mysterious Works, a Denver-based machine

learning venture. My gripe is that this will occur until they notice that it is there.
Williams et al. researched the coding of quantum computing and integrated quantum networks by adding supernode coding transmitted over optical links in the network environments [43]. The Bell-state method was used for measurement, which is based on the hyper-entanglement in the temporal and freedom also considered by using polarization degree for two-photon state emitted from the quantum light source. The common single-photon and linear optics were used to measure the single-qubit channel size of 1.665_0.018. The experimental details were given for the operation of quantum-classical communication and hybrid protocol for image transfer applications. The research also proves of integration of devices in software-defined and fiber optical transmitters and receivers as part of the experiment model, which provides a new design for the extension of quantum commutation for future development.

5.5 Types of Quantum Cryptography

- Quantum cryptography falls into two types, one Symmetric Key Cryptography and other Asymmetric Key Cryptography [44].
- Symmetric Key Cryptography: It is also known as symmetric encryption in which only one key is used to encrypt and decrypt the same data. This type of encryption had been widely used in the past decade by governments and militaries [45]. Nowadays, there are two most common methods are using in symmetric cryptography based on block and stream chips.
- Asymmetric key cryptography: Asymmetric cryptography is public-key cryptography. It uses public and private keys for the encryption and decryption of data [46]. Private is to keep as private while the public is for sharing with others. One of the keys is used to make the information encrypted, and the opposite one is to decrypt it. Asymmetric cryptography is the most widely used in RSA (Rivest-Shamir-Adleman) and many protocols.

Nowadays, all the countries around the globe want to create the first usable quantum computer. Quantum computers would easier to solve computing problems than that today's computers. Many large industries and companies all around the world use quantum cryptography to make their clients satisfy the encryption of their information [47]. According to NIST Quantum Cryptography took historically two decades to deploy modern public-key cryptography infrastructure [48].
Quantum Cryptography has the trust of many scientists because it promises virtually unbreakable encryption. But researchers have recently revealed that it can be capable of hacking. Surely, Quantum cryptography needs quantum computers, which we may see in the next 20 years till then it will be known as virtually unbreakable encryption.

5.6 Quantum Key Distribution (QKD)

QKD provides a way to distribute and share secret keys from one place to another place, which is very important for the quantum cryptographic method. The quantum key distribution was first suggested in the 1970s [49]. Nowadays, everyone wants to secure data and our digital society. All depended on the security of our data and during communication or in storage like e-hospitals, e-business, e-banking, offices, e-government channels, etc. Especially where one considers safety, where records may need to be protected for the lifetime security of a person. Quantum key distribution is the only technology that can fully fix this long-term security issue. Quantum key distribution is related to the family of protocols to establish a private encryption key between towing peoples that send to the receiver. Quantum networking is an advanced technology invention of china, and day by day scientists of china become making more advances and work in progress [50]. It can help for securing our data send to only the receiver no one is allowed to hack data.
Elkouss et al. proposed a method to overcome the distance limitation of quantum key distribution in optical network infrastructures. This QKD theory provides information about secret key distribution based on the basic rules of quantum physics [51]. The developed QKD devices are enough mature at the industrial level, these devices can perform at distance limitations, so the quantum photon signal is lost in the intermediate devices and communication channels. To solve the problem researcher used intermediate repeaters (nodes), and the network model was proposed, which is based on the trusted repeaters instead of weak repeaters. The method pushes the hacker to concurrently break numerous paths to get access to the exchanged key, thus improving expressively the security of the network. The results show that the network model allows users to exchange secure keys in real scenarios in metropolitan optical networks.
Wu et al. proposed a network based on the integration of previous classical communication with the support of the quantum key distribution layer [52]. The distribution of nodes in this model is based on the two communication ways, one for quantum key distribution and the second for classical communication. During the research, for the creation of entangled photons within the nodes, atomic ensembles were used. The repeaters of the quantum network were used to develop entanglement among the remote nodes for the extension of entangled photons for maximizes the distribution distance. The goal of development was to develop a suitable key distribution path in the quantum key distribution layer, which depends on the routing information retrieved by the upper classical network. The nodes will use the BBM92 or Ekert91 protocol for the generation of secret keys shared among each other after the development of entanglement among

the remote quantum nodes. The designed key will guarantee the security of communication in a classical network.

5.7 Advantages of Quantum Cryptography

- Instead of using mathematical encryption quantum cryptography works on the laws of physics, which provides more secure communication and transfer of sensitive data.
- As it works based on quantum physics, it is virtually un-hackable.
- Not many resources are needed to maintain it.
- Quantum stated data changes itself when attacked by an eavesdropper.

6. Quantum Gaming

The word Quantum is a reference to physics as we heard of the action between the two physically tiny particles at the subatomic level or can access the smallest bit of something that can be called Quantum by far it comes from a Latin word Quant. The base of the Quantum Game came from the Quantum Mechanics (Origin) as partially relying on wave function for the probability of particle and to find the actual location of it. One of the Quantum games is Qiskit Blocks developed with Qiskit's open-source framework by IBM like Minecraft's world [53]. In the world of Qiskit Blocks, you can solve the puzzle and build, solve, or manipulate the circuit of quantum. You can get OpenQASM an assembly language of Quantum programming that you can test on IBM quantum computing as if your result is right or not. The game itself is an open-source program that you can access on GitHub. On the other hand, we got The Quantum Game as they call it Quantum Game with Photons is also a puzzling game but more of photon and its reaction with the objects. Photon is the quant of electromagnetism, such as signal or light [54]. There you must pass the photon to a detector with a probable amount of it, where you observe the result and learn as quantum possibilities that are endless and impossible to solve by a classic computer-based on 0 and 1 as compared to Qubit that can be both at the same time. It is an unpredicted form with a precise percentage of 0 and 1 until it is declared a classic bit as well-known as Superposition. To play the game visit its website or find its source code, which is also available on GitHub.
So, these are the to-date things that happened and are possible due to quantum, but just think about what can be possible in the future as we go further and realize it is important as we can see some of the predicted examples in sci-fi games and movies.

6.1 Quantum in Sci-Fi

A game development company called Remedy Entertainment designed a realistic physics game called Quantum Break [55]. The impressive visualization that attracts your eye, but it creates a non-realistic concept of quantum and how it interacts and fluctuates with time partially. By freezing time at a certain area and using it as a shield or super speed and fast-forwarding time just like a time machine. A Hollywood film company Marvel Studios produced by Walt Disney produces fictional comic movies. It has a universe of superhero movies of them (Ant-Man and the Wasp and Avengers: Endgame), and they discuss and visualize the Quantum Realm [56].
As per the comic, the object's area matters for the Quantum Realm because the Realm that completely based on it [57]. At the level of Realm, there are many portal passages, which you travel to a multiverse. The multiverse is the same as Universe just in a parallel of it and more the once. So you get to decide with the Quantum coordinates where to go and have to choose, which period (Past, Present, and Future) just like a time machine. It may also feel like teleportation or give you the idea of it. The interesting part is what happened in a different period somehow will not affect any to a different timeline just as current for us or for the one who belongs to their period. As we discuss some of the ideological thoughts that Quantum may bring a step closer, just think of it how powerful Quantum can be.

6.2 The Bottom Line

Certain things are going to happen in the future of games on Quantum Computing, which can be more complex decision making of its moves with the deck of cards or flip the coin better with the precise prediction than a human with in-game and based on probable switches called Qubit that's a bit of Quantum Computing [58]. An ability of Quantum is the Entanglement that may possible teleportation for technology i.e a way to use in teleported internet that can access and utilize by Quantum computers. It is just an idea that how transferring data and information may improve with zero lag and ping. The definite answer, everything is prediction and still in research, or as they say from the very starting stage that "we create the reality as we see it" about Quantum.

7. Open Issues

The development of large-scale quantum computing contains several challenges such as architecture, verification, and fabrication because quantum computing can store complex states in a single bit, so this makes quantum systems hard to design, build and verify. The quantum required a very low temperature to operate bits; the development of the system must be accurate because its states are delicate [59]. It is difficult to measure the state of the quantum system accurately, so verification is difficult. The verification of operations did not always provide the same answer but only an answer with a particular probability. Finally, errors occur much more

often than with classical computing, making error correction the dominant task that quantum architectures need to perform well.

To support the development of suitable algorithms and proof-of-principle implementations, a Collaborative Computational Project in Quantum Computing has been set up to network between quantum computing experts and application experts across a broad range of computational science. The emerging model of diverse combinations of computing hardware is a practical way to enhance the available computing power but is also very challenging to program effectively. An interdisciplinary approach is essential in the pioneering stages of developing quantum enhancements for useful computational applications. With the current investment by the UK in research and innovation funding for quantum technology topping £1 billion, the field is developing rapidly, and this is an excellent time to start developing new computational methods for hard problems in the life sciences.

IoT security is a major issue for organizations to manage communication between IoT devices [60, 61, 62]. Quantum mechanics provide high-level security, by adding quantum computing methods to IoT security; which will make it more secure and reliable communication [63].

Energy efficiency is also a major concern in cloud computing, and service providers are willing to reduce the energy of cloud processors. A lot of research works are provided by researchers for energy efficiency in the cloud computing environment [64, 65]. Cloud quantum computing research work provided to reduce energy efficiency but still more research is required for a more reliable solution, so this future research on cloud quantum computing will provide a better solution to save energy in cloud processing [66].

8. Conclusion

In this paper, we presented analysis and start-of-the-art quantum computing in different areas such as quantum mechanism, networks, cryptography, and gaming. Table 1 provides qubit bit information on password exchange and Fig. 1 represents a common network scenario of quantum networks. We give key concepts and background of quantum computing, we also described the latest developments in networks, cryptography, and gaming. Finally, we have discussed the open issues and future directions for research in the field of Quantum Computing. Conclusion thoughts say that commercial organizations with sensitive information want to protect their data, which attracts eavesdroppers who expect that quantum cryptography will be highly secure. In short, quantum cryptography looks more promising as a highly deployed solution for the security of data.

Conflicts of interests

Authors did not have any conflict of interest.

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