

Research Article

Sixth-Generation (6G) Mobile Cloud Security and Privacy Risks for AI System Using High-Performance Computing Implementation

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The exchange of information from one person to another is called communication. Telecommunication makes it possible with electronic devices and their tools. The scientist Alexander Graham Bell has invented the basic telephone in 1876 in the USA. Telephones now have the new format in the form of mobile phones, which are the primary media for communicating and transmitting data. We are using 5th-generation mobile network standards. Still, there are some requirements for the users that are believed to be solved in the 6th-generation mobile network standards. By 2030, all of the people would be using 6G. The computing model in the cloud is not dependent on either the location or any specific device that would provide the service. It is an on-demand computational service-oriented mechanism. Combining these two technologies as mobile cloud computing provides customized options with more flexible implementations. Artificial intelligence is being used in devices in many fields. AI can be used in mobile network services (MNS) to provide more reliable and customized services to the users, such as network operation monitoring, network operation management, fraud detection, and reduction in mobile transactions and security to the cyber devices. Combining cloud with AI in mobile network services in the 6th generation would improve human beings' lives, such as zero road accidents, advanced level special health care, and zero crime rates in society. However, the most vital needs for sixth-generation standards are the capability to manage large volumes of records and excessive-statistics-fee connectivity in step with gadgets. The sixth-generation mobile network is under development. This generation has many exciting features. Security is the central issue that needs to be sorted out using appropriate forensic mechanisms. There is a need to approach high-performance computing for improved services to the end-user. Considering three-dimensional research methodologies (technical dimension, organizational dimension, and applications hosted on the cloud) in a high-performance computing environment leads to two different cases such as real-time stream processing and remote desktop connection and performance test. By 'narrowing the targeted worldwide audience with a wide range of experiential opportunities,' this paper is aimed at delivering dynamic and varied resource allocation for reliable and justified on-demand services.

1. Introduction

Exchange of information from one person to another is called communication. It is done in many ways. The first form of communication is verbal. It means one speaks, the

other one listens, and vice versa. However, if these conversants are located at two different geographical locations and conversation is needed, it is done using some telecommunication approach. Telecommunication is done using some electronic tools that would easily express the required

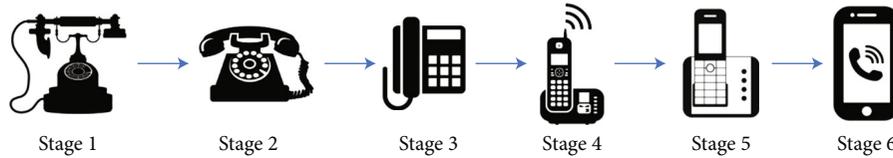


FIGURE 1: Pictorial representation of telephones.

information or message quickly. The electronic devices transmit the message to a longer distance within a short period. ‘Tele’ means ‘distance’ and ‘phone’ means ‘communication’ [1]. Therefore, telephone means distant communication. It means communicating with a person who is in a long distance [2]. Alexander Graham Bell is behind all these scientific investigations today about mobile communications. He invented this device in 1876 in the USA. Today, many people might not have seen, but till the early 1990s, rotary dial telephones has dominated almost all areas in public places, government offices, and individual private houses. Figure 1 shows a pictorial representation of telephones.

Later, push-button phones have dominated the market. These are a few examples of landline phones. Later, mobile phones came into existence. Mobile phones are portable phones; they do not have any wires connected to any telephonic links. They run on a wireless network process. These mobile phones will have a simcard which will provide a unique identity to the subscriber. From anywhere on this globe, no other person would have this number. These simcards are removable and insertable into the mobile [3]. All today’s mobile phones would have CPUs. But these CPUs will run on lesser electrical or battery power with less memory and more sophisticated work. Today’s modern phones will have many features like radio, music, navigational tools, and video games. Mobile phones are the primary media for the communication and transmission of data. Cloud computing is a device-independent and location-independent, on-demand computational service-oriented mechanism. Combining these two technologies as mobile cloud computing provides customized options with more flexible implementations. The recent trends in this field are ‘narrowing the targeted global audience with a wide range of experiential opportunities’ [4, 5]. Recent times suggest that significant businesses are being carried out using mobile cloud computing. Most companies do not own a cloud and rely on cloud service providers. Lower investments and usage-based billing are the major attraction for major businesses migrating to the cloud [6]. Still, there are unsolved problems in this field, such as the need to improve the GPS with low electricity consumption, screens with higher resolution, and three-dimensional cameras to mobiles. In the 1st-generation mobiles, the network signals used are analog by nature. The 2nd-generation mobiles are digital networks. These networks use approximately 12-15 kbps. In this generation, people have enjoyed text messaging. 3rd generation has increased new frequency bands thereby data transfer rates have increased. 4th generation has given away to the internet accessibility, HD TV, games, and cloud-based services [7, 8]. 5th generation is under development. It is aimed at reducing the latency and increase the efficiency of cover-

age. Speedwise, the 1st generation has experienced 2 kbps. The speed 200 kbps in 3G and in 5G is aimed at being as fast as 35.46 Gbps [8]. Figure 2 shows analog signal, digital signal, and analog-to-digital signal conversion.

In the earlier days, people used to have lesser transactions on mobiles. They were realistic, and their works have existed in the real world. But today’s world is turned much more virtual rather than practical [9]. Perhaps much of the shopping is done on mobiles today. The characteristics of the goods are provided with all minute details and photos on the commercial sites they are being purchased with digital currency. As a result, a considerable amount of data would be generated, and such data need to be used. Hence, there is a need for cloud computing. These cloud services could store a large amount of data related to the customers and the sellers online [10, 11]. Processing these data and the applications would increase the speed enormously. The data is acquired from much more remote locations using a simple internet connection with some simple secured protocols. The cloud space is enough to maintain many volumes of information for many years. A cloud is formed from the collaboration of many data centers to provide a reliable service to customers. This enormous amount of data stored on the servers is not possible; thereby, 3rd party assistance is used in the form of the cloud to support the existing services to the customers [12]. When a user enters some details for his commercial or financial services in his/her mobile needs to connect to a web application, thereby which it should connect to a server that is at a remote location. Inserting noninformation bits into data is known as bit stuffing. Keep in mind that overhead bits and packed bits are two very different things. Bits that do not really contain data but must be sent are known as overhead. It is possible to use bit stuffing to synchronize several channels before multiplexing, to match the rates of two separate channels, and to perform length-limited coding when necessary. Run-length-restricted programming was done in order to restrict the number of consecutive bits of the same value in the data that is to be conveyed. After the maximum allowable number of consecutive bits, a bit of the opposite value is added. Bit suffocation does not guarantee that the data delivered is intact when it reaches its destination. For the most part, this is just a means to guarantee that the transmission begins and stops in the right locations. The delimiting flag sequence in a data connection frame typically consists of six or more consecutive 1 s. A single bit is tucked away in the message to distinguish it from the flag in the event of a similar sequence. At the conclusion of every string of five consecutive 1 s, an additional 0 bit is added for good measure. The stuffed 0 s are removed by the receiver after each five-one sequence. When the message has been unstuffed, it is forwarded up to the

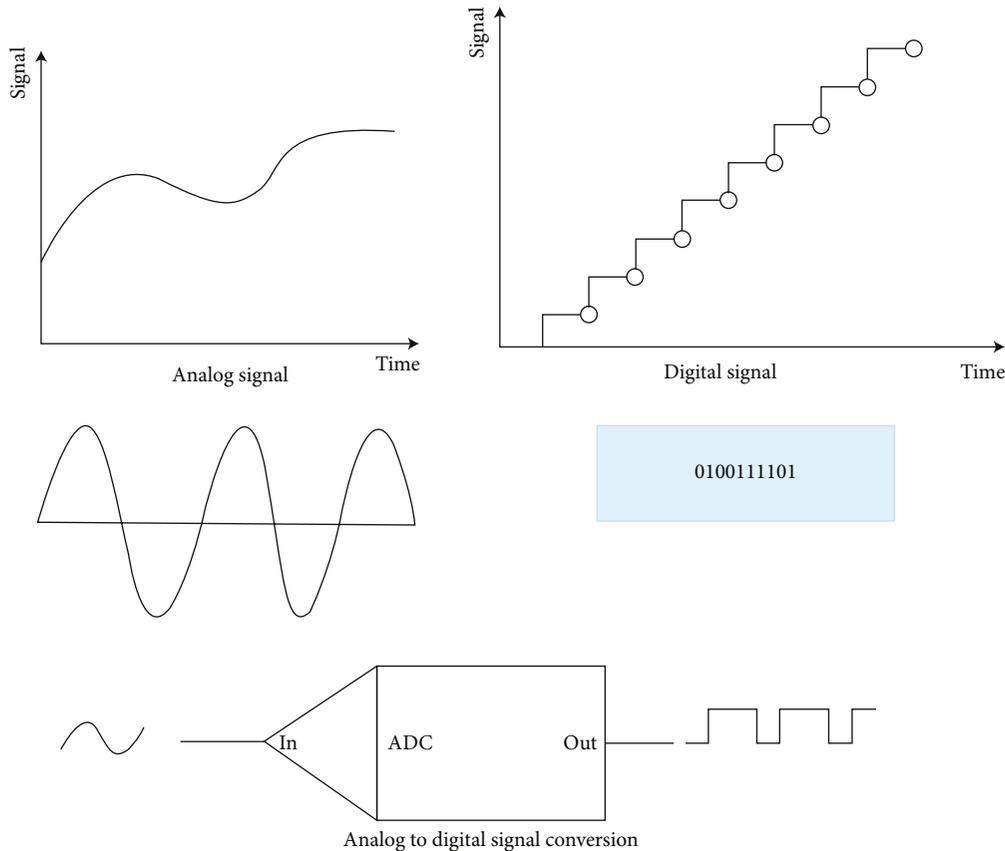


FIGURE 2: Analog signal, digital signal, and analog-to-digital signal conversion.

higher tiers. As a result of the coding rate instability caused by bit stuffing, it is not always a reliable method of data transmission. All the server services need to be achieved using some web browser that works like a mediator. Generally, Web application service is provided with a blend of added service-oriented architecture. Thereby, it can be known as a sophisticated internet-based application.

1.1. Aim of the Study. The aim of study is by ‘narrowing the targeted worldwide audience with a wide range of experiential opportunities,’ the goal was to deliver dynamic and varied resource allocation for reliable and justified on-demand services. In fields including manufacturing automation, health care technology, and transportation, the fast growth of the mobile information business has spawned a variety of mobile applications. Mobile devices may not be able to handle the processing demands of these apps, which often need large calculations and severe latency requirements. Mobile edge computing (MEC) is a potential technology for supporting these kinds of applications since it installs edge servers near mobile devices to facilitate computation offloading. MEC has the ability to significantly increase the computational power of mobile devices. There are drawbacks to offloading computations from mobile devices to edge servers, such as increased transmission delay and energy usage. This may lead to nonnegligible compute time due to the limited CPU power available on the edge servers. A cooperative allocation of processing and communication

resources is important in MEC systems because their effects are tied together. According to the majority of current research, network slicing and MEC optimization simply takes into account mobile devices’ resource slicing, energy scheduling, and power allocation without factoring the operator’s income. We cannot have a different network for each application situation since it is not viable. Using network slicing to overcome this problem has been suggested as an option. In network slicing, numerous conceptually distinct networks are operated on top of a shared physical infrastructure, which is the primary characteristic. Network resources may be dynamically and flexibly distributed to logical network slices in response to specific on-demand service needs via the use of network slicing. There has been a shift in network edge service needs due to the fast growth of Internet of Things (IoT) and cyberphysical systems. Existing works, on the other hand, have not been able to keep up with the ever-changing demands of these applications. Therefore, how to enable various apps in a shared physical infrastructure is still an unanswered question. If you are looking for a way to support edge services with special needs, mobile edge computing (MEC) is a potential solution. With MEC, latency and energy usage are lowered since it is closer to the edge of the network than traditional cloud computing systems. In both academics and business, the combination of network slicing with MEC has piqued a lot of interest. Large-scale energy harvesting fog computing networks have been developed with dynamic network slicing design to enhance

resource efficiency and balance workloads across fog nodes. Fog radio access networks were the subject of more study into hierarchical radio resource allocation (F-RAN). Network slicing resource allocation in MEC systems was investigated by most studies, but they did not consider the computing resources. However, the dynamic demand of services has not been addressed in most recent publications on the use of network slicing to MEC systems. Cloud forensics and high-performance computing would offer improvement. However, the authors of this paper suggest considering the fog computing-based dynamic network slicing design would enhance the computational potentialities.

1.2. Motivation for the Study. Since the world has become very gregarious for handling impeccable knowledge to savvy and scrupulous educators, in this era of scientific inventions. Today, it is aimed at gravitating to innovative ideas in the field of science and technologies with human touch. It is the time to tease off and endorse to bring out precocious advancements in the field of science and technologies. Today, all are committed to the creation, dissemination, and acquisition of knowledge through our research and developments. As unprecedented methodologies phase in to create a pathfinder way, new innovative and gravitate ideas are needed. It is needed to focus on thriving technological trends for the prosperity and opportunities for the human endeavor in recent times and in the coming years, too.

2. Review of the Literature

According to Laxman Shankar [13], the Bigonet cloud-based mobile framework was established to meet the requirements of the subsequent standard level in cloud apps. Such following level apps would require parallel processing apart from several connected systems needing to be handled in the distributed environment. They show how the network-based activity analysis in the operating system and robust multipoint to multipoint apps in the distributed switching, highly accessible, scalable infrastructure, and user-friendly interfaces make developing and managing numerous parallel and concurrent processes easier [14]. While network slicing allows on-demand services, many of their apps need multi-access edge computing (MEC) structural design to be deployed in the 5th-generation distributed system. Originally, edge computing is a key force behind the 5th-generation and 6th-generation mobile standard distributed systems; its role in network slicing remains unknown. The 5th-generation distributed system will use multiaccess edge computing as its structural architecture. As a result of multi-access edge computing (MEC), traffic and service processing is moved away from the cloud and closer to the end user. The network edge processes, analyzes, and saves data instead of transmitting it all to the cloud. High-bandwidth applications benefit from reduced latency and real-time performance since data is collected and processed closer to the client. In addition, MEC provides a network edge IT service environment and cloud computing capabilities. Distributed data centers at the edge are often used to implement MEC.

High bandwidth and low latency are essential for edge applications. Distributed data centers, or distributed clouds, are created by service providers to accomplish this goal. To put it another way, there is no such thing as “the cloud”; it is a collection of resources that can be located in any location, including the customer’s location. With the MEC platform, you have the option of employing either a server or CPE for edge computing. It is possible to employ a software-defined access layer as an extension of a cloud. Open source hardware and software, including SDN and NFV, are being used in the majority of edge computing projects. There are a number of popular MEC use cases that may be listed, including data analytics, location tracking services, IoT, and augmented reality. Hosting stuff locally, such as movies, on a server in your area, driving patterns, road conditions, and other vehicle movements may all be monitored by a connected automobile as an example of an Internet of Things (IoT) application. On-time delivery of predictive and prescriptive information is critical. Sensor data must be gathered, processed, and analyzed at the edge in order to deliver low latency insights to the driver. This means that MEC may be used for a broad range of applications requiring immediate reaction time, such as autonomous cars, virtual reality, robots, and other immersive media. Indeed, new technical ideas might bring about a paradigm change from 4G to 5G. An ongoing effort is needed from both academic and industrial sectors to successfully use MEC in 5G networks. MEC technology and its prospective uses and applications are first discussed in this study. This is followed by a summary of the most recent research findings on the integration of MEC with 5G and other emerging technologies. In addition, we provide an overview of edge computing testbeds, experiments, and open source efforts. This section sums up findings from current research and discusses problems and future perspectives for MEC studies. According to Chihani et al. [15], contextual information is used to characterize the conditions of entities (end-users and systems) and their responses. Apps require such data to make adjustments in their processing approach as a response to make change in the context of the end-users. On the other hand, like the machine-to-machine-based communication approach, the cohesiveness of many systems makes keeping the established contextual information extremely challenging. The lack of a scalable and simply customizable solution for efficient context management is a show-stopper in a big and dispersed system. This research presents a scalable cloud-based context management paradigm for dealing with contextual data in large distributed contexts. This framework was developed and proven to allow programs to subscribe to context changes and declare how context data should be handled using an XML-based programming language. Since there is a need of enormous data upload and download in all the time, there is also a need of transmission of data continuously. It is always needed to use extensible markup language- (XML-) based programming language. It is now required for a file format that can store, transport, and reconstruct arbitrary data. Since then, it establishes a set of guidelines for encoding documents in a human- and machine-readable manner. Serialization is

the primary goal of XML. XML is a markup language that labels, categorizes, and arranges information structurally. The data structure is represented by XML tags, which also contain information. The data included within the tags is encoded according to the XML standard. A separate XML schema (XSD) specifies the metadata required for interpreting and validating XML. The canonical schema is another name for this. A well-formed XML document follows basic XML rules, while a valid XML document follows its schema. Characters from the unicode repertoire are used exclusively in XML documents. Except for a tiny number of control characters that are explicitly banned, every unicode character can appear in an XML document's content. The encoding of the unicode characters that make up the document can be identified using XML. Therefore, it is advised to use XML-based programming language for all the needs of 6G. According to Segal et al. [16], heterogeneous computing is a potential approach for high-performance and energy-efficient computing. Till now, the high-performance heterogeneous computing industry was dominated by discrete GPUs, but new options based on APUs and FPGAs have emerged. These innovative concepts have the potential to increase energy efficiency significantly. Heterogeneous computing based on FPGA has a lot of promise since it allows one-of-a-kind hardware for data-centric parallel applications to be designed. Most significant impediment to FPGA acceptance as high-performance computing systems is their programming difficulties. According to El-Araby et al. [17], parallel computers with integrated FPGA chips are high-performance reconfigurable computers. The Cray XT5 h and Cray XD1, the SRC-7 and SRC-6, and the SGI Altix/RASC are examples of such systems. In classic high-performance computers, the single-program multiple data method is used to execute parallel programs on HPRCs (HPCs). FPGAs have previously been used as coprocessors in similar systems. Overall, system resources are typically underutilized because reconfigurable processors are deployed unevenly compared to standard processors.

Because of the asymmetry, the SPMD programming approach cannot be utilized on these devices. In this paper, we describe a resource virtualization technique. Underutilized processors will be able to share reconfigurable processors thanks to this method. According to Ba et al. [18], the message forwarding interface has already become a common communication library for distributed memory computing systems. Since new MPI standard versions are published, several MPI implementations have been made publicly available. In various implementations, different approaches are employed. Communication performance is the key in message passing-based systems, so choosing an appropriate MPI implementation is crucial. According to Kim et al. [19], the TCP/IP protocol suite is the most widely utilized networking computer. They looked on the role of TCP/performance IPs in data sharing under the UNIX operating system once a connection was established in this study. By measuring accurate data for various areas of the protocol implementation, we identify the key bottlenecks and define the maximum performance limitations. They took memory bandwidth requirements into account when processing

high-speed TCP/IP. Empirical studies imply that the TCP/IP protocol can process data at up to 85 Mbps under the UNIX operating system when a good data connection layer interface is provided, needing a memory bandwidth of 172 Mbyte/s.

According to Shivabhai and Babu [20], high-performance computing (HPC) is utilized to address vast and difficult computer issues by combining scientific research and industry innovation. The ultimate objective is to connect a high-performance computing cluster to a web-based interface that hides the complexities of high-performance computing. The massive resource broker (MRB) bridges the gap by providing a web-based task submission, administration, and monitoring interface for high-performance computing. Naive users submit jobs, monitor clusters, and produce reports using the MRB portal. Saving time, delivering more productive output, reducing mistakes, and improving consistency are all priorities for large resource brokers. The relevance of MRB, its implementation, and significant elements such as job submission, monitoring, analysis, benefits, and workflow are all discussed in this article. An approach for systematically finding and isolating floating point implementation errors in high-performance multiple CPU computing systems has been devised, according to Ghoshal [21]. A validation suite has been created and put through its paces. The results reveal that the implementation was flawed. Proposed and prototyped guidelines for proper implementation are presented.

2.1. Artificial Intelligence Usage in Mobile Networks. AI is an acronym for artificial intelligence. It is an antonym for natural intelligence. Natural intelligence is an exhibiting nature of natural living beings, and artificial intelligence is done by the devices. These devices are generally called agents [22]. Devices are aimed at achieving their targets more precisely than natural beings. These agents can have the capacity to store in memory, they can learn, and they can make a decision and express appropriately. All these activities simply follow human intelligence thereby possible to deploy in many other fields where human involvement is not possible. AI can be used in mobile network services (MNS) such as to provide more reliable and customized services to the users. Some of them can be (i) network operation monitoring, (ii) network operation management, (iii) fraud detection and reduction in mobile transactions, (iv) security to the cyber devices, (v) customer services, (vi) marketing management, (vii) digital assistance, and (viii) customer relationship management.

2.2. The Sixth-Generation Mobile Network. The fifth-generation network standard would provide new functionalities; along with this, it would also provide improved service quality in contrast with the fourth generation network standard. The fifth-generation network standard would encompass numerous new additional strategies, the latest frequency bands, such as the mmWave and the optical spectra, superior spectrum utilization and control, and the combination of licensed and unlicensed bands. Nevertheless, the fastest boom of the data center-based centric and automated systems can also exceed the competencies of 5G Wi-Fi structures [23].

A few devices, together with virtual reality (VR) devices, would go to head past 5G because they would require not less than 10 Gbps facts charge. The key drivers of sixth generation might be the convergence of past capabilities, including community densification, excessive throughput and reliability at a high level, lesser energy consumption, and higher data for the connectivity. The sixth-generation machine could additionally maintain the traits of the previous generations, which included new offerings with new technology.

As per reliable sources like Cisco, these features include driving and maintenance of different types of vehicles, assigning various tasks and achieving the targets more precisely by robots, running and maintaining other drones in commercial and noncommercial areas, maintenance and safeguarding of home appliances, and supporting them in IOT, supporting many intelligent devices in the fields of constructions, care, and industries [23]. The feature also includes upcoming technologies like augmented reality, extended reality, and virtual reality. Speed of internet access would increase in geometrical proportion. The influence of this technology would bring out some exciting offers to society such as (1) zero road accidents, (2) advanced level special health care, and (3) zero crime rates in community.

2.3. Sixth Generation and Its Challenges. By 2030, all of the people would be using 6G. The upcoming 6G needs more sophisticated services by using 1 TB per second [24]. This means one would have the devices which would receive its signals 8000 GB per second. This prediction is based on a study at Sydney University. It would have decentralized networks. Not based on one single operator, perhaps a collection of operators would cohesively provide the services to the user. Science fiction like communicating with others in space could be easily possible with this 6G. China has already started the 6G development project. Very recently, China has launched 5G. There is going to be a tough challenge for the implementation in 6G. This new wireless communication will require ultrareliable low-latency communication networks. Not only this, the upcoming devices should possess the speed of terabit/second speeds [25]. This requires making much more advancement in the field of electronics.

2.4. Major Demanding Advancements. Some more aspects need to be advanced.

- (1) Computational power has to be increased. The present computational power is not sufficient even for 5G. Accommodating present-day computational power for 6G would be unimaginable
- (2) The reliability has to be increased. Mission critical tasks in 6G needs a high level of reliability and consistency
- (3) The network coverage needs to be widespread. Antennae numbers and density have to rise more
- (4) The network speed needs to be much faster. It requires THz of speed

- (5) Energy capability needs to be increased. Present-day batteries are not competent enough for 6G
- (6) Security has to be increased. There, it should not leave a chance for hackers and crackers
- (7) The spectrum share must be focused. There, it should no race but cooperation between the operators
- (8) Governing consortium: until now, no formal entity exists that would govern the technology in the coming days
- (9) It is needed to be established

3. Service Requirements for 6G

The 6G wireless system will have the following key factors:

- (1) Need of security improvement in 6G: 6G is expected to contain sophisticated technology that will provide considerably greater privacy and security to the user's data, such as channel coding and estimation in the physical layer, as well as multiple access in the MAC layer, among other things. It is widely assumed that 6G will employ quantum communication
- (2) Mobile broadbands need to increased in 6G: 6G will link devices with extremely low data rates, such as biosensors and IoTs, as well as devices with large data rates, such as HD video streaming in smart cities. As a result, 6G is now supported by mobile broadbands. They ought to be elevated.
- (3) Lesser latency communications that are ultrareliable: 6G services should rely on ultrareliable low-latency communications (URLLC) services, which have a latency of less than 1 millisecond and a 99.999 percent reliability, according to the Electronics and Telecommunications Research Institute (ETRI). This URLLC focuses on communications and gives stringent performance guarantees.
- (4) Machine type machine communication in 6G: machine type communication, which includes both mission essential and huge connectivity characteristics, is expected to be a crucial cornerstone of 6G development, driven by a desire to supply vertical-specific wireless network solutions [26].
- (5) More energy capability need to be increased in 6G: due to their ability to operate in higher-frequency bands than previous generations, 6G gadgets require significantly more energy than previous generations. As a result, energy consumption and efficiency are key concerns that need to be addressed right away
- (6) Lesser network access overcrowding in 6G: the key concern is user service delivery. After establishing connectivity, speed, capacity, and latency are used to assess a network's efficiency

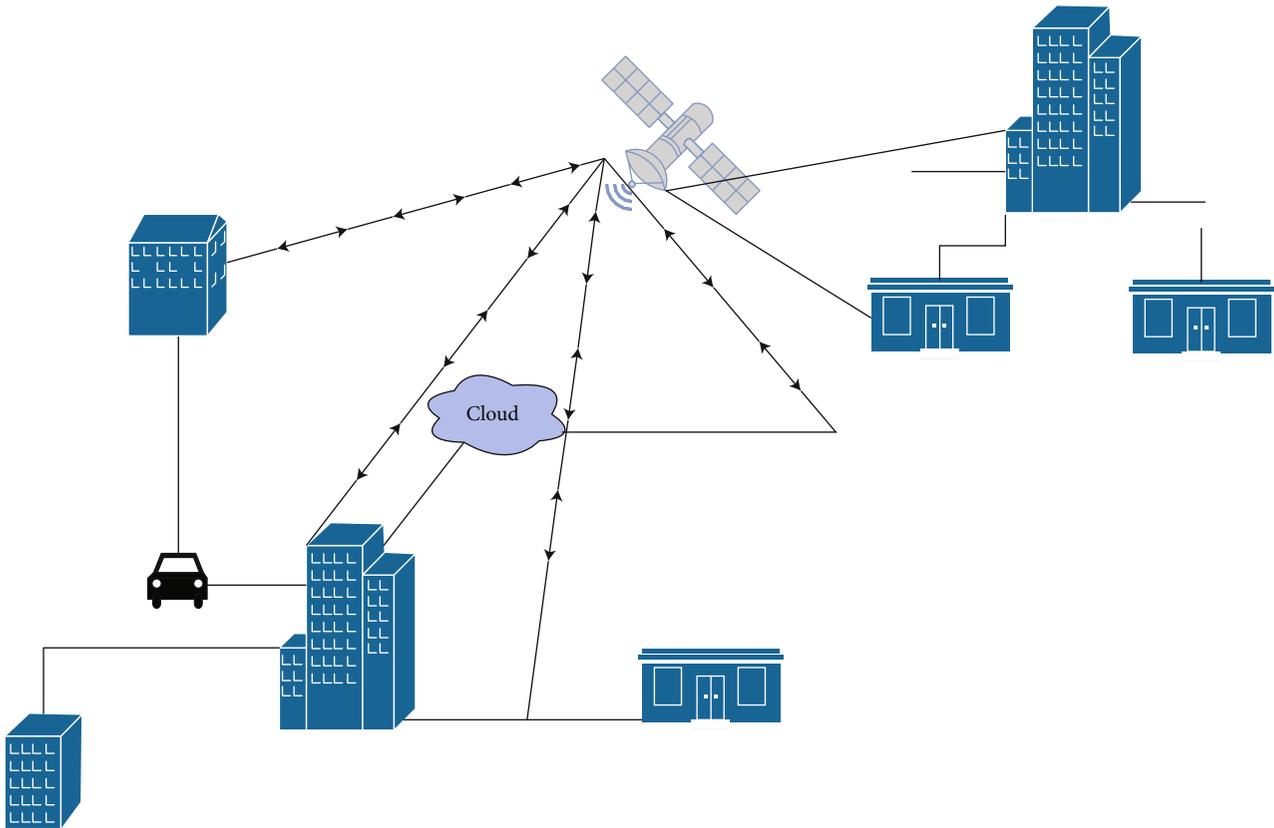


FIGURE 3: Pictorial representation of sample 6G network usage.

(7) Communication integrated with artificial intelligence: artificial intelligence, automated systems, and 6G mobile communications can all be said to be interconnected. The fundamental technology for automated systems is artificial intelligence. The fundamental driving factor behind automation is a variety of machine learning algorithms and deep learning principles. Real-time learning is a principle that allows an automated system to perform well. When discussing 6G communication technologies, automated systems are important. To get the most out of the potential of 6G communications, many systems must be automated when linked throughout the world.

(8) Lesser backhaul in 6G: mobile backhauling is a physical channel that connects radio controllers and base stations. It is often implemented using optical fibers or microwave radio connections. Backhaul systems today often rely on cost-effective packet-switched technologies (e.g., Wi-Fi and WiMAX).

3.1. Key Performance Indicators in 6G. These below are key performance indicators in upcoming 6G. They are as follows:

- (i) System capacity: (a) peak data rate in 1000 Gbps, (b) experienced data rate 1 Gbps, (c) peak spectral efficiency 60 b/s/Hz, (d) experienced spectral efficiency 3 b/s/Hz, (e) maximum channel bandwidth

100 GHz, (f) area traffic capacity 1000 Mbps/m², and (g) connection density 107 devices/km²

- (ii) System latency: (a) end-to-end latency 0.1 ms and (b) delay jitter 10⁻³
- (iii) System management: (a) energy efficiency 1 TB/J, (b) reliability 10⁻⁹ packet error rate, and (c) mobility 1000 km/h.

Figure 3 shows the pictorial representation of sample 6G network usage.

3.2. Key Factor Requirements in Sixth Generation. Essential requirements of the sixth-generation mobile communication standards could be as given below:

- (1) High-performance networking: compared with fifth-generation communications, sixth-generation communications would help networking and connect most people. Presently, in highly populated areas, this task may not be easy. Even in the case of less populated regions deep below the water surface, the communication signals are also not possible to connect. Sixth-generation communications will use novel conversation networks to support different data types such as audio and video. This would reach a new kind of experience in touch using virtual networking technology and involvement everywhere

- (2) Higher energy efficiency: in sixth-generation mobile network standards, higher energy capability necessities for Wi-Fi gadgets with charging limits would exist. Apart from this, battery for the mobile has become lost for a lesser time. Hence, lengthy battery existence and usage would be the most considerable points for research in this standard communications. Consider the case of unmanned aerial vehicles (UAVs) and electric vehicles (EVs) in the Wi-Fi era. Recently, a new technology called symbiotic radio (SR) was released to overcome power issues for wireless devices [27]. The authors coined the word “unmanned aerial vehicles” with reference to power issue to the upcoming 6th-generation mobile technological standard. Unmanned aerial vehicles recently started using symbiotic radio (SR) technology; it is particularly with reference to wireless devices to overcome the power issue. Smart electricity control is every other promising strategy for dynamically optimizing the stability of electricity needs for supply. AI-based solutions for black communication technologies would be critical for optimizing power utilization and power usage scheduling for all Wi-Fi devices in an ever-changing technological environment and more complex optimization goals. For the optimization, available and updated machine learning-based technologies, such as deep reinforcement learning (DRL), could be applied. This would optimize the computing task devolvement in determining the Wi-Fi gadgets and an improved working and suspended time scheduling solution, lowering energy consumption. It integrates passive backscatter devices with a lively transmission device. Ambient backscatter communication is a classic example of SR, which allows network gadgets to use ambient RF indicators to transfer data without requiring vigorous RF transmission, allowing for battery-free communication. Smart electricity control is every other promising strategy for dynamically optimizing the stability of electricity needs for supply
- (3) A high-level security and privacy: the available research particularly specialized in network throughput, reliability, and delay in 4G and 5G communications. However, wireless communicational exchange security and privacy issues have been disregarded to some extent in recent years
- (4) A high-level intelligence: The sixth generation’s high-level intelligence would be useful in providing users with high-quality, tailored, and intelligent services. As shown below, the sixth-generation high-intelligence standard would contain (i) operational intelligence, (ii) application intelligence, and (iii) service intelligence
- (i) Traditional network operations entail a slew of resource optimization and multigoal overall performance optimization difficulties. Optimization tac-

tics based on game theory, contract ideas, and many more are widely employed to achieve a high level of network operation. However, those optimization theories will not yield the best results in large-scale time-varying variables and multiobjective scenarios

- (ii) Application intelligence: applications connected to fifth-generation networks are becoming increasingly intelligent. Intelligent applications are one of the applicational needs for sixth-generation networks. FL enabled Wi-Fi communication technology, allowing devices to connect to sixth-generation networks and execute a wide range of intelligent applications
- (iii) Furthermore, as a human-centric network, the sixth-generation community’s excessive intelligence will provide intelligent services satisfaction-oriented and individualized. FL, for example, would provide clients with individualized healthcare and referral services

3.3. Key Factor Requirements in Sixth Generation. In terms of evaluation, respondents in business units are less inclined to transfer power to appropriate IT for picking public clouds (41%), determining/advising on which apps pass to the cloud (45%), and selecting private clouds (40%). Overall, cloud challenges are declining: expertise, security, and spend tie for first place lack of assets/understanding, the top cloud assignment in recent years. Security concerns have also decreased to 25%, down from 29% last year. The most frequently stated venture among seasoned cloud users (24 percentages). Users are focusing on costs resulting from significant waste in cloud spending. The latest trends in this field are server computing and multivendor approach. Here are some predictions for cloud computing for a near future as follows:

- (1) Hybrid infrastructure: hybrid infrastructures are now restricted to public and private cloud infrastructures. Hybrid infrastructures will broaden its reach to meet the agencies’ demands for efficiency, safety, control, and cost-effectiveness. The services would be improved in terms of performance while also providing dependability and scalability
- (2) No. of apps would increase on cloud: cloud computing is the way of the future for businesses, and companies have begun to prepare their programs to be cloud-compatible. Generally, roughly 70% of businesses consider cloud to be a distinguishing factor, and 65% of businesses spend about 10% of their budget on cloud services

4. Research Methodology

There are three dimensions to the research methodology:

- (1) Dimensional technical: it is necessary to collect information that is flexible, static, and verifiable. In a remote computing context, such data should be processed using accessible criminal-related logical methods

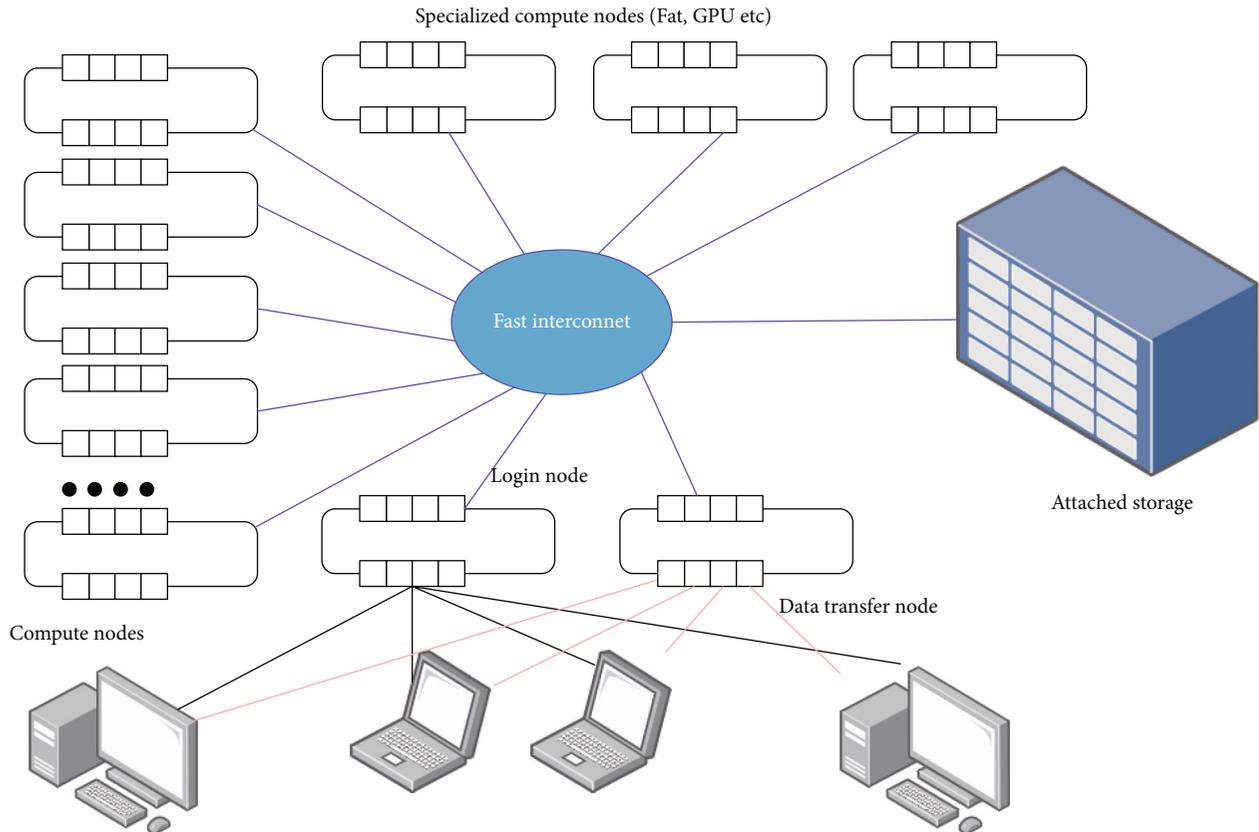


FIGURE 4: High-performance computing-based scalable 'cloud forensics-as-a-service' readiness framework.

- (2) Dimension of organization: it is primarily considered in the context of distributed computing. They are cloud customers and cloud service providers, respectively. The programs are hosted in the cloud
- (3) As a result, the services of one cloud service provider are linked to those of other cloud service providers. The inquiry process is complicated by the reliance on multiple parties. As a result, it becomes quite difficult

4.1. Testing Environment Plan. The following are the experimental plans for testing important components of the cloud forensic tools operating mechanism. To verify the viability of the technique's execution, a few tests must be carried out at various stages. Some tests are also designed to set benchmarks for the underlying components. The systems that must be tested before cloud forensics may be implemented are listed in the table below.

There should be an HPC cluster with a large number of nodes. This cluster will need to be hosted on a high-performance computing machine. On the virtualization cluster nodes, virtualization software is installed, allowing one node to function as several nodes. Amazon's Elastic Compute Cloud (EC2) offers cloud computing with elasticity. VMs from one or more physical clusters are put on dispersed servers to form virtual clusters. The goal of employing virtual machines is to integrate multiple functions on a single server. Virtual machines (VMs) can be rep-

licated across many servers to improve distributed parallelism, fault tolerance, and disaster recovery. In order to get started with a typical virtual machine, the administrator must write down or describe the sources of configuration information. Inefficient network configurations almost always lead to overloading or underutilization when additional VMs join a network. EC2 is an excellent example of a web service that delivers scalable computing capacity in a cloud, such as Amazon's EC2. EC2 allows customers to construct virtual machines and manage user accounts throughout their usage. In order to create a virtual cluster, one or more physical clusters must host a virtual machine (VM). The borders of the virtual clusters are shown as different lines. In a virtual cluster, virtual machines (VMs) are dynamically provisioned. Nodes in the virtual cluster might be both real and virtual computers. On a single physical node, many VMs each running a separate operating system may be set up. To operate in a virtual machine, you need a guest operating system, which is typically different from the operating system of your host computer. Consolidating numerous functions on a single server is the goal of virtual machines. This will considerably increase the server's usage and the flexibility of the application. Parallelism, fault tolerance, and disaster recovery may be achieved by colonizing (replicating) VMs over numerous servers. Virtual cluster deployment, monitoring, and administration across huge clusters, as well as resource scheduling, load balancing, server consolidation, and fault tolerance, are all part of this. The ability to efficiently store a large number of virtual

TABLE 1: Systems needs of cloud forensic tool implementation.

Name	RAM	CPU	Cores	Threads	Disk space
HPC cluster	24 GiB	2 Intel Xeon X5660@2.8 GHz	12	24	100 Mib/s
Virtualization	128 GiB	2E5-2670@2.60 Hz	16	32	1 GiB/s
Cluster work station	SGiB	Intel Core i7- \$60@2.8 GHz	4	8	100 Mib/s

TABLE 2: Data transfer calculations theoretically.

Size of the evidence	100 Mbit/s	10 Gbit/s
100 GiB	02:56:00	00:01:43
500 GiB	14:45:22	00:08:30
1 TiB	30:16:32	00:16:43
5 TiB	153:25:30	01:26:43

TABLE 3: Evidences needed to use in testing processing.

	Ubnistl.gen3.E01	Nps-209-domexusers.E01
Compressed	855 Mib	4.05 GiB
Uncompressed	1.98 GiB	42 GiB

machine images is critical in a virtual cluster system. The nodes in the various virtual clusters are shown in the diagram by the various colors. The most crucial thing to consider when dealing with a big number of virtual machine images is how to store them in the system. Operating systems and user-level programming libraries are among the most popular installs for most users and applications. Preinstalled templates for these software programs are available. Users may create their own software stacks with the help of these templates. The template VM may be used to create new OS instances. These instances allow the installation of user-specific components, such as programming libraries and apps.

This would allow virtualization-based cluster systems to have more nodes, each with 24 gigabytes of RAM. It is necessary to set up task processing from the beginning. These responsibilities will be carried out on the evidences, as well as the possible imaging and encryption of the proof for internet broadcast. This level's testing must be completed entirely on a workstation. Data can be processed quickly, and complex computations can be completed quickly, thanks to high-performance computing. This high-performance computation can be done on any computer with a 3 GHz CPU. This computer is capable of performing over 3 billion operations per second. A supercomputer, on the other hand, has similar powers.

High-performance computers can now do miracles. It advances significantly in a wide range of sectors, including science and technology. It benefits technology such as the Internet of Things, artificial intelligence, and 3D imaging, to name a few. The high-performance computing operating system includes computation, networking, and data storage. A cluster is a group of computers connected together to perform high-speed processing. Workstation clusters are now a viable substitute for supercomputers. In general, these workstation clusters were preferred for all high-performance pro-

cessing requirements. There are two sorts of parallel hardware and software designs.

4.2. Testing. This test is designed to determine how many nodes each forensic cloud user has. Begin by evenly distributing all nodes over all conditions, starting with one. Increase the number of instances one by one until the processing speed is too slow to bear. Keep track of the number of nodes required to make a scenario operate. The HPC cluster and the workstation performed similarly. It is unable to give it with the same or equal storage device that the virtualization cluster provided due to technological restrictions. If a quicker storage was used, processing performance would improve. Figure 4 shows high-performance computing-based scalable 'cloud forensics-as-a-service' readiness framework. Table 1 shows the system needs of cloud forensic tool implementation.

Simultaneous imaging and upload and encryption are observed. Scenario 1 includes setting up the first processing activities that need be conducted on the evidence, as well as potential imaging and encryption of the evidence for Internet transmission. The data processing should begin at the same time as the imaging procedure. To speed up processing, the client should allow for simultaneous data transmission and picture creation. The client should be run twice: once to just upload the test data to the server, and again to submit the test data while concurrently creating an image of it. This will be used to test if the client can perform both tasks at the same time while maintaining a 120 MB/s upload pace. Each node had 24 Gigabytes of RAM and 12 threads.

4.3. Cloud Security Mechanism in HPC Environment. Once the image has finished uploading, tools that would need the entire image would be run. Because the devices will function in a cluster, the results will be stored in the working directory. The virtual computer's connection will be safeguarded. Only the virtual computer holding the evidence submitted by the cloud forensics expert will be accessible. The virtual machine displays the results of the tools as they are complete on the cluster. They require access to tools that are unable or unwilling to operate on a collection during this virtual machine. They cannot access evidence that belongs to another cloud forensics specialist since virtual machines are separated from one another. The information will be encrypted using the analysis virtual machine for the cloud forensics professional.

5. Results Obtained

To protect the data's secrecy and integrity throughout transmission, encryption must be applied to the evidence being

TABLE 4: One node for one cluster outputs.

	Parameter-1	Parameter-2	Parameter-3	Parameter-4	Parameter-5	Parameter-6
Factors	HPC	Virtualization	Work station	HPC	Virtualization	Work station
Sec	114.2	43.7	102.1	892.2	559.2	889.9
Mebibyte per second	19.22	46.1	19.06	47.3	71.9	47.2
Mebibyte	2106	2106	2106	42949	42949	42949
Bound	CPU	CPU	CPU	CPU	-None-	CPU
Threads	12	12	8	12	12	8
RAM	24v	24	8	24	24	8

TABLE 5: Outputs of workstation clusters.

Factors	Ubnist1.gen3.E01				Nps-2009-domexuser.E01			
	Node~1	Node~2	Node~3	Node~4	Node~1	Node~2	Node~3	Node~4
Sec	34.8	43.7	25.8	4.9	459.1	22.8	198.4	44.2
Mebibyte per second	13.9	12.8	19.2	108.4	21.7	51.3	51.7	222.3
Mebibyte	520	520	520	546	10737	10737	10737	10737
Bound	C.P.U.	C.P.U.	C.P.U.	-none-	C.P.U.	C.P.U.	C.P.U.	Input and output

transferred between the client and server. The advanced encryption system (AES) is a well-known symmetric key encryption standard with a proven track record. For data security during network transmission, this is deemed to be sufficient. Table 2 shows data transfer calculations theoretically.

In real-time stream processing: to speed up the analysis process, data must be processed as soon as it becomes available to the server. There are two methods for processing digital evidence. The two possibilities are bulk data analysis and a file-based technique. Data chunks are treated as a whole in bulk data analysis, regardless of their structure. The data must be chunked and supplied to each tool, with suitable nodes assigned. To handle data at the file level, several programs use file-based approaches. By extracting files from a stream in real time, the forensic cloud cluster can perform file-level analysis. Table 3 shows evidences needed to use in testing processing.

In remote desktop connection, performance test, the cloud forensic investigator connects to a distant virtual machine using VDI's built-in remote desktop protocol. There are two protocol alternatives for VMware Horizon View VDI: PCoIP and Microsoft's RDP. As an alternative to Microsoft RDP, the PCoIP protocol for Microsoft RDS is available. For terminal services, the PCoIP protocol is now available for use with PCoIP devices, including low-maintenance, ultrasecure zero clients, for increased performance across any network. Customers of Teradici Arch are able to do the following: by employing the PCoIP protocol to broker and manage both VMware View and RDS session desktops with VMware View Manager, you can provide a rich, interactive experience across any network. The APEX server offload card can protect and ensure a consistent user experience regardless of task or activity level while complying with stringent government and security mandates and being virus-resistant; it can reduce TCO with low-maintenance PCoIP zero clients and eliminate the need for

expensive VPN products. Using the latest technology, firms are able to do the following: for both View VDI and RDS published desktops, the PCM facilitates communication between the view connection server (VCS) and end points. Remote access to the PCM may be achieved by implementing the PCM on the corporate network or in a DMZ. PCoIP Security Gateway (PSG) must be configured if the PCM is placed in a firewalled environment (DMZ). The PSG may be added to the PCM as an optional component. VMware View Security Gateway may be replaced with the ova package without the need for a VPN connection, and customers may access their remote workstations from the Internet. The nodes are the clients in this scenario. The files can then be handed to appropriate tools for file-centric processing after they have been made available. Table 4 shows one node for one cluster outputs. More functionalities, such as USB redirection and multimonitor support, are available with PCoIP. The usefulness of the remote desktop protocol will be determined in this test. We connect to the available cloud forensic tools to find out. Table 5 shows outputs of workstation clusters. Table 6 shows outputs of high performance clusters. Table 7 shows outputs based on virtualization cluster.

5.1. Advantages of Present Study. We studied reports and employed forensic tools after making my judgments to verify if the virtual machine was still useful. The virtual machine should react quickly and without any noticeable lag. Before deciding on the optimum processing option for digital data in forensic cloud tools, it is critical to establish a benchmark for how rapidly a forensics workstation can handle digital evidence. When parallelization is employed, both the virtualization and HPC clusters must test the speeds that each tool can achieve.

A variety of forensic cloud workflow components must be studied to identify the particular forensic cloud system.

TABLE 6: Outputs of high-performance clusters.

Factors	Ubnist1.gen3.E01				Nps-2009-domexuser.E01			
	Node~1	Node~2	Node~3	Node~4	Node~1	Node~2	Node~3	Node~4
Seconds	44.7	63.7	29.2	9.8	479.5	259.3	167.2	54.3
Mebibyte per second	12.4	7.9	14.7.8	48.7	21.8	39.4	64.9	199.8
Mebibyte	520	520	520	546	10737	10737	10737	10737
Bound	CPU	CPU	CPU	-None-	CPU	CPU	CPU	Input and output

TABLE 7: Outputs based on virtualization cluster.

Factors	Ubnist1.gen3.E01				Nps-2009-domexuser.E01			
	Node-1	Node-2	Node-3	Node-4	Node-1	Node-2	Node-3	Node-4
Sec	19.0	25.8	13.5	5.9	239.2	169.2	164.3	46.8
Mebibyte per second	24.6	18.8	34.8	89.4	43.9	61.6	65.3	224.8
Mebibyte	519	520	520	546	10737	10737	10737	10737
Bound	C.P.U.	C.P.U.	C.P.U.	-none-	C.P.U.	C.P.U.	C.P.U.	Input and output

These tests show discover just how much capacity and processing power a forensic cloud installation can handle.

6. Limitations of Present Study

The advantages of this model are as follows:

- (i) The total analyzing time of large volumes of data is reduced by utilizing the capabilities of a high-performance computing environment and modifying current tools to work inside this context
- (ii) If a smaller department does not have access to commercial software, it can use it remotely
- (iii) Allows for teamwork. Because the data is stored in the cloud, anyone with the right authority from the case owner can access it and perform extra analysis

6.1. Recommendations. The goal of this test is to see if data can be uploaded to a forensic cloud. It uses several data set sizes and uploads and downloads each data set separately from different forensic cloud providers. Keep track of how long it takes for each file to upload. Calculate how long a single user would take to perform the task. This test is used to see if a forensic cloud environment can handle a large number of uploads. Upload and download a 500 GB or larger data collection from two forensic cloud facilities at the same time. Keep track of how long it takes for each file to upload. Increase the number of upload sites by one and reupload the files. Looking at the limitation of this present study, the goal of the nodes per job test is to conclude the optimal node numbers for every task. This test is aimed at examining if data can be uploaded to a forensic cloud environment. It is using various data set sizes, we upload and download each data set and upload and download a data collection with a size of 500 GB or more from two forensic cloud facilities simultaneously. Keep track of how long each file takes to upload. Reupload the files after increasing the number of

upload sites by one. Keep track of how long it takes for each file to upload. Continue to add one facility at a time until any user's upload time becomes prohibitive. Therefore, there is a need to search an alternative way to conduct more comprehensive comparison.

7. Conclusions

There is a need of such a congregation of cohesive redressal prognostication which would surely make a solid impression with a comprehensive knowledge on many issues and will increase the knowledge of sharing for a cohesive success due to global technological trends. The world is being embarked on to a greatest reset. This would be an ever-changing innovation and technological advancement. After a detailed study, it is observed that the method of resource management techniques are differed one from the other and one strategy may be useful for real-time interactive application that may not be suitable for some other application area. Therefore, there is a need to find a solution using high-performance computing which would be suitable for mobile cloud computing also. The sixth-generation mobile network is under development. By 2030, all of the people would be using 6G. Combination of mobile networks with cloud computing environment provides customized options with more flexible implementations. AI can be used in mobile network services (MNS) such as to provide more reliable and customized services to the users. However, the most vital needs for sixth-generation standards is the capability of managing large volumes of records and very excessive-statistics-fee connectivity in step with gadgets. Sixth generation has many exciting features. Security is the major issue that needs to be sorted out using appropriate forensic mechanisms. There is a need to approach high-performance computing for the improved services to the end user. This approach would provide dynamic and versatile resource allocation for reliable and warranted on-demand services by narrowing the targeted global audience with a wide range of experiential opportunities.

8. Scope for the Future Work

The combination of 6th-generation mobile network standards with cloud computing along with artificial intelligence, cloud forensics, and high-performance computing would offer improvement in the user experiences; however, for managing the huge volumes of records and very excessive-statistics-free connectivity in step with gadgets, there is a need to check with machine learning which would automate the analytical model building.

Data Availability

The evaluation data that support the findings of this study are available on request from the corresponding author.

Disclosure

The funder had no role in the design of the study; in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

Conflicts of Interest

The authors declare no conflict of interest.

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