5G AND NETWORK SLICING TECHNOLOGY

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Abstract: The arrival of 5G technology will trigger an even bigger transformation than it. It will fundamentally improve the data throughput and ultralow latency of current mobile networks, therefore greatly expanding their capacity and reach. However, in a broader sense, 5G will serve as the foundation for several fourth industrial revolution (IR4) technologies, including telemedicine, drones, augmented reality, virtual reality, and driverless cars. Through 5G, billions of different types of devices will be linked together and provide a level of functionality and user experience that has never been possible before. Our daily operations and way of life will alter forever. Applications of fifth-generation (5G) slices improve the services in accordance with availability, which relies on the importance of urgent circumstances and the preferences of consumers. Because there are so many people trying to access the various services during peak hours, managing network traffic is still very much in demand. This demand causes an increase in network traffic, slows down services, and restricts access to facilities owned by service providers. The availability of 5G slices in network management can be assessed by using the fundamental specifications of the three slice types standardised by the Enhanced Mobile Broadband (eMBB), Internet of Things (IoT), and Ultra-Reliable and Low Latency Communications (URLLC) 5G slice committees. Through system modelling, rate, latency, and connectivity-based network slicing techniques make these issues simpler. The following three methods can be used to increase availability in response to demand for accessing issues. First, rate levels are given priority in order to increase service availability, which may not be dependent on latency and connectivity. Second, latency levels are given priority in order to increase service availability, which may not be dependent on rate and connectivity. Finally, connection levels are given a higher priority in order to increase service availability, which may not be dependent on latency and rate. We may utilise software-defined network (SDN) technology, such as SDN-based multiple access, to overcome the issues since it offers variable settings when customers implement various services and applications. In order to improve network traffic performance, this strategic research article will examine new slice algorithms of the network traffic system based on software-defined multiple access (SoDeMa). With the help of this system modelling, we can increase the availability of 5G slices based on the average response time to the services.

I. INTRODUCTION TO 5G

Over the past two decades, both the number of mobile users globally and their data demands have grown dramatically. We have witnessed enormous advancements in mobile technology throughout the same time span. But the current mobile technologies are at their apex. If the new 5G technology in not switched, service quality and efficiency will substantially decline as more users and gadgets join the network.

5G technology for mobile networks is attracting interest from all across the world thanks to its promises of extremely fast data speeds, extremely low latency, and billions of connections. Consumers in Australia, China, Ireland, Monaco, New Zealand, Norway, the Philippines, Romania, and South Korea may access the first 5G mobile networks. Other nations, like Pakistan, Germany, and Finland, have already had 5G spectrum auctions and are preparing to construct and deploy networks shortly. 5G has already been introduced by more than 40 telecom carriers globally [1].

High data throughput is a feature of the highly scalable 5G technology. Different 5G cell types may handle various deployment scenarios, including residences, coffee shops, tiny offices, aeroplanes, retail establishments, airport terminals, transit hubs, and expansive open spaces. When fully implemented, it is anticipated to replace the cellular mobile network and Wi-Fi with a single continuous technology, enabling a seamless user experience across all mobile and Internet of Things (IoT) devices. Power consumption, technical complexity, and cost will all be significantly reduced as a result of the cellular network and Wi-Fi's convergence.

The mobile telecoms industry in India has lately witnessed a seismic change. With the entry of new competitors, the industry has become extremely competitive, with improved coverage and cheaper, better voice and data options being offered to customers. All cell providers are now involved in a pricing war as a result of this. Their debts have increased while their revenues have decreased. In order to generate economies of scale and align synergies and improve competitiveness in the market, this move has also led to consolidation among mobile service providers [2]. Additionally, the Supreme Court ruled against the incumbent mobile operators in October 2019 and ordered them to repay the government US$13.9 billion in licence fees, penalties, and interest payments (Bharti Airtel approximately US$3 billion, Vodafone Idea approximately US$3.9 billion, and Reliance Jio approximately US$1.8 billion) [3]. The Supreme Court has granted a 10-year timeframe for paying the outstanding licensing fee in equal year installments [4]. These events appear to be obscuring India's 5G deployment.

However, it is anticipated that the size of the telecom equipment business would increase to US$26.38 billion by 2020, supported in part by the country's projected increase in internet customers to 829 million by 2021. By 2021, the total amount of internet traffic might double with a 30% CAGR. By the end of 2020, the Mobile Value-Added Services (MVAS) market is anticipated to reach US$23.8 billion at a CAGR of 18.3% [5]. In addition, by 2022, the National Digital Communications Policy, 2018 plans to attract investments totaling $100 billion USD [6]. Due to the potential for exponential development, mobile carriers in India are vying for the top spot in the country's future 5G market.

1.1 FREQUENCY SPECTRUM FOR 5G

The frequency of the electromagnetic spectrum that the most recent standard of wireless technology uses is one of the key distinctions between 5G and earlier generations of wireless networks. The channel bandwidth, or the difference between the highest and lowest signal frequencies, that the technology can employ, determines the maximum amount of data that can be transmitted across a mobile network. On the frequency spectrum, lower frequencies offer smaller channel bandwidths, whereas higher frequencies offer broader channel bandwidths. The constraints of physics eventually limit future advancements, even when digitalization, multiplexing methods, and software-based data compression algorithms allow us to fit more data into the same channel bandwidth.

5G is slated to operate in three separate frequency bands: low-band, mid-band, and millimetre wave (mmWave), in order to give a larger channel bandwidth. Low-band 5G operates in the same spectrum as 4G, often below 3GHz. At up to 250 Mbps, it delivers slightly faster internet speeds than 4G. Mid-band 5G offers a downlink speed of up to 1 Gbit per second (Gbps) using a frequency range up to 6 GHz, which is generally utilised by Wi-Fi. Using a significantly greater frequency band between 24GHz and 300GHz, millimetre wave 5G can deliver high-speed data at downlink speeds of up to 20 Gbps [7].

5G NR (New Radio) has been suggested as a new international standard for the air interface of 5G Networks by the 3GPP, an umbrella group of top telecoms standards development organisations. Two frequency groups exist under 5G NR: FR1 (Frequency range 6 GHz), which covers the frequency range of 3.3–4.2 GHz with a maximum channel bandwidth of 100 MHz, and FR 2 (Frequency range > 24 GHz), which covers the frequency range of 24–300 GHz with a minimum channel bandwidth of 50 MHz and a maximum of 400 MHz. For information on the 5G frequency spectrum with regard to audible sound and visible light, see Figure 1.

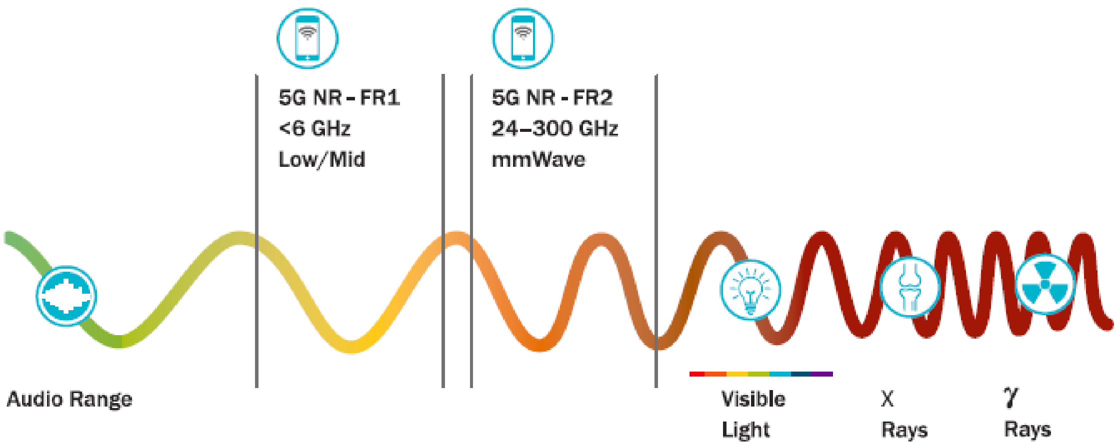

Figure 1. 5G Frequency Spectrum

Low-band 5G is projected to launch a few years before 5G in the other two bands since it can be developed on the existing 4G infrastructure whereas mid-band and mmWave require fresh spectrum auctions. However, when mmWave 5G is implemented, the whole potential of 5G will be realised. For 5G, many nations have set aside or begun to release millimetre wave spectrum. The deployment of mmWave 5G would take several years.

Shorter distances are covered by the signal since mmWave 5G employs a higher frequency. To create a seamless 5G network, many additional cell towers will be needed due to the coverage area's limitations. The size of the cell tower antenna will be significantly smaller and less noticeable. Each cell will be able to handle up to 10 times more connections (such as mobile phones, tablets, and IoT devices) in the same locations than 4G due to the enormous throughput capacities. In heavily populated metropolitan regions, this 5G technology will thus be particularly beneficial.

1.2 PROS & CONS OF 5G

Like previous technologies, 5G offers both advantages and disadvantages as shown in Figure 2.

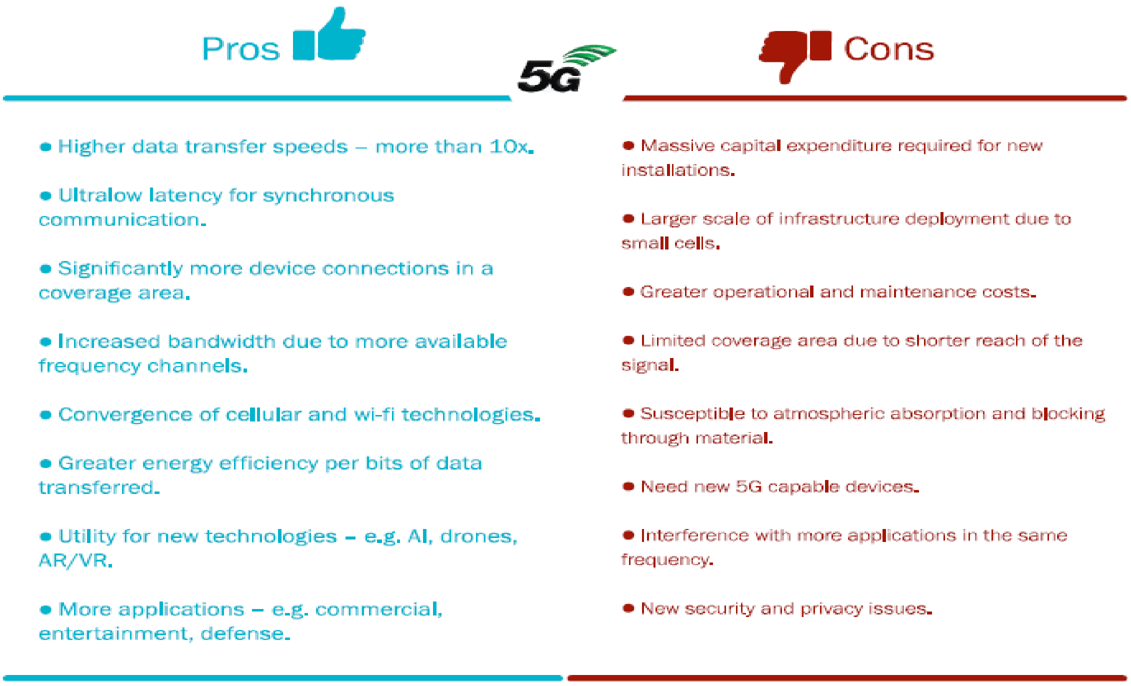

Figure 2. 5G: Pros and Cons

II. NETWORK SLICING: DIVIDING A SINGLE NETWORK INTO MANY SLICES

Broadband and low latency connections may be provided even when there are many things linked to the network, which is one of the benefits of 5G mobile networks. Every use case has a unique set of needs, many of which might be orthogonal in terms of quality, allowing for efficiency in scenarios including infrastructure sharing [8].

For instance, while taking into account the use case of an autonomous vehicle in virtual reality, which demands minimal latency and high dependability for safety, it calls for high throughput with relaxed reliability because missing a few pixels, frames, or a lesser resolution may be manageable. The same physical infrastructure might provide each of those quality metrics simultaneously. A network slice for the Vehicle Network, with particular KPIs for latency, and another network slice to support high throughput for VR applications, may both be constructed on top of the same hardware.

The significant use of the Software Defined Networking (SDN) paradigm to manage the numerous devices involved and Network Functions Virtualization (NFV) to create logically distinct functions for each of the slices will make Network Slicing practicable from an implementation standpoint.

Mobile network operators, as an illustration, can separate their network into smaller virtual sub-networks and link them together. The services and functionalities may be tailored to a customer's demands since each partitioned virtual network offers autonomous network operations. The wireless access network, the central elements of the Evolved Packet Core (EPC), or the data centres may all be virtually divided via slicing. As seen in Figure 3, network slicing features include adaptability, shared infrastructure, isolation, and a dedicated network.

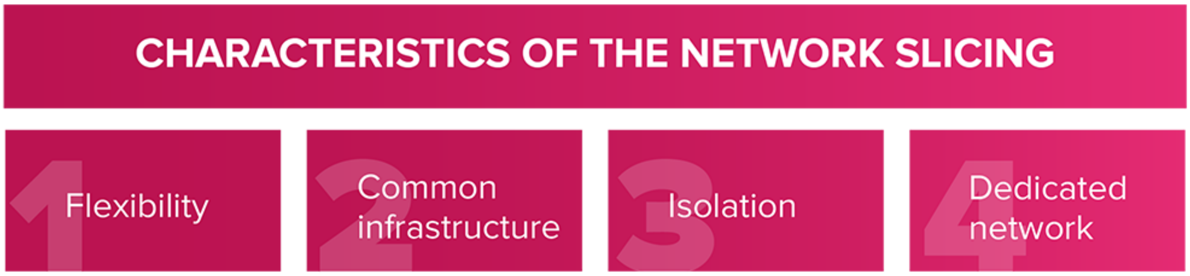

Figure 3. Network slicing characteristics

2.1 NECESSITY FOR NETWORK SLICING

Network slicing is required when each application has to "see" a network set up in the best possible way to handle its traffic. Even if the network that the programme sees is a "slice," a virtual "slice" of the actual network, this is still achievable with slicing. Network slicing offers benefits beyond simply displaying an application's optimum network.

The several "slices" of the physical network are also segregated from one another, which, for example, ensures higher communication security and the ability to change one slice's functioning without impacting the others. By acting specifically on just one slice, an operator can significantly alter the service it provides to its clients. This would also enable testing and research on dedicated slices, where each slice may mirror a live network and provide genuine services on top, without disrupting other slices that support the live network.

2.2 NETWORK SLICING APPLICATIONS

The necessity arises when the network service provider wishes to share a physical infrastructure to offer many services, each with different needs. Because the virtual slice may be "tailored" for the particular service without integrating all the capabilities of the underlying network, it enables infrastructure sharing in a flexible and more effective method.

By ensuring isolation, assured performance, scalability, and support for multi-vendor and multiple-operator scenarios, it can be claimed that slicing is employed wherever there is a shared infrastructure where on-demand customization is possible.

2.3 PRINCIPAL PLAYERS AND APPLICATIONS

Different participants will gain from Network Slicing because they will be able to use a common hardware infrastructure that supports several logical and virtual networks and provides a variety of independent services.

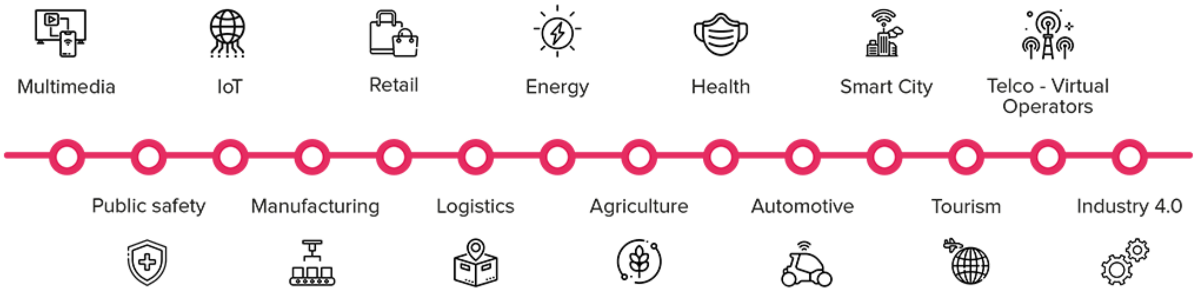

Figure 4. Applications of Network slicing

These participants may be the creators, suppliers, or consumers of such virtual services. Multimedia, Telco and Virtual Operators, Tourism, Energy, Health, Smart Cities, Public Safety, Manufacturing, Logistics, Agriculture, Automotive, Retail, Industry 4.0 and IoT in general are just a few of the industry sectors that are interested in the effects of Network Slicing. Figure 4 lists more business sectors as well.

III. CASE STUDY: THE SDN-BASED 5G NETWORK SLICING TECHNOLOGY FOR MANAGING NETWORK TRAFFIC

SDN-based technology is used to slice the 5G network and manage network traffic. When many users seek various services and apps at various times, advanced technologies anticipate experiencing high network load. Additionally, the devices used by users and the services they need depend on a variety of parameters, such as how the channel between users and base stations changes depending on the location. Network slicing principles and the availability of network slices give the essential supports with the most recent SDN technology to improve these circumstances. The main factors that promote boosting availability in the architecture of 5G network slices are latency, data rate, and connectivity [9–14]. When consumers access services and applications, connection, data throughput, and latency are requirements for traffic management.

Orthogonal multiple access (OMA) and non-orthogonal multiple access (NOMA) are key components of the 5G network that improve the channel, transmission, and reception performance of data. SoDeMa, which was influenced by the delta OMA standard announced in [15], is currently thought to be a new multiple scheme for 5G and beyond. Despite being built on several OMA and NOMA schemes, the SDN concept has gained traction as a means of enhancing traffic throughput. When SoDeMa uses other numerous schemes that are impacted by OMA and NOMA, the switching capabilities of SDN swiftly pick the many OMA and NOMA kinds. Although customers have high hopes for 5G and 5G+, the network's availability is still being held back by high data traffic. This forecast is dependent on the transmission rate and channel capacity, two aspects of the 5G standard. Despite high expectations, user devices should be instantly able to interact with internet services and apps. The management of the data traffic should be centred on multiple access (MA), channel capacity, transmission rate, etc. We are motivated to analyse, monitor, and manage the traffic in this study because of the high volume of traffic and the need to identify ways to improve the uptime of online services and apps. The fundamental characteristics of SDN inspire us to develop a revolutionary network slicing technique and SoDeMa-based algorithm in the contribution. We may increase the response time for machine learning (ML) applications engaged with rapid timing by configuring network problems and settings through the SDN, which simplifies 5G slicing for controlling network traffic using SoDeMa.

IV. EVALUATION OF THE LITERATURE AND RELATED WORK

In order to enhance the availability and accessibility of network services, this section covers the network slice used in 5G networks and how it controls network traffic using SoDeMa. Despite the fact that SDN technology improves the 5G needs, the network slice algorithm based on the requirements enables us to increase the service availability by providing the required functionality. In essence, network slices are logical networks that offer exact and particular networking resources and network properties.

The ability to construct traffic isolations that offer optimised solutions for various market customers is provided by network slicing. One of the core technologies of the 5G mobile networks, according to [16], is network slicing. The slicing method allows for virtual networks and on-demand, customised services. By 2030, the network slicing capabilities of the 5G+ network will enable a wide range of services and applications with potentially diverse technical needs. To address the varied needs, 5G+ slices for a mobile network operator should develop into an end-to-end adaptable, scalable, and demand-oriented system [17].

For enhancing and controlling network traffic, the 3GPP (3rd Generation Partnership Project) and telecommunications groups have standardised three types of slices [18]. several high-speed communication and service sectors that rely on 5G slice management are combining with several automation industries. Different services, business models, etc. are among them. Basic network slices are only one of the numerous internal and external elements that make managing data traffic in 5G environments more difficult. Additionally, it makes it possible for big apps to use 5G networks' Quality of Service (QoS) mechanisms more easily.

The effective design of MA protocols makes the MA useful for controlling data flow. They include cooperative content caching, channel partitioning, random access for brain communication, dynamic resource management, cache management, etc. The data flow will increase, among other advantages, with the creation of MA protocols based on SoDeMa methods.

The authors of [19] claims that TM is in charge of the lightweight data, which may be as little as 40 bytes. With the use of SDN, the admission control algorithm enhances TM and enables service providers to segment the 5G network, which carries monitoring and other light data traffic. It's important to use effective algorithms for classifying sliced services in 5G mobile networks' data flow. SoDeMa may be used in these situations to streamline and distribute traffic based on the circumstances and priorities.

SDN-based traffic engineering solutions offer effective TM in any circumstance [20]. Dynamic weight setting of routing algorithms enables service providers to enhance network management and traffic throughput instead of utilising a fixed weight setting of routing algorithms. The conditions for TM are the traffic measures taken into account in the network applications. Despite the existence of several traffic models, the SDN idea dynamically monitors traffic measurements, improves monitoring capabilities, and systematically manages and regulates traffic.

Future network generations, such 5G+, will need to handle the various network communication services, managing traffic and applications intelligently and dynamically.

Due to their extensive coverage, femtocells may be thought of as having higher energy efficiency (EE) than big cells in this situation. When using femtocells, one of the aspects taken into account is energy-efficient management through traffic monitoring, analysis, and measurement. Although there are numerous obstacles, we are encouraged to investigate the traffic modelling used in IoT-femtocell based applications and slices connected with accessing technologies. Different traffic models, including as the dynamic and static presented in [22], allow us to design a novel strategy that delivers efficient TM.

The 5G domain's approaching forms might foresee the innovation and thorough integration of tiny cells. These cells are mobile phone nodes that use the least amount of power possible to maximise frequency utilisation within the finite region while improving bandwidth efficiency, one of the metrics taken into account when evaluating the performance of network traffic. The fast proliferation of condensed networks among a large number of networked IoT devices is caused by the reinforcement of bandwidth efficiency, which prevents any further extension of the range. The development of traffic modelling with network slices, which improve the network TM with the QoS and the availability of services at the peak period, is supported by small cells in the next 5G-based IoT [23].

V. PERFORMANCE OF 5G SLICES

The network slice managers, who arrange the available slices based on user preferences and priorities, are what the TM relies on. We can develop the network slice algorithm for controlling network traffic, services, and ML-based 5G network applications based on the features listed in Table 1.

Table1. Expected 5G MA functionalities in standardised slice types

Standard types of Slices	**Expected functionalities of 5G MA**	**Measurement Setailsof SoDeMa used for managing traffic**
eMBB	Large network capacity High user density Uniform user experience Easy multi-user-multiple inputs multiple outputs (MU-MIMO) Mixed traffic types transmission Highly efficient small packets transmission	Power, Bandwidth, spectrum Uptime, availability EE, spectral efficiency, etc
URLLC	Power, Bandwidth, spectrum Uptime, availability EE, spectral efficiency, etc	Accuracy of latency Lifetime, EE Packet size and rate details
IoT	Massive connectivity	Complexity, scalability

Table 1 lists the anticipated capabilities of generic MA, SoDeMa measurement information, and traffic management for a few chosen 5G network slices. eMBB, massive machine-type communications (mMTC), millimeter-wave (mmWave), URLLC, IoT, relay, long term evolution, WiFi, and vehicle to vehicle (V2V) communications are taken into account in these chosen slices. In article [24], the URLLC-aware frame structure is introduced, along with the combined mmWave-microWave communications. The growing wireless communication is improved by an integrated version of 5G network slicing with SoDeMa, even if mmWave communication alone might not be sufficient support.

5.1. RATES AND AVAILABILITY

When numerous users are using the network slicing algorithm's rate-dependent services and applications, such enhanced mobile broadband services, the availability of the services is improved. Examples of rate-dependent services include holograms, 4K/8K Ultra-High Definition (HD) video, virtual reality, augmented reality, and other high-speed and high-quality multimedia services. These services are accessible whenever and whenever the consumers require them. The overall transmission rate for slice m is determined similarly to (1) by:

$$R_m(t) = \sum_{n=1}^{N} \sum_{i=1}^{k_m} c_{i,m}^{n}(t) R_{i,m}^{n}(t) \tag{1}$$

where, The overall rate of user equipment (UE) for slice m is Rni,m. There are M slices in the network. The km is a slice m active UE. N (nN) subchannels are present. The sub-channel allocation adjustment action is also known as cni,m(t). Higher data rates are necessary for improved media capability and consumption since there will be more consumers and devices. Future network traffic will be increased by HD and multi-view HD screens, mobile 3D projections, immersive video conferencing, and sophisticated network services.

5.2. LATENCIES WITH AVAILABILITY

The network slice technique focuses on minimising latencies, whereby low-complex design is the best way to improve the services, even though the predicted delay is less than 1ms. For example, medical services employ the lowest latencies to increase precision during surgery and while prescribing drugs online. Low-latency communications with maximal EE are necessary for several delicate and mission-critical applications, including vehicle-to-everything (V2X) connections and remote control of industrial and medical robots. Through the network slice algorithm and functions, many services in various applications will use simpler, low-latency, and maximal EE designs. In general, delays increase the latency of the network slice algorithms' step-by-step slicing operations. The average delay (2) can be improved by taking into account the queue length, the volume of data that arrived, and the quantity of packets that UE i communicated in slice m.

$$D_m = \sum_{i=1}^{k_m} D_{i,m} \tag{2}$$

The Di,m and Dm and represent, respectively, the average delay of slice m and the delay of the UE i in slice m. Slice m's maximum delay is determined by the algorithms and slice design.

5.3. CONNECTIVITY AND AVAILABILITY

The purpose of the mMTC is to facilitate connections and communications between a sizable number of IoT devices. In the future, mMTC devices should be able to manage hundreds of thousands of active connections per square kilometre (km^2). Network slicing techniques may also handle numerous concurrent connections (estimated connection density: 1,000,000 devices/km^2). Maintaining energy across the links will enhance them [26]. The energy length, the amount of energy consumed during the connection, and the amount of transmission energy consumed by UE i in slice m should all be taken into account when calculating the connecting energy (3).

$$E_{i,m}^{c} = \min\{[E_{i,m} + A_{i,m} - L_{i,m}], B_{i,m}\} \quad (3)$$

where Ei,m,Ai,m,Li,m,Bi,m stand for the duration, arrival, consumption, and battery capacity of the energy, respectively. Future networks will have more linked devices than human users since more services will be connected to more devices. The degree to which the services are accessible and available may vary on the users' choices, the sorts of devices they choose, and the connecting priorities. Different services that make advantage of 5G network slices reach consumers' devices, such as smart gadgets, as more and more objects become linked. Healthcare and vehicle-to-vehicle and vehicle-to-road infrastructure communication are a few examples of services.

VI. SLICES OF THE NETWORK FOR MANAGING NETWORK TRAFFIC

Service providers employ the RAN, the availability of network slicing features, and CN, respectively, to improve the services in accordance with the preferences of the users. Try to access one service at a time when there are many people and their devices online; otherwise, accessing that particular service will be challenging due to the service's delayed connectivity and slower data rate. The network slicing functions, which affect the data throughput, latency, and connection, are a requirement for novel slice algorithms. The network slicing used in Figure 5 to manage data traffic improves the accessibility of services.

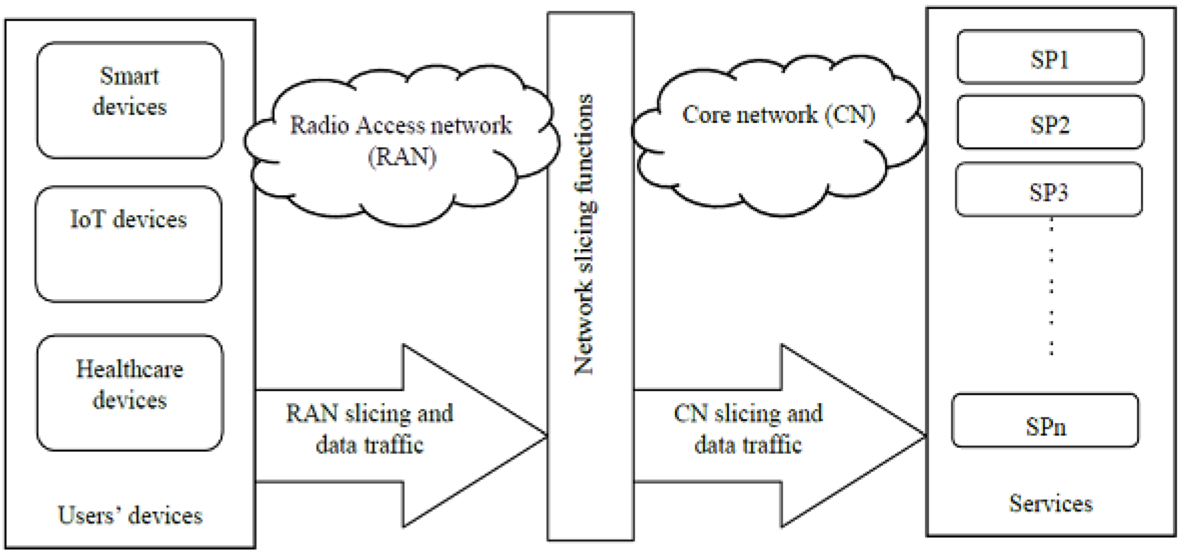

Figure 5. Network slicing for managing data traffic and services

It is possible to specify classes of service at radio and end-user accessing providers' resources in accordance with network slicing. In order to preserve the QoS, service providers (SP1, SP2,..., SPn) supply the services via RAN and CN with the appropriate slicing. Transport is given some autonomy from radio in this fashion so that it may organise its internal resources into services and expose them in the appropriate slices, as well as dynamically reorganise traffic.

6.1. ALLOCATION OF RESOURCES

Despite several features of resource distribution, slices provide the virtualization of SDN-dependent network resources, enabling service providers to share the physical resources in a programmable manner. Complete 5G network slicing architectures put a strong emphasis on allocating physical resources to the virtual slices. Because SDN can control mobility in slicing networks rather accurately, it can easily handle all the operations of resource allocation for central slices. Additionally, the management of software's hardware and infrastructure is the foundation for developing the slicing network architecture for the 5G network. Physical infrastructure will be shared by all network slices, and they must all share the same network resources, yet each slice will operate independently as a distinct network.
Users should be able to control their data through network services whenever and whenever they want to do so by utilising the resources shared between them and the service providers. Therefore, service providers must guarantee that all of the network services they offer (sensitive and mission-critical services based on 5G slices) are accessible when consumers need them. Here, temporal complexity affects the service time, which is reliant on the network services' effect on the resources, whether they are up or down.

$$A = \frac{t_s - t}{t_s} \tag{4}$$

(4) states that it is possible to compute the availability (A) of the services utilised in any application. In this, (4) represents the service time calculated using the network slice technique, and t represents the service downtime.

6.2. COMPLETE SLICE ORCHESTRATION

The sliced network in 5G presents a substantial difficulty for end-to-end slice orchestration. It should be a simple matter to generate a slice using effective slicing and mapping, given the capability of the system. But it must also be flexible in how it deploys the services and must not be constrained. This is the main difficulty in orchestrating crucial flexible slices from beginning to end. In other words, slice orchestration failure as a result of virtualization's restricted capability [27]. The functions employed in the network slice technique are improved by adaptive network slicing with multi-site deployment in 5G core networks [28].

VII. SLICES AND NETWORK TRAFFIC USING SOFTWARE-DEFINED MULTIPLE ACCESS

Although simple MA based on SDN improves accessing management of network traffic, modelling network traffic expected to have the aforementioned qualities. Here, the devices and services supported by the 5G slices for users (U1,U2,...Un) are depicted. Priority (Pu), limited (Lu), energy (Eu), security (Su), etc., may be taken into consideration with 5G slices in these services. According to this study, modelling the network traffic model (NTM) based on SoDeMa is a suggested strategy for enhancing traffic [29–33]. Additionally, service providers are able to handle and control the dynamic network traffic thanks to NTM monitoring.

7.1. A SUMMARY OF THE SLICING ALGORITHM

Figure 6 depicts the network TM procedure, which depends on the SoDeMa slicing algorithm, traffic algorithms, and network slicer features. Although there are other slicing techniques, we concentrated on the slice algorithm for latency calculation since it accelerates the NTM's reaction time. The following are the steps of the slicing algorithm: 1) If the network slice's throughput is more than zero, 2) The functions in Section 4 are used for network slices of 5G+ traffic, and Section 5 describes how to manage data traffic using SDN. 4) The latency for the network slice is determined by dividing the capacity by the throughput of that network slice. This method for the priority service (Pu) served as an example for how we calculated and examined the response time.

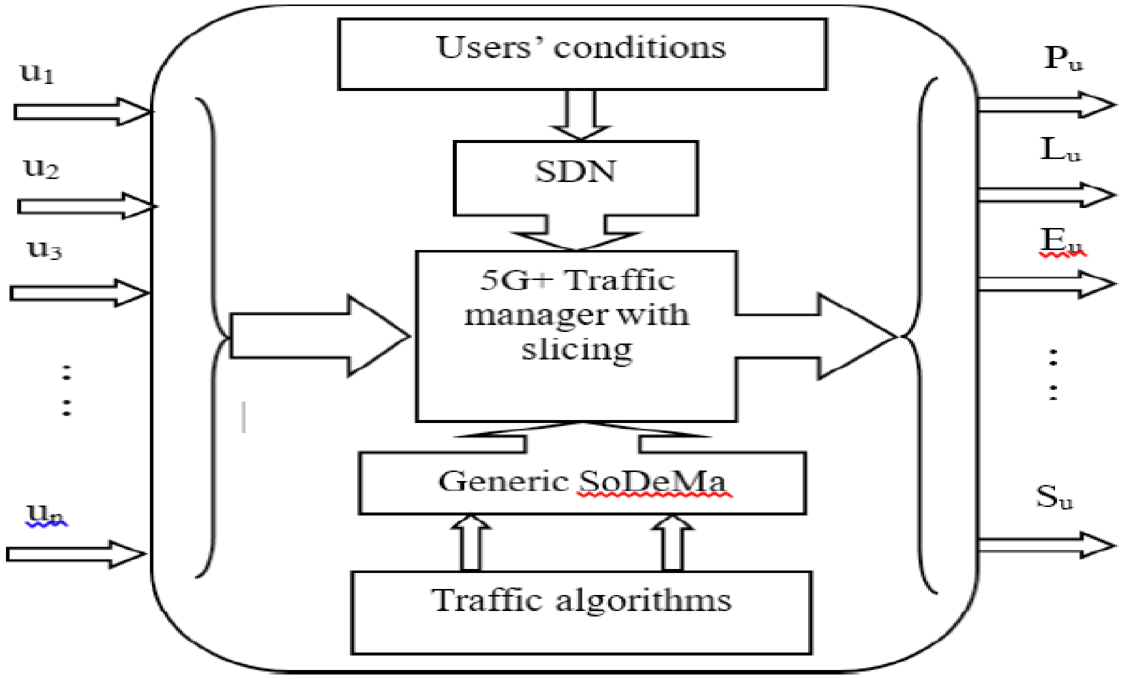

Figure 6. Network traffic model based on SoDeMa

7.2 CONCLUSIONS AND ANALYSIS

The availability is shown by the average response time (figure 7), which enables us to enhance the services using network slices. Here, the SoDeMa-based architecture of the network slicing method decreases overall complexity and enhances reaction time. With the 5G network slicing, which allows the services' availability and access based on the users' choices, response time stays the same as we add more users.

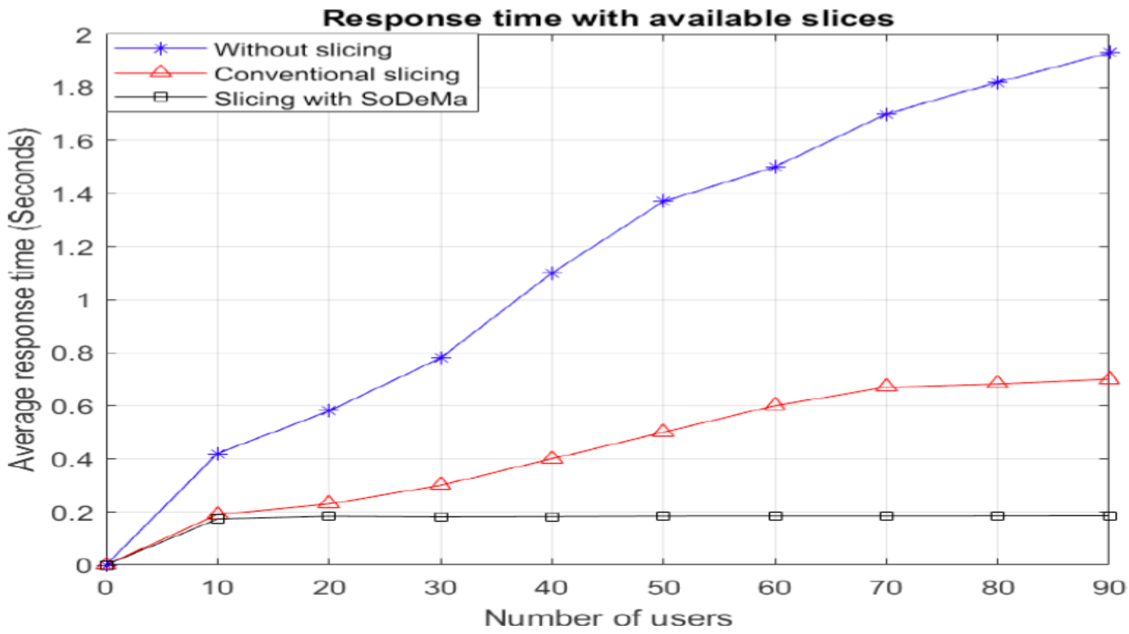

Figure 7. Average response time of with/without network slice

The network slicing algorithm and all active resources between the transmitter and receiver determine whether network services are accessible for any applications involving ML-based accuracy measures.

VIII. SUMMARY AND FUTURE WORK

This example of work offers improvements to 5G network traffic through the use of Software Defined Multiple Access (SoDeMa) and 5G slices. The three categories of standardised slices (eMBB, IoT, and URLCC) that enable us to assess the availability of 5G slices were researched. SoDeMa is regarded as a great multiple access system for huge wireless connection in 5G and 5G+ wireless networks, despite the fact that we have investigated a variety of accessing approaches. This theoretical study proposed a brand-new network traffic model for efficiently controlling data flow and services. We innovated in this new model by using generic SoDeMa. SoDeMa contributes significantly to lowering the processing time, receiver complexity, and installation costs in relation to the availability of 5G network slices. The largest problem in future work will be to consume the least amount of energy while maintaining the highest level of security due to the necessity to control the rapidly increasing traffic among numerous users. With SoDeMa, we intend to create a new network architecture that might address the real-time traffic issues faced by data handlers, service providers, etc. [34, 35] contend that data handlers, including machine learning-based data centres, should take a more proactive approach to addressing the growing issue of managing data traffic and cybersecurity concerns taken into account in 5G networks and beyond.

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