5G AND NETWORK SLICING TECHNOLOGY

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 Industrial Revolution 4.0 (IR 4.0) technologies, including telemedicine, drones, virtual reality, augmented 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. Fifth-generation (5G) applications improve services in line with availability, which depends on the significance of urgent situations and client preferences. Managing network traffic is still in high demand since there are so many people wanting to use the numerous services at once during peak times. This demand slows down services, increases network traffic, and limits access to service provider-owned facilities. 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. To boost service availability, which might not be reliant on

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latency and connectivity, rate levels are given precedence first. In order to enhance service availability, which may not be dependent on rate and connectivity, latency levels are given importance. In order to boost service availability, which may not be reliant on latency and rate, connection levels are given a higher importance. We may use software-defined network (SDN) technology to solve the problems since it allows for flexible settings as users deploy different services and applications. This strategic study article will look at novel slice algorithms of the network traffic system based on software-defined multiple access (SoDeMa) in order to enhance network traffic performance. Based on the average response time to the services, we may boost the availability of 5G slices with the aid of this system modelling.

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 Norway, Monaco, Australia, Ireland, Romania, New Zealand, the Philippines, China, 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. It is projected that, when fully deployed, it would completely replace Wi-Fi and the cellular mobile network, offering a unified 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]. In addition, the Supreme Court dismissed the appeals of the incumbent mobile operators in October 2019 and mandated that they pay back the government US$13.9 billion in licence fees, penalties, and interest payments (roughly US$3 billion for Bharti Airtel, US$1.8 billion for Reliance Jio, and US$3.9 billion for Vodafone Idea) [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.

By 2020, it is anticipated that the market for telecom equipment would reach US$26.38 billion, helped in part by the country's predicted rise in internet users to 829 million by that year. With a 30% CAGR, the overall volume of internet traffic might quadruple by 2021. The Mobile Value-Added Services (MVAS) market is projected to grow at a CAGR of 18.3% to reach US$23.8 billion by the end of 2020 [5]. The National Digital Communications Policy of 2018 also aims to draw investments of $100 billion USD by 2022 [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. 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 band width, or the difference between the highest and lowest signal frequencies, that the technology can use determines how much data can be sent through a mobile network. Channel bandwidths are wider at higher frequencies than they are at lower frequencies on the frequency spectrum. Even though we can fit more data into the same channel bandwidth thanks to digitalization, multiplexing methods, and software-based data compression algorithms, physics will always put a stop to further advancement.

Low-band, mid-band, and millimeter wave (mmWave) are the three distinct frequency bands that 5G is intended to operate in order to provide a wider channel bandwidth. Low-band 5G uses the same spectrum as 4G and frequently operates below 3GHz. It offers slightly faster internet speeds than 4G, reaching up to 250 Mbps. Mid-band 5G offers downlink speeds of up to 1 Gbit per second (Gbps) and operates in the 6 GHz frequency band, which is typically used by Wi-Fi. Millimetre wave 5G can deliver high-speed data at downlink speeds of up to 20 Gbps using a significantly larger frequency band between 24GHz and 300GHz [7].

A new international standard for the air interface of 5G Networks has been proposed by the 3GPP, a group of top organizations that develop telecommunications standards. This standard is called 5G NR (New Radio). FR1 (Frequency range 6 GHz), which covers the frequency range of 3.3-4.2 GHz and has a maximum channel bandwidth of 100 MHz, and FR 2 (Frequency range > 24 GHz), which covers the frequency range of 24-300 GHz and has a minimum channel bandwidth of 50 MHz and a maximum of 400 MHz, are the two frequency groups under 5G NR. Details on the 5G frequency spectrum in relation to audible sound and visible light can be found in Figure 1.

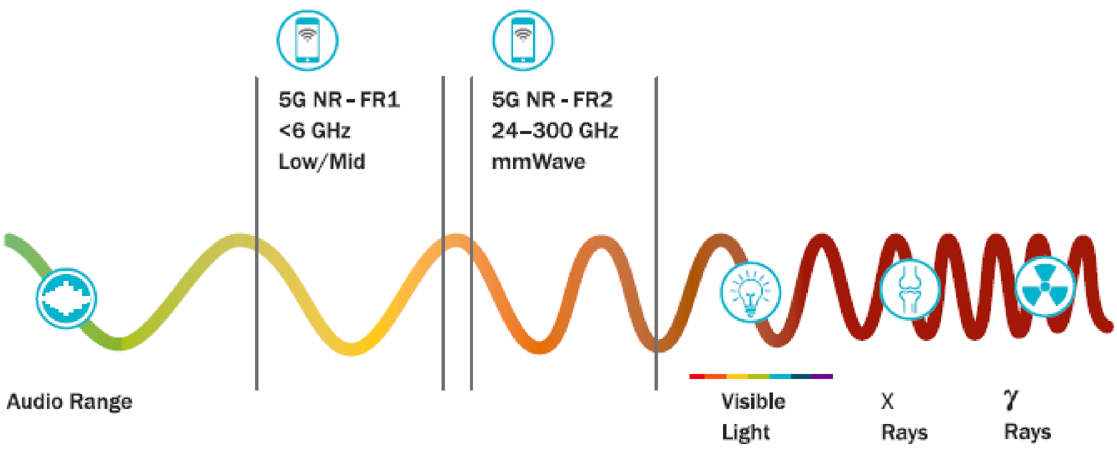

Figure 1: 5G Frequency Spectrum

Low-band 5G is anticipated to launch a few years before 5G in the other two bands because it can be developed on the existing 4G infrastructure while mid-band and mmWave require new spectrum auctions. However, once mmWave 5G is implemented, the full potential of 5G will be realized. For 5G, many nations have already reserved or begun to release millimeter wave spectrum. mmWave 5G deployment 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 cell tower antenna will be considerably smaller and less obvious. Each cell will be able to support up to 10 times more connections (such as mobile phones, tablets, and IoT devices) in the same locations as 4G thanks to the enormous throughput capacities. In heavily populated metropolitan regions, this 5G technology will thus be particularly beneficial.

2. PROS & CONS OF 5G

Like previous technologies, 5G offers both advantages and disadvantages as shown in Table 1.

Table 1: 5G: Pros and Cons

5G: Prons	5G: Cons
Greater data transfer rates—more than 10 times.	Massive capital expenditure required for new installations.
For synchronous communication, very low latency.	Small cells have led to a larger scale of infrastructure deployment.
Significantly more connections between devices within a service region.	Higher expenditures for operations and maintenance.
More bandwidth since there are more frequency channels available.	Limited coverage area due to shorter reach of the signal.
Convergence of Wi-Fi and cellular technologies.	Susceptible to blockage by material and atmospheric absorption.
Increased energy efficiency per transmitted data bit.	Devices capable of 5G are required.
Usefulness in relation to emerging technologies, such as drones, artificial intelligence (AI), and augmented reality and virtual reality (AR/VR).	Additional applications using the same frequency cause interference.
Additional uses in business, entertainment, defence, etc.	New security and privacy issues.

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

The ability to deliver broadband and low latency connections even with a large number of devices connected to the network is one benefit of 5G mobile networks. Each use case has its own set of specifications, many of which might be orthogonal in terms of quality, allowing for effectiveness in situations like infrastructure sharing [8].

When considering the use case of an autonomous car in virtual reality, for instance, it is necessary to have high dependability and high throughput for safety, but it is also necessary to have high throughput with relaxed reliability because it is possible to miss a few pixels, frames, or a lower resolution. The same physical infrastructure may deliver all of those quality metrics at once. It is possible to build two network slices on top of the same hardware: one for the Vehicle Network with particular KPIs for latency and the other to offer high throughput for VR applications.

Due to the extensive use of the Software Defined Networking (SDN) paradigm to manage the numerous devices involved and Network Functions Virtualization (NFV) to build logically independent functions for each of the slices, Network Slicing will be implementable.

For instance, mobile network operators can create smaller virtual sub-networks within their network and connect them. The services and functionalities can be tailored to the needs of the client because each partitioned virtual network offers autonomous network operations. The wireless access network, the central elements of the Evolved Packet Core (EPC), or the data centers could all be divided theoretically through slicing. Figure 2 depicts the characteristics of network slicing, which include flexibility, shared infrastructure, isolation, and a specialized network.

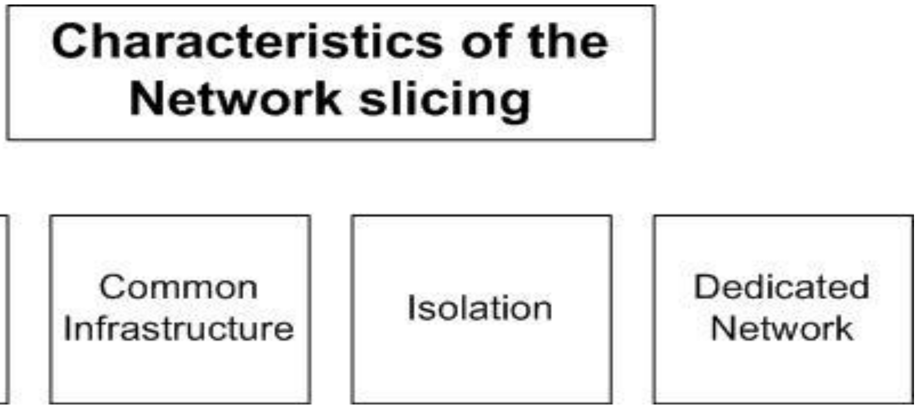

Figure 2: Network slicing characteristics

1. Necessity for Network Slicing

Network slicing is required when each application must "see" a network set up in the best possible way to handle its traffic. Even if the network that the software sees is a "slice," a virtual "slice" of the actual network, this is still possible with slicing. Network slicing has benefits beyond merely displaying the best network for an application.

The numerous "slices" that make up the physical network are also isolated from one another, which, among other benefits, ensures increased communication security and the adaptability to change one slice's functionality without affecting the others. By acting specifically on just one slice, an operator can significantly alter the service it provides to its clients. As a result, testing and research on dedicated slices would be made possible. These slices could individually mirror an existing network and offer real services on top without interfering with other slices that maintain the existing network.

2. Network Slicing Applications

A network service provider must share a physical infrastructure in order to provide multiple services, each with unique requirements. Since the virtual slice can be "tailored" for the particular service without incorporating all the capabilities of the underlying network, infrastructure sharing is made flexible and effective.

Since it guarantees isolation, guaranteed performance, scalability, and support for multi-vendor and multiple-operator scenarios, it can be said that slicing is used whenever there is a common infrastructure and on-demand customisation is practical.

3. Principal Players and Applications

Network slicing will be advantageous to a variety of players because it allows them to use a shared hardware infrastructure that supports multiple logical and virtual networks and provides a selection of independent services.

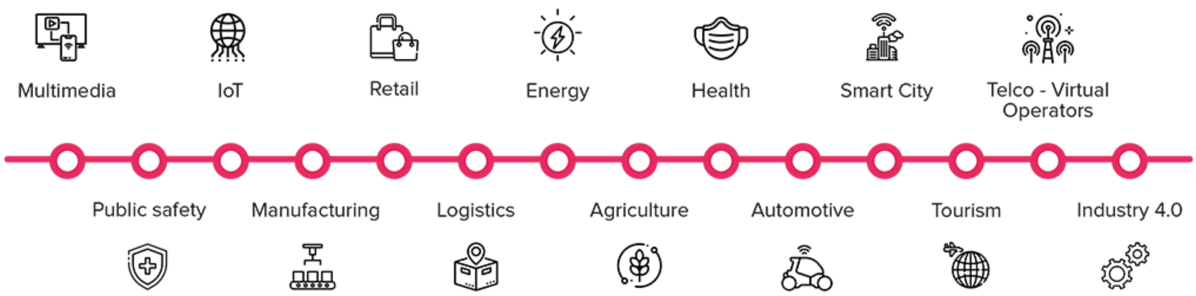

Figure 3: Applications of Network slicing

These participants may be the creators, suppliers, or consumers of such virtual services. Tourism, Multimedia, Manufacturing, Agriculture, Retail, Energy, Health, Public Safety, Logistics, Smart Cities, Automotive, Industry 4.0, Telco and Virtual Operators, and IoT in general are just a few of the industry sectors that are interested in the effects of Network Slicing. Figure 3 lists more business sectors as well.

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

The 5G network is divided into segments, and network traffic is managed using SDN-based technology. Modern technology prepares for significant network strain when many users use multiple services and apps at once. The devices that users use and the services they need are also impacted by a number of factors, such as how the channel between users and base stations changes depending on the location. The principles of network slicing and the availability of network slices give the most recent SDN technology the assistance it needs to improve these circumstances. Latency, connectivity, and data rate are the main factors that encourage boosting availability in the architecture of 5G network slices [9–14]. Traffic management demands connection, data throughput, and latency when users access services and applications.

The 5G network's essential elements, non-orthogonal multiple access (NOMA) and orthogonal multiple access (OMA), enhance the channel, transmission, and reception performance of data. SoDeMa is currently considered to be a new multiple scheme for 5G and beyond, having been influenced by the delta OMA standard announced in [15]. 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 NOMA and OMA 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. User devices should be able to rapidly interface with internet services and apps, despite high expectations. The multiple access (MA), channel capacity, transmission rate, and other factors should be at the core of the management of the data flow. The study motivates to assess, monitor, and manage the traffic in this study as a result of the high volume of traffic and the need to find strategies to improve the uptime of online services and apps. For the contribution based on the fundamental characteristics of SDN, we created a cutting-edge network slicing technique and SoDeMa-based algorithm. This may reduce the response time for machine learning (ML) applications involving fast timing by defining network issues and settings through the SDN, which streamlines 5G slicing for regulating network traffic using SoDeMa.

EVALUATION OF THE LITERATURE AND RELATED WORK

This section discusses the 5G network slice and how it uses SoDeMa to manage network traffic in order to increase network services' accessibility and availability. Despite the fact that SDN technology increases the requirements for 5G, the network slice method based on requirements allows us to maximize service availability by delivering the required functionality. Network slices, which offer precise and specific networking resources and network features, are essentially logical networks.

Network slicing makes it possible to create traffic isolations that provide the best solutions for various market clients. According to [16], one of the key technologies of the 5G mobile networks is network slicing. Virtual networks and customized, on-demand services are made possible by the slicing technique. By 2030, the 5G+ network's network slicing capabilities will enable a wide range of services and applications with potentially disparate technological requirements. To meet the range of demands, 5G+ slices for a mobile network operator should develop into an end-to-end adaptive, demand-oriented, and scalable 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 random access for brain communication, channel partitioning, cooperative content caching, cache management, dynamic resource management, etc. The development of MA protocols based on SoDeMa techniques will have several benefits, including an increase in data flow.

TM is in charge of the lightweight data, which might only be 40 bytes in size, according to the authors of [19]. The 5G network, which handles monitoring and other light data traffic, can be divided by service providers thanks to the admission control method, which also improves TM. This is done with the use of SDN. 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]. Service providers can enhance traffic performance and network management by using dynamic weight settings for routing algorithms rather than fixed weight settings. 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 manage traffic and applications intelligently and dynamically in order to handle the numerous network communication services. Femtocells may be conceived of as having greater energy efficiency (EE) than giant cells in this scenario due to their broad coverage. When using femtocells, energy-efficient management through traffic monitoring, analysis, and measurement is taken into account. Despite the many obstacles, we are eager to examine the traffic modeling used in IoT-based femtocell applications and slices related to accessing technologies. We can create a unique plan that generates effective TM using various traffic models, such as the dynamic and static models shown in [22].

The upcoming forms of the 5G domain could incorporate innovation and complete integration of microscopic cells. These cells are mobile phone nodes that increase bandwidth efficiency and frequency utilisation within the constrained area, two metrics that are taken into account when evaluating network traffic performance. The rapid spread of condensed networks among many connected Internet of Things devices is brought on by the improvement of bandwidth efficiency, which precludes any further range extension. The development of traffic modeling with network slices, which improve the network TM with the QoS and the availability of services during the peak period, is supported by small cells in the upcoming 5G-based IoT [23].

IV. PERFORMANCE OF 5G SLICES

The network slice administrators, who arrange the available slices in accordance with user preferences and priorities, are responsible for the TM. We can develop the network slice algorithm for managing services, network traffic, and ML-based 5G network applications based on the characteristics listed in Table 2.

Table 2: Expected 5G MA functionalities in standardised slice types

Standard types of Slices	Expected functionalities of 5G MA	Measurement details of SoDeMa used for managing traffic
eMBB	High user density, large network capacity standardised user experience MU-MIMO is a simple multi-user multiple input multiple output system, transmission of many traffic kinds, highly effective transmission of small packets	Bandwidth, spectrum uptime, Power, spectral efficiency, availability of EE, etc
URLLC	Ultra high-reliability transmission, Ultra-low latency transmission Highly efficient small packets transmission	Rate details, EE Packet size Accuracy of latency Lifetime.
IoT	Large-scale connectivity	Scalability and Complexity.

For a few selected 5G network slices, Table 1 lists the anticipated capabilities of generic MA, SoDeMa measurement data, and traffic management. eMBB, millimeter-wave (mmWave), long-term evolution, URLLC, massive machine-type communications (mMTC), Internet of Things (IoT), relay, WiFi, and vehicle-to-vehicle (V2V) communications are all taken into account in these chosen slices. The article [24] introduces the URLLC-aware frame structure and integrated mmWave-microWave communications. Even though mmWave communication alone might not be sufficient support, an integrated version of 5G network slicing with SoDeMa improves the expanding wireless communication.

1. Rates And Availability

The network slicing algorithm's rate-dependent applications and services, including enhanced mobile broadband services, are made more readily available when a large number of customers utilise them. Holograms, augmented reality, 4K/8K Ultra-High Definition (HD) video, virtual reality, and other fast and excellent multimedia services are a few examples of rate-dependent services. The users may obtain these services whenever they need them. Slice m's total transmission rate is calculated 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, slice m's total user equipment (UE) rate is $R^{n}_{i,m}(t)$. There are M slices in the network. The k_m is a slice m active UE. N ($n \in N$) subchannels are present. The sub-channel allocation adjustment action is also known as $c^{n}_{i,m}(t)$. 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, sophisticated network services, and immersive video conferencing, and

2. Latencies with Availability

The network slice technique focuses on minimizing latencies, whereby low-complex design is the best way to improve the services, despite the predicted delay being less than 1 millisecond. For instance, medical services use the shortest latencies to increase accuracy during surgery and when writing online prescriptions for medications. 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. Numerous services in numerous applications will use less complex, low-latency, and maximal EE designs thanks to the network slice algorithm and functions. The step-by-step slicing operations of the network slice algorithms typically have higher latency due to delays. The average latency (2) can be decreased by taking into account the queue length, the volume of data that arrived, and the quantity of packets that UE i sent in slice m.

$$D_m = \sum_{i=1}^{k_m} D_{i,m} \quad (2)$$

The $D_{i,m}$ and D_m 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.

3. Connectivity and Availability

The mMTC's goal is to make it easier for numerous IoT devices to connect and communicate with one another. Future mMTC hardware ought to be able to control millions 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). The linkages will be improved if energy is maintained across them [26]. Calculating the connecting energy should take into consideration the amount of energy used during the connection, the energy length, and the amount of transmission energy used by UE i in slice m (3).

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

where; Ai,m, Ei,m, Bi,m Li,m, stand for the arrival, duration, and battery capacity of the energy, and, consumption, 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. With the proliferation of connected objects, various services utilizing 5G network slices are now accessible to consumer electronics like smart appliances. Services include communication between vehicles and between vehicles and road infrastructure, among other things.

V. SLICES OF THE NETWORK FOR MANAGING NETWORK TRAFFIC

Service providers use the RAN, the availability of network slicing features, and CN, respectively, to better cater to customer preferences. Try to only use one service at a time when many users and their devices are online; otherwise, accessing that particular service will be challenging due to the service's delayed connectivity and slower data rate. The network slicing features, which affect data speed, latency, and connectivity, are a requirement for novel slice algorithms. The usability of services is improved by the management of data traffic through network slicing, as shown in Figure 4.

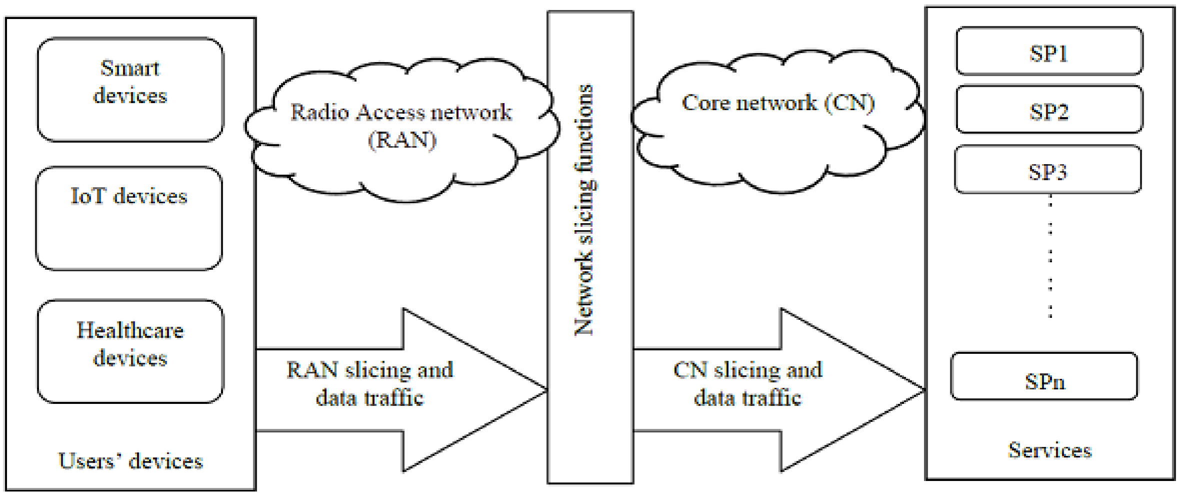

Figure 4: Network slicing for managing services as well as data traffic

Establishing classes of service at radio and for end users using the resources of providers is possible in accordance with network slicing. In order to maintain QoS, service providers (SP1, SP2,..., SPn) deliver the services over CN and RAN with the appropriate slicing. Radio grants transportation a great deal of autonomy in this manner, enabling it to organize its internal resources into services, expose them in the appropriate slices, and dynamically reorganize traffic.

1. Allocation of Resources

Despite having various resource distribution characteristics, slices enable the virtualization of SDN-dependent network resources, enabling service providers to distribute the physical resources in a programmable manner. Allocating physical resources to the virtual slices is a key component of complete 5G network slicing designs. Since SDN can precisely control network mobility, it can easily manage all resource allocation processes for central slices. The foundation for developing the slicing architecture of the 5G network is also the control of software's hardware and infrastructure. Although each network slice will operate independently as a different network, all network slices must share the same physical infrastructure and network resources. By exploiting the resources shared between them and the service providers, users should be able to govern their data through network services anytime and whenever they want to. Therefore, service providers need to make sure that all of the network services based on 5G slices that they offer are accessible when customers need them. The service time in this case is influenced by temporal complexity and is dependent on how the network services affect the resources, including whether they are up or down.

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

According to (4), it is feasible to calculate the services' availability (A) for use in any application. In this, t stands for service downtime, and (4) represents the service time determined using the network slice approach.

2. Complete Slice Orchestration

End-to-end slice orchestration is harder with 5G's sliced network. 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. To put it another way, slice orchestration failure brought on by virtualization's constrained power [27]. Adaptive network slicing with multi-site deployment improves the functionality of the network slice approach in 5G core networks [28].

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

Even though simple MA based on SDN improves accessing management of network traffic, the aforementioned characteristics are expected when modeling network traffic. Below is a list of the devices and services that the 5G slices support for users (U1,U2,...Un). Priority (Pu), limited (Lu), energy (Eu), security (Su), and other factors may be considered with 5G slices in these services. The development of a network traffic model (NTM) based on SoDeMa is suggested as one strategy for boosting traffic in this study [29–33]. Service providers can manage and control the dynamic network traffic with the help of NTM monitoring.

1. A Summary of the Slicing Algorithm

Figure 5 depicts the network TM process, which is reliant on the SoDeMa slicing algorithm, traffic algorithms, and network slicer characteristics. Despite the fact that there are numerous slicing techniques, we concentrated on the slice algorithm because it accelerates the NTM's response time. The stages of the slicing algorithm are as follows: The functions in Section 4 are utilised for network slices of 5G+ traffic, and Section 5 covers how to control data traffic using SDN, if the network slice's throughput is greater than zero. 4) One can determine the latency of a network slice by dividing its capacity by its throughput. This method for the priority service (Pu) served as an example for how we calculated and assessed the response time.

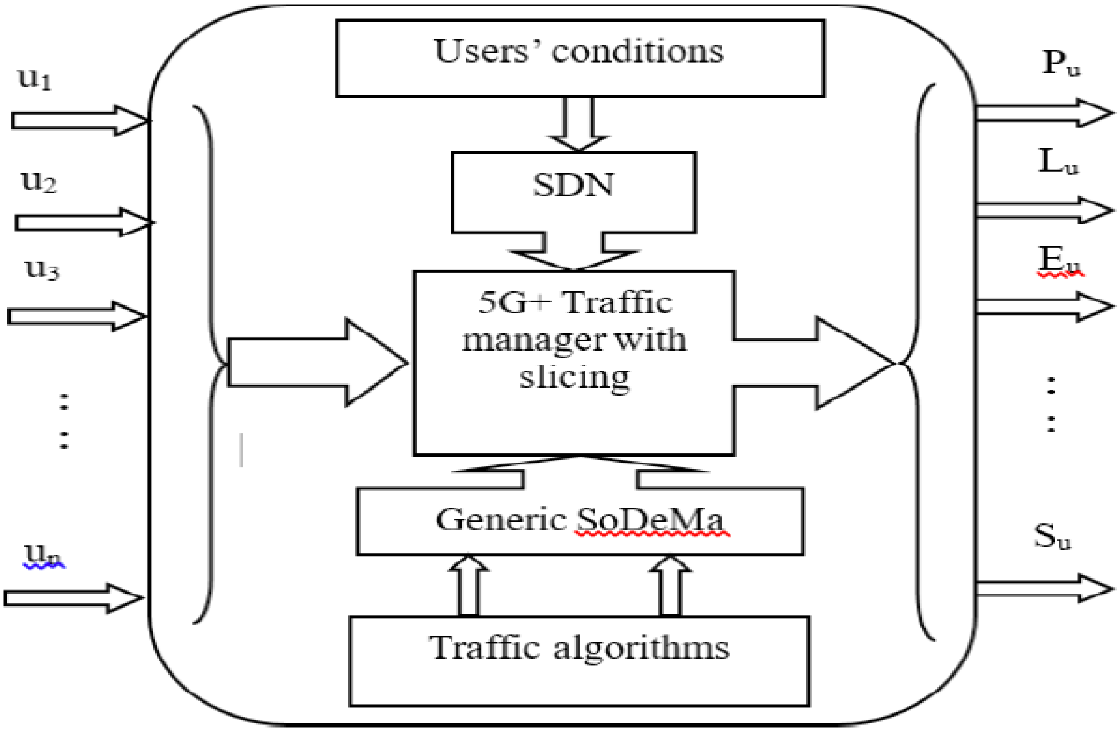

Figure 5: Model for network traffic based on SoDeMa

2. Conclusions and Analysis

The availability is demonstrated by the average response time in figure 6, which enables us to use network slices to enhance the services. Here, the SoDeMa-based design of the network slicing method reduces overall complexity and accelerates response time. Thanks to the 5G network slicing, which enables the services' availability and access based on the consumers' preferences, response time stays constant as we add more users.

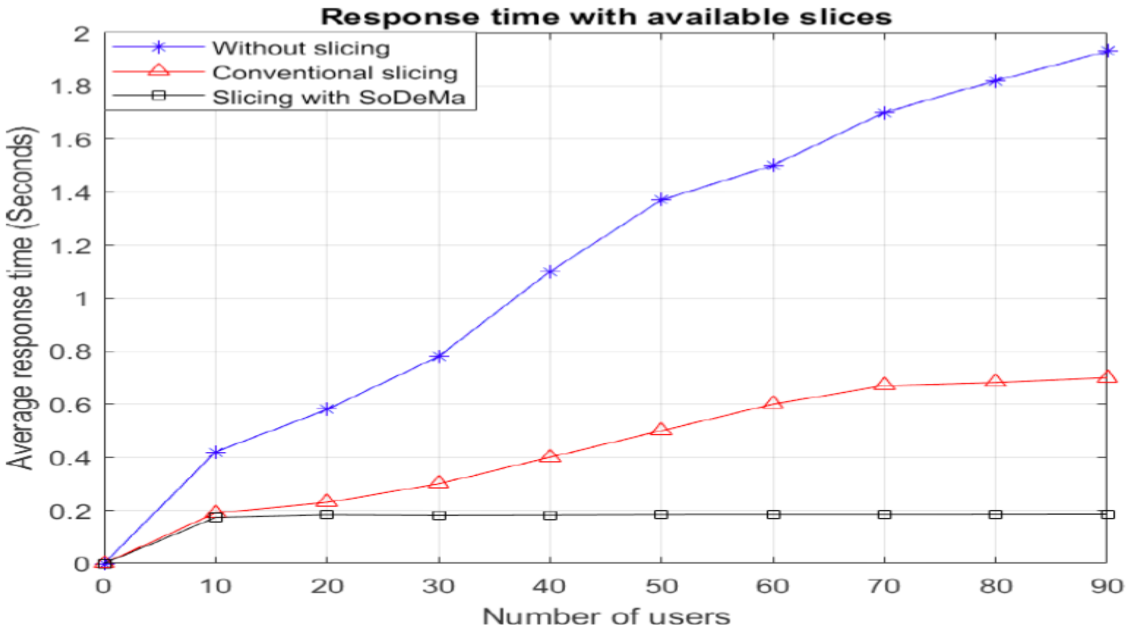

Figure 6: Response time average with and without network slices

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

VIII. SUMMARY AND FUTURE WORK

Through the use of Software Defined Multiple Access (SoDeMa) and 5G slices, this work example offers improvements to 5G network traffic. The current chapter analyzed the three standardised slice types (IoT, eMBB, and URLCC) that enable us to assess the accessibility of 5G slices. SoDeMa is still regarded as a superb multiple access solution for large wireless connections in 5G and 5G+ wireless networks, despite the fact that we looked at other accessing techniques. An innovative network traffic model was suggested in this theoretical study for effectively managing data flow and services. By utilising a generic SoDeMa, we innovated in this new model. SoDeMa significantly reduces receiver complexity, processing time, and installation costs in relation to the availability of 5G network slices. Due to the need to manage the continuously expanding traffic among various users, the biggest challenge in future development will be to utilise the least amount of energy while maintaining the greatest degree of security. To address the real-time traffic issues that data handlers, service providers, etc. face, we intend to create a new network architecture called SoDeMa. [34, 35] make the case that data handlers—including data centers utilizing machine learning—should take a more proactive approach to addressing the growing issue of managing data traffic and cybersecurity issues taken into account in 5G networks and beyond. The potential of event-driven networking and 5G wireless technology holds promise for the future of telecommunications, but how well the remaining issues are resolved will decide the outcome.

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