5G Network Implementation in Least Developing Countries: Possibility, Barriers and Future Opportunities

***Abstract*—Everyone nowadays requires a cellular network, and the telecommunications sector is developing new infrastructure and technologies to help end customers get more out of their networks. When compared to older generations, new ones like 5G have a number of advantages (1G to 4G). 5G systems are more adaptable, have reduced latency, can communicate with other systems, and are 10 times faster than 4G, which benefits everyone. There are some problems and problems for developing countries. Most of the Developing countries just put in place 4G mobile networks, which are still in the process of being turned out. In this paper, we look at how possible it is for a developing country like Bangladesh to focus on a possible 5G network deployment right now. This paper talks about the history of the 5G network and the security problems it faces. It also includes some future recommendations and ideas that the organization should consider before creating and implementing 5G. Finally, we will explain you how to handle these issues. Then, we mapped the innovation opportunity based on the recently published study article's technical domain. We concluded that innovation prospects exist in security, networking, technological implementation, and applications research.**

***Index Terms*—5G Network, Barrier, Challenges, Implementation , LDC, Security Issues**

I. Introduction

5G is the next generation of wireless technology that will allow 5G mobile networks to provide unparalleled data speed and capacity, enhanced QoS, and reduced latency. Key characteristics of 5G networks include large capacity, reaction times of less than 4 to 5 milliseconds (ms), high speed up to 10 Gbps, and interoperability with a wide range of applications that can accommodate 100 times more devices The expense of having a minimal number of characteristics is high. The spread of 5G is a challenging endeavor, but it is made even more onerous for LDCs [1]. LDCs have a GNI per capita below $1035 and a poor human development index, according to the UN which we can be seen through Fig. 1. We relied on the UN's list of least developed countries (LDCs) for our analysis [2].

5G requires new networking, service delivery, storage, and computing technologies. With these cutting-edge ideas and technology, network security and user privacy will remain critical challenges. Wireless communications have had security issues since their introduction [3]. 4G mobile networks allowed smart gadgets, multimedia traffic, and new mobile services as IP-based communication developed [3]. Furthermore, we show that the majority of 5G's core use cases cannot be implemented in the current LDC environment. Market and economic circumstances in these countries must be significantly more advanced than in LDCs. It is expected that 5G would mostly be used in LDCs to enhance mobile broadband services. Secondly, we demonstrate that LDCs are not capable of managing all elements of 5G security. The beginning of 5G implementation in LDCs will also take significantly longer than anticipated, as we have learned from our discussions. The third portion addresses our technological concerns, with an emphasis on security and limited frequency spectrum resources A study on the potential for innovation in many technical fields was published just recently, and this was one of the findings.

A. 5G Infrastructure Approaches:

As a starting point, 5G will be used on top of 4G networks. A stand-alone mode will be available when it is fully completed. Fig. 2 depicts the possible cohabitation of 5G and 4G networks. Detailed descriptions of each combination are provided below. A new radio interface and a 5G core are the two components of 5G technology. As shown in Fig. 2, 4G's evolved packet core (EPC) may be maintained and improved by connecting it to LTE base stations (eNodeB base stations).

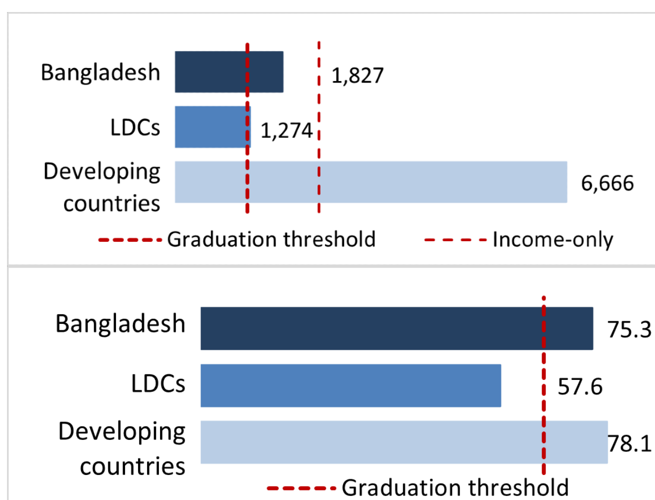

Fig. 1. LDC Criteria for Bangladesh in 2022

Fig. 3 depicts the new 5G radio (NR) technology base stations (called "gNodeB base stations").
(a). An LTE base station will handle everything. Fig. 2 shows how 5G may replace 4G.
(b). 5G's core will be linked to gNodeB base stations via Radio (NR) technology. In case the NR base station fails, backup 4G LTE base stations will be accessible. Third possibility: a hybrid of the two. In its infancy, the EPC core (Fig. 2 (c)) will remain linked to 4G LTE base stations (like before). Additional mobile operators will link to 5G NR base stations. Practicality forces them to live together. Any base station may support a single-or dual-interface mobile device [4]–[6].

B. 5G Network Architecture:

According to 3GPP TR 23.799 [7], [9] the architecture of 5G networks is depicted in Fig. 3.The following is a list of the functions of each network node:
1) The Next Generation Node Basestation (NGNB) is the User Equipment (UE) (gNB).
2) The AMF handles NG2 (RAN) and NG1 (NAS) termination, mobility management, authentication and authorization, routing, as well as the interface between the UDM and UE.
3) UFP handles QoS, packet routing, traffic statistics, and an external domain name interface.
4) SMF manages sessions, IPs, control rules, and data gathering fees.
5) DN manages internet access as well as other vital services.
6) AUSF communicates with UE to authenticate services.
7) UDM keeps track of user and repository credentials throughout time.
8) PCF is in charge of regulating network usage and behavior as well as establishing policies.
9) With dynamic policies and charging controls, AF executes the request.
10) Network interfacing in 5G networks is done with NG1 through NG15 [8]. Rel-15 focused on improving mobile broadband services, whereas Rel-16 focuses on URLLC and industrial IoT capabilities, including TSC, better location services, and support for non-public networks. Rel-15 emphasized mobile broadband (NPNs). 5G Evolution focuses on improving features introduced in Rel-15 and Rel-16, advancing operations, and expanding the 5G System's applicability to new markets and use cases. [9], [10].

C. 4G and 5G Difference:

In comparison to 4G, 5G has significantly quicker speeds, greater capacity, and reduced "latency," or delay, in communications between devices and servers [11].

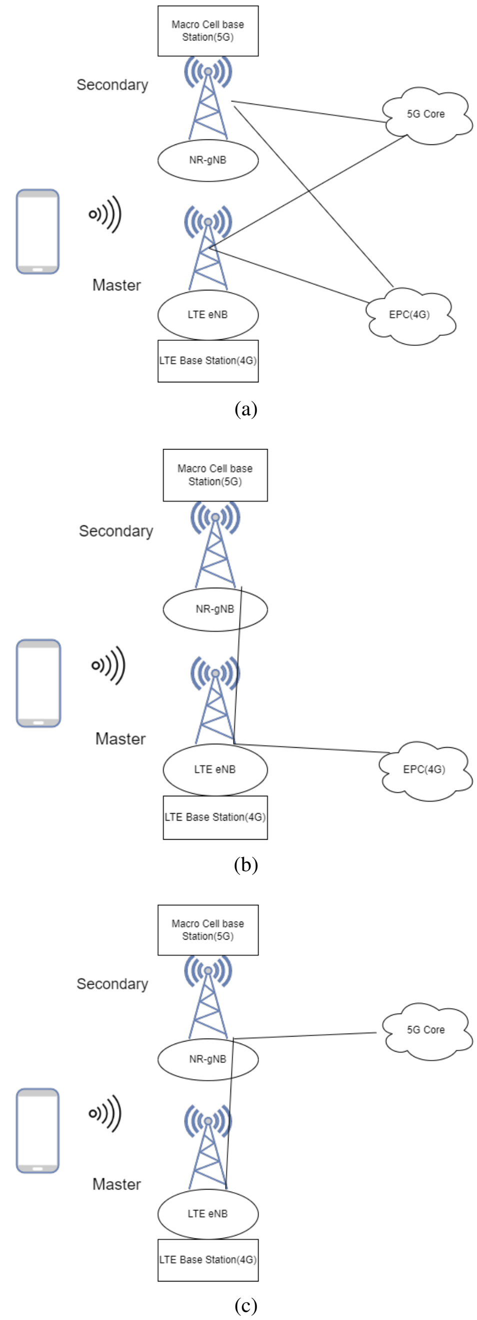

Fig. 2. Understanding the Interaction Between 4G and 5G Networks:(a) Master 4G eNB for 4G networks; (b) For the 5G gNB master; (c) Coexisting are eNB and gNB [1]

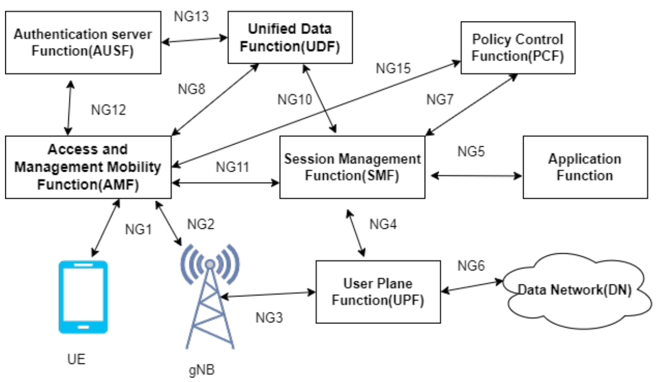

Fig. 3. Network Architecture of 5G [8]

TABLE I
DIFFERENCE BETWEEN 4G AND 5G TECHNOLOGIES

Differences	**4G Network**	**5G Network**
Speed	Slower than 5G	In comparison to 4G, 5G is predicted to be roughly 100 times faster. Superhigh-frequency airwaves, commonly referred to as high-band spectrum, are the foundation of most 5G networks, allowing for extremely fast data transfer rates. Far more data can be transmitted at much higher speeds than 4G.
Capacity	Too many gadgets might clog a network. The network can't handle so many devices, resulting in slower data speeds and longer download times.	Next-gen networks will have more capacity than 4G. That means stronger phone connections so you can brag on social media about being at the game. It will allow for more network connections.
Latency	Latency is the interval between sending a text message to a friend's phone and the friend's phone registering that it has received a new message. Latency is already low with 4G.	5G will make it virtually zero.
Reliability	Less reliable than 5G	5G provide greater reliability.

Although the LTE standard contains an MTC variation for Internet of Things (IoT) traffic, 5G technologies are being built from the bottom up to allow MTC-like devices. The 5G networks will consist of multiple technologies, including 2G, 3G, LTE, LTE-A, Wi-Fi, M2M, and others. In other words, 5G will be designed to accommodate a variety of applications, such as the Internet of Things, wearables with Internet connectivity, augmented reality, and immersive gaming. The 5G network, unlike its 4G sibling, will be able to manage a variety of linked devices and traffic types. 5G lines will be incredibly quick for HD video streaming but will have a poor data rate for sensor networks. 5G networks will utilize cloud RAN and virtual RAN to streamline network configuration and optimize server farms with edge data. 5G will use cognitive radio techniques to decide autonomously the type of channel to provide, differentiate between mobile and stationary objects, and adapt to the present environment [12]. 5G networks will facilitate the industrial Internet and social networking applications.

Main Comparative Analysis of 4G and 5G Technologies includes:

TABLE II
COMPARATIVE ANALYSIS OF 4G AND 5G TECHNOLOGIES

Features	**4G Network**	**5G Network**
Name Extension	4th Generation	5th Generation
Data Transmation Rate	2Mbps-1Gbps	1Gbps +++ (Higher)
Frequency Bandwidth	2-8 GHz	3-300 GHz
Specifications	Al access convergence including OFDMA, MC-CDMA, network-LMPS	CDMA versus BDMA
Tech	Universal IP, integrated broadband LAN/WAN/PAN, and WLAN	5G employs unifying IP, proactiveness of broadband LAN/WAN/PAN/WLAN, and OFDM-based advanced technologies
Function	Scalable data access, wearable gadgets, high-definition streaming, and worldwide roaming	Fast information access, wearable gadgets, HD streaming, and the satisfaction of any user need
Key system	Every IP networks	IP network flattening and 5G network interfacing (5G-NI)

II. TECHNICAL CHALLENGES AND ISSUES

The goals, objectives, and full potential capabilities of 5G mobile communications necessitate widespread harmonization of mobile spectrum [13]. Following the global success of 4G mobile communications based on the Long-Term Evolution (LTE)-Advanced standard developed by the Third Generation Partnership Project, the industry is actively studying 5G mobile communications (3GPP). A 20 Gb/s peak data rate need for 5G eMBB is the driving force for using new frequency bands that offer much more bandwidth [14]. Extreme base station and device density and high carrier frequencies are just some of the features of 5G that will revolutionize the way we communicate. The 5G air interface and spectrum will be backwards compatible with LTE/LTE-A and WiFi. Energy and economic considerations will govern the design and development of the next generation of 5G networks [14].

A. Spectrum distribution:

Spectrum availability determines the implementation of 5G networks locally according on the stakeholder and country involved. Analysis demonstrates that regulators' spectrum decisions are growing more diversified and new local spectrum licenses are developing. There is a wide range of approaches in different nations, and this has an impact on both domestic and export potential. Spectrum availability and new company prospects are linked in strategic management [15]. 5G mobile communication technologies will offer unprecedented levels of connection, incredibly fast data transfer speeds (up to 20 Gbps), and outstanding mobile communication dependability. Technology developments to match these capabilities will be deployed in existing cellular broadband communication system frequency bands, but they will also demand additional spectrum band resources [16]. There is a pressing demand for 0-100GHz whole band spectrum access and global spectrum harmonization. A wide range of topics are discussed, including the current mobile communications spectrum, forecasted demand, possible candidate frequency bands, and spectrum management concerns. Certain intellectual viewpoints [17] are also offered for future investigation. Divvy up the frequencies. 5G will need a lot of spectrum to increase data speeds and network capacity. Cells and microcells need low-frequency bands (less than 1 GHz), mid-frequency bands (2.3-3.5 GHz), and high-frequency bands (mmWave, 26-100 GHz). Fig. 3 displays an LDC's current spectrum utilization. In order to make the necessary spectrum accessible for 5G, a variety of cleanups, harmonizations, and policy-level actions may be required. There may not always be an opportunity for a buy-back if a third party had purchased a piece of the necessary spectrum for another purpose (like Wi-Max deployment). It's possible that this will have legal repercussions. The regulatory authority will have to go through a lengthy diplomatic procedure in order to retrieve any spectrum that has already been allocated to government bodies [1].

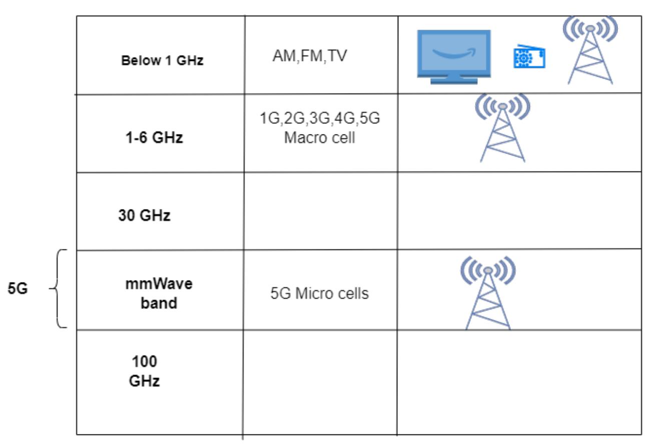

Fig. 4. Spectrum Distribution

B. Price of spectrum:

Newer wireless networks will require significantly more capacity and coverage than those of the previous generation (5G) and beyond. Current annual capital expenditure (CapEX) for mobile network operators (MNOs) in the United Kingdom (UK) is £2.5 billion, however the expected deployment cost to achieve these criteria is between £30 billion and £50 billion. As a result of this circumstance, the building of 5G physical infrastructure has been significantly delayed [18]. It is difficult to prepare for 5G because of untested business models and claims for applications that may not be financially feasible, as well as confusion about radio spectrum options and equipment vendors, as well as possible public health risks, when it comes to 5G [19]. Another concern is the expense of spectrum. Spectrum prices in LDCs are, on average, three times more than in wealthier countries, according to a recent study. Since spectrum prices are likely to play a key role in influencing the speed at which different nations implement 5G.

C. Infrastructures Challenges:

The infrastructure and technical difficulties of 5G heterogeneous cellular architecture will be significant. Analyzing infrastructural constraints such as RF spectrum and network scarcity, as well as traffic management issues that may arise when constructing a 5G mobile system design [20].

1) Scarcity RF Spectrum:: High-performance mobile gadgets, such as smartphones, tablets, and wearables, have grown more popular as technology advances. In the foreseeable future, more mobile devices will use RF spectrum in 5G. This difficulty can be solved with the help of certain modern technologies. Cognitive Radio Network (CRN) is one of them, since it makes use of coexistence licensed and unlicensed spectrum to reduce wavelength. As a wireless communication system, mm-Wave-Visible Light Communication (VLC) is another option [21], [22].

TABLE III
OPERATIONS AND TECHNOLOGIES FOR NETWORK AND TRAFFIC MANAGEMENT [20]

Operations	Technologies
Enhance the reach of your network	Mobile Femtocell Heterogeneous Networks (HetNet) concept.
Incorporate more subchannels into the system.	MIMO Spatial Modulation Distributed Antenna Systems (SMDAS) (DAS).
Increase the bandwidth.	Broadband Cognitive Radio Network (CRN) mm-Wave Communication Through the Use of Visible Light (VLC).

2) Network and Traffic Management: Components of a 5G mobile system include a CRN, a mobile femtocell, a large MIMO network, a core network, and the Internet. The velocity of incoming and departing traffic makes data management difficult. Instead of routers and Layer-3 switches, software-based network administration is proposed by researchers. Traditional administration employs physical devices and their respective configuration types [20]. Rather than manually connecting to devices, network managers can utilize SDN to modify settings or data routing rules. Changes that are centralized allow for rapid network construction and adjustment [23], [24].

3) Technology Challenges: HetNets are comprised of MIMO, Spatial Modulation, Distributed Antenna Systems, Mobile Femtocell, Visible Light Communication, and Cognitive Radio Networks. Each emerging technology should be studied separately. Here, we investigate the weaknesses and interactions of various technologies.

4) Antenna Deployment Problem in HetNets: The effective usage of DAS by separating interior and outside user situations is one of the key concepts of the 5G wireless infrastructure. The primary BS is positioned roughly in the middle of the cells in traditional systems, which are still utilized in 3G and 4G systems, and thus offers coverage for linked heterogeneous networks. As a result, both indoor and outdoor users have a direct link to the main BS, and user placement in the cells is irrelevant. While this is not an issue for indoor users, it can have certain drawbacks for outdoor users who interface directly with BS. As a result, outside users get farther away from the main BS, the signal strength weakens, and penetration is lost. As a consequence, the data rate is significantly harmed. Researchers propose a Distributed Antenna System with distinct scenarios to overcome these issues. Instead of installing hundreds of antennas on the main BS, it is hoped that the number of antennas at the main BS would be reduced in DAS. For instance, if 50 antennas were previously utilized in the main BS, 10-15 antennas are sufficient for the main BS in the new design, with the remaining antennas distributed across cells. Fiber optics connect antennas located within cells to the BS. In a DAS system, the outside user first communicates with the nearest antenna, and then the signal from the outdoor user is used to establish a connection to the primary base station (BS). Consequently, this signal reaches the main BS [23] regardless of the user's location in HetNet.

5) Other Challenges for HetNets: Identifying deployment options for macro-eNBs can be difficult in large cells because of their high-power evolved nodes (eNBs). Small cells benefit from better interior coverage thanks to the use of low-power BS or RRHs. Macros service little cells, while batteries serve large ones [24]. Batteries serve huge cells, while micros serve little ones. With this higher frequency spectrum, tiny cells can be utilized to offer a massive throughput [25], [26]. Inter-cell interference, backhaul, medium access control (MAC) layer efficiency, and public reliability are all concerns that HetNets must address.

6) Massive MIMO Challenges: Antennas are crucial to communication networks. The antenna quantity and design of current wireless technology may impact cellular network performance. Massive MIMO was designed for TDD, however it may also be used with FDD, for which it was

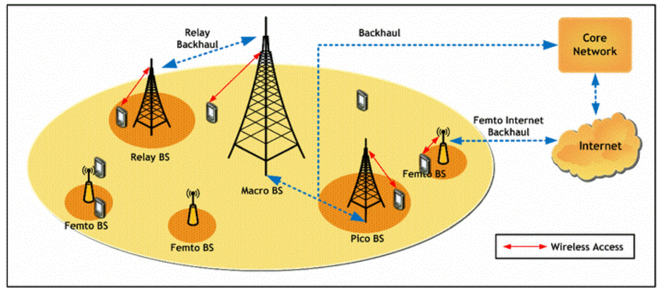

Fig. 5. A 5G cellular heterogeneous network (HetNet) architecture [27]

originally intended (FDD). Massive MIMO, which boosts total system capacity and allows for more subchannels, may be advantageous for 5G networks. Large MIMO offers substantial dependability, spectrum efficiency, and energy efficiency benefits. Massive MIMO systems outperform smaller ones with regard to energy and spectrum efficiency. They significantly influence cellular throughput. A second advantage of massive MIMO is reduced latency. In order to decrease intra-cell interference and simplify the design of the medium access control (MAC) layer, big MIMO systems also utilize a simple pre-coding technique.

D. 5G Use Case and Application:

This section will discuss usage cases and how they may function in the context of LDCs.

1) Uses: In the early days of mobile networks, only humans were using them. Only phone calls and text messages may be made over the 2G network. 3G/4G is the second revolution in the mobile network, and this generation is the first to utilize a smart phone to access the Internet over the mobile network. Humans will no longer be the exclusive users of 5G; in fact, humans will constitute a smaller and smaller portion of the user population in future generations [2].

All kinds of people and apps will take use of the 5G networks. There are three main types of 5G use cases: mobile, fixed, and wireless.

(a) Increasing Mobile Broadband:
Humans may access EMBB's high-speed phone, data, and text messaging services, which are suitable for streaming 3D movies, HD television, working or playing in the cloud, and live streaming events, among other applications

(b) Machine Type Communication:
mMTC replaces Wi-Fi and Bluetooth with mobile networks to connect billions of IoT devices. Examples of intelligent technologies include smart cities, asset tracking, intelligent agriculture, environmental monitoring, and intelligent water and waste management. In this context, "users" includes sensors and water meters.

(c) Low latency communication:
eMMB, mMTC, and URLLC were established for

human-machine interaction. This connection will enable mission-critical applications like driverless automobiles, augmented reality, and robot-assisted surgery.

2) Applicability in the Context of LDCs: The most popular uses of 5G in low- and middle-income nations are expected to be fixed wireless connectivity for households and extended mobile broadband services. Accessing data, downloading files, and streaming media are the most common activities of those working in LDCs. Customers in LDCs, where the average income is low, will be unable to afford 5G phones, tablets, and hotspots for many more years. So that consumers may benefit from the 5G core's capabilities, 4G and 5G base stations will likely coexist in LDCs for a long time to come. The transportation and healthcare industries may necessitate complex market frameworks for some use cases. It is clear that applications like as autonomous automobiles and remote-controlled robotic surgery will be decades away before they become commonplace in LDCs. The socio-cultural elements of a nation are crucial in the second use case of huge machine-to-machine interactions. Developing smart cities that can track assets, efficiently manage garbage, and keep an eye on the elderly from afar is a worthwhile endeavor in civilizations with strong social structures, good living standards, and a well-educated populace. Almost all of these conditions do not exist in the LDCs' social structure. LDCs need to be 5G-ready for other use cases, which they aren't currently. Robotic surgery and self-driving automobiles are two examples of this sort of technology in use. These are irrelevant in LDCs because of the absence of a functioning economic system. It is only through Narrow Band IoT (NB-IoT) that LDCs will get real benefits from 5G's prospectus [1]. NB-long IoT's battery life is suitable for application in subterranean tunnels, indoor malls, basement parking lots, and rural locations due to its status as a premier LPWA (Low Power Wireless Access) technology. By connecting NB-IoT with utility meters, street lights, parking meters, and pipelines, these fixed devices can be used to track packages or manage inventory. In Bangladesh and Sri Lanka, NB-IoT applications are currently being developed. Because 4G has just recently been adopted in impoverished countries, NB-IoT is easier to implement because newer 4G devices have the requisite NB-IoT capabilities [1].

III. Security Issues for LDCs

5G will demand new security measures for the protection of both critical infrastructure and society as a whole. If the security of online power supply networks is breached, the consequences might be severe for the whole electrical and technical infrastructure of civilization [3]. If you want to ensure that 5G networks are safe, you need to look into and stress the primary security risks, and you also need to analyze the potential remedies [26]. Fig. 6 highlights the most important 5G problems.

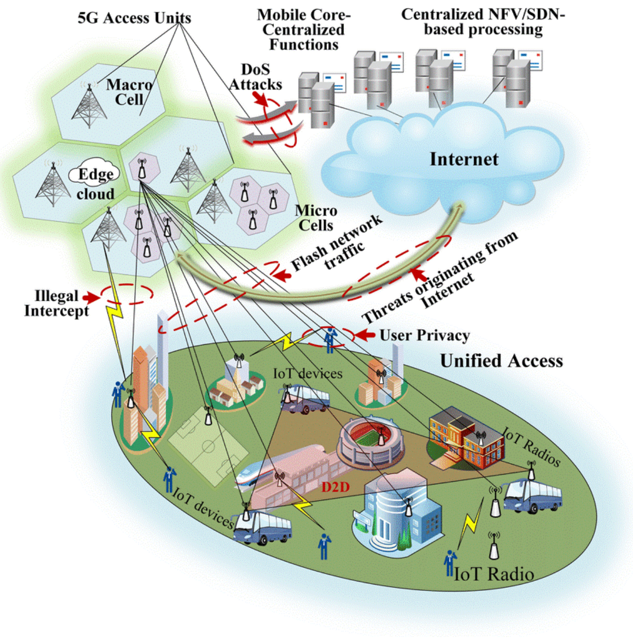

Fig. 6. A 5G network's threat environment

1) Security Challenges in Mobile Clouds: There are a number of ways in which a user might harm the performance of a cloud computing platform or use more resources or get unrestricted access to resources of other users. Conflicts over configuration can arise in multi-tenant cloud networks when each tenant has their own control logic. Using cloud computing ideas, Mobile Cloud Computing (MCC) is included into 5G ecosystems. As a result, there are several security issues, the majority of which stem from design and infrastructure flaws. Attackers can exploit the weaknesses in mobile cloud computing's (MCC) open architecture and the adaptability of mobile terminals [28]. Depending on the targeted cloud components, we divide MCC risks into front-end, back-end, and network-based mobile security problems.
Mobile terminals and cloud-accessible apps and interfaces make up the client platform in MCC architecture. Cloud service provisioning relies on data storage systems, hypervisor software, virtual machines, and protocols for its back-end infrastructure. Mobile cloud servers are the prime target of security threats on this platform. From data duplication to HX-DoS attacks, these dangers can range widely [29], [30].

2) In SDN and NFV, security is a major concern: SDN centralizes network management platforms and allows communication networks to be programmable. These two characteristics, however, open up the network to hackers and breaking. DoS attacks, for example, would prefer centralized control, and exposing vital APIs to unwanted malware might bring down the whole network. Because the SDN controller adjusts the data path's flow rules, the controller's traffic is readily apparent. Since of this, DoS assaults see the controller as an easy target because it's so well-known. [31], [32] have shown that the controller may become a bottleneck for the whole network owing to saturation assaults when network control is centralized. Due to the fact that a large majority of network services may be implemented as SDN applications, rogue SDN apps can cause havoc throughout a network [33]. As significant as NFV is, it faces fundamental security issues such as confidentiality, integrity, authenticity and nonrepudiation. If you look at existing NFV systems, they do not adequately protect or isolate virtualized telephony services, according to . As a result of the dynamic nature of Virtual Network Functions (VNFs), security breaches and configuration problems might occur while using NFV in mobile networks [18]. Another issue that has to be addressed right once is that the hypervisor itself may be hacked, which is noted in Table 1 [3], [34].

3) Security and Privacy Issues with 5G: From a user's viewpoint, data, location, and identity are the most important aspects of privacy. Before they may be installed, the majority of mobile apps need personal information from the user [35]. Companies and application developers seldom discuss how the information is kept and what it will be used for. Location privacy is the primary focus of threats such as semantic information and timing assaults as well as boundary attacks [36]. Access point selection techniques in 5G mobile networks may expose location privacy at the physical layer [37].

IMSI capturing attacks, which capture a subscriber's User Equipment's IMSI, may be used to disclose the subscriber's identity (UE). Alternatively, a false base station may be put up and utilized by the UE as the preferred base station, causing subscribers to reply with their IMSI. 5G networks contain a variety of players, including Virtual MNOs (VMNOs), CSPs, and Network Infrastructure Providers. The level of security and privacy that each of these actors values differs. It will be difficult for the 5G network to coordinate the varying privacy rules of these many players [38]. All system components were under the control of mobile carriers in the previous version. CSPs and other new players, such as 5G mobile carriers, are taking over management of the systems. 5G providers will no longer be able to control security and privacy [39] on their networks. Sharing infrastructure with a variety of parties, such as VMNOs and rivals, poses a severe threat to user and data privacy. In addition, the 5G network does not have any physical limits since it uses cloud-based data storage and NFV characteristics. As a result, 5G service providers have no control over where their customers' data is stored in the cloud. There are varying levels of data privacy in different nations, therefore if user data is kept in a cloud in another country, privacy is compromised. [3], [40].

IV. Opportunity

In order to discover new avenues for technological advancement, it is necessary to go into the technical realm. In many scientific and engineering magazines, we've monitored the rise of 5G-related technological issues. There are 18 research papers that point to 5G as the most important problem in their respective fields. Papers, reviews, and a document review are all included in the collection of publications.

As a general rule, it signifies that the technical sector has not yet concentrated its efforts on a certain technological goal. On the other hand, relay selection, mobile ad hoc networks, and one hop cooperative MAC were investigated more than the others [41]. Security, network and technology implementation and application challenges may be addressed by the research topic we selected.

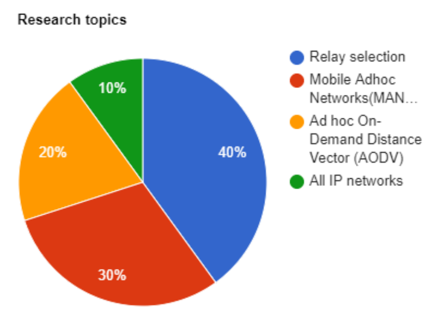

Fig. 7. 5G Top research topic

Avoiding collisions, DoS, blacklisting, etc. are discussed. Protocol, all IP network, and ad hoc network are also discussed. The scientific community continues to focus on frequency hopping, MIMo systems, space-time codes, relay selection techniques, and multi hop systems. Remote monitoring and telemedicine are additional 5G uses.

Based on these findings, we may develop a concept for exploiting an opportunity on a certain technological agenda. Research in these areas might lead to new 5G advancements. For countries in the poor world, an idea like this may be a boon in terms of creativity and technical advancement. A fresh researcher may collaborate with existing researchers in the field because of the wide study of relay selection. Messages from a source node can be received by a relay node on a wireless network, which can then process and forward them to their intended destination node. Development nations can instead focus their efforts in another area, such as AODV or collision avoidance systems because research in these disciplines is rare.

Five-generation (or "5G") wireless technology is based on the notion that it may be used to improve human existence in a variety of ways. The 5G basic technologies, in particular flat-IP and cognitive radio, can be combined by any researcher to create major standards. For example, as shown in Table 1, such research paves the way for future technological advancements by making data more readily available while simultaneously fostering creativity.

For the most part, industrialized countries like the United States, Japan and a few European countries have dominated the technical advancement of prior norms (1G, 2G, and 3G). Due to their inventive potential, developing nations should now and in the future contribute to the advancement of 5G technology. It is possible to put 5G research into submissions to international standards groups like the ITU. As a result, governments in the developing world may push their own companies to develop patents and innovate in 5G-related industries. The country's competitiveness might be boosted and global standards could be influenced by these initiatives [41].

V. Conclusion and Future Work

We examine the viability of 5G networks in LDCs. LDCs will encounter technical and security difficulties with 5G. Technological problems include establishing a continuous spectrum from the fragmented allowed spectrum, exorbitant spectrum costs, inadequate mobile network infrastructure, and a lack of regulation in dynamic spectrum sharing. These difficulties demand financial and human resources. SDN security concerns include DoS/DDoS, MITM, and exploiting open-source flaws. Data breaches, destructive loops, network disruptions, and hostile VMs manipulating the hypervisor are NFV hazards. Due to the enormous number of devices, it's tough to scale protection against spoofing, replay, system cap, sniffer, and tamper threats. To preserve SDN safety and limit DoS/DDoS threats, increase the centralized control plane's security and restrict SDN access. To fight MITM attacks, the shared data-control connection must be safeguarded. Firewalls and encryption might increase NFV security. Researchers and other organizations have created a multitude of practical answers. LDCs lack 5G security understanding. They lack the funds to train experienced security workers. 5G's major use cases are inapplicable to non-LDCs because they lack modern market procedures and economic situations. Once 5G is implemented, broad acceptance will take considerably longer.

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