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A Review On: Secure Live Video Streaming and Network Slicing

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ABSTRACT

Multi-networking platforms can all use the same physical infrastructure called "network slicing". It is a logical representation of the connections between the network devices and the back-end applications. Slicing and virtualizing 5G networks and their functions is discussed in the present study. Researchers also explore 5G network slicing technologies including SDN, NFV, fog computing, and Virtual machines. In the 5th Generation (5G) of mobile communication networks, it was discovered that network slicing is connected to the creation and maintenance of an independent logical network on a common physical platform With the advent of 5G, new technologies like network slicing will make it possible for various parts of the network to share resources. Smart, critical, and multiservice with diverse requirements can be delivered through the network as an infrastructure and then into the network as a set of services using this technology. Despite its advantages, there are a number of security concerns stemming from resource sharing and isolation among services. Slices delivering customized services with various requirements may also have varying security levels and rules, which makes security a major issue for network slicing. Consider the influence of these security challenges on network slices when establishing or designing security protocols. In order to safeguard the privacy and security of our users while also delivering the performance and quality our customers expect, we must address these issues. Network slicing architecture, taxonomy, difficulties, security issues and threats classification are only a few of the topics that have been addressed in the available literature. With SDN, network behavior may be dynamically initialized, controlled, changed, and managed via open interfaces. SDN is a new approach to network programmability. It is possible to overcome the restrictions of the old Internet architecture and provide services such as inter-domain network layer multicast for live video streaming thanks to the rise of SDN technology.

Keywords— Video Streaming, Network Slicing, 5G.

I. Introduction

Providing real-time multimedia services over the Internet has been made possible because to recent advancements in computer and compression technology, as well as high-bandwidth storage devices and fast networks. As the name suggests, real-time multimedia is constrained by a sense of time. Audio and video files, for example, must be played back indefinitely. The playout process will pause if the data is not received in a timely manner, which is inconvenient for human ears and sight. Using SDN, the control and forwarding planes are separated, making it possible to programme the network control directly and to abstract the underlying infrastructure for use by network applications. Network traffic can be monitored, forwarded and optimized at runtime by a centralized controller that has a global view of the network. Using this flexibility and control, services like inter-domain multicast can be provided. Because 40% of Internet video traffic is live, multicasting can save a lot of system and network resources. For some time now, it has been advocated to use SDN-based multicast frameworks to provide content and/or network providers with the control they need to implement a streaming video service.

It has been increasingly difficult to maintain a high quality of service (QoS) in wireless networks during the past few decades. As a result of the proliferation of these tools, there has been an increase in the demand for radio spectrum and bandwidth. Existing wireless networks are unable to meet the needs of today's networks with the resources they have available. A novel method based on dense and flexible architecture is therefore necessary in order to maintain acceptable QoS and QoE while saving resources. Each service's unique needs were addressed by researchers in the development of cutting-edge technologies that maximized the network's bandwidth and reduced traffic strain. Host new services with different specs and requirements without increasing network resources while retaining network performance thanks to new emerging technologies.

For many decades, video has been a vital communications and entertainment medium. An example of how a movie can be used to tell a story is by showing a series of images that appear to be moving in real time. It was known in China in the second century, but curiosity lasted until the end of the nineteenth century. Around 1888, the first motion picture camera was invented, allowing for the capture and storage of all of the film's separate frames on a single reel. This allows for the automatic recording of scenes for the first time. Moving pictures were also transformed into large-scale presentations for large crowds when movie projectors were created. This was done in a hurry to accommodate a larger audience. Since its inception in 1928, television broadcasting has attracted billions of people from around the world to simultaneously watch both live events and recorded videos on their television screens. As a key source of entertainment and news, television replaced newspapers and radio as the preferred mode of communication for many people. Over-the-air broadcasts and cable transmissions were the only means to view television for most of the twentieth century.

One of the most passionately debated issues in the ongoing attempts to define and standardize the 5G System pillars, which are aiming at an early 2020 implementation, is Network Slicing. 5G's "Network Slicing" was first discussed in the NGMN by mobile network providers. To have a better grasp of a topic, it's helpful to go back to the beginning. While testing 5G applications in 2015, it became evident that the 4G network architecture couldn't accommodate all the needs that arose from 5G applications. 4G design was viewed as "not versatile and adaptable enough to properly manage a wider range of enterprises needed when each has its own set of performance, scalability and availability criteria" as a result of this According to the report, a 5G system should have been developed that was future-proof and allowed for the rapid introduction of new network services. As a starting point, the concept of 5G Network Slicing was introduced. When it comes to network slice concepts, NGMN stated that SIL, NSI, and Resource layers were all part of the overall concept. "A Service Instance is a representation of a service," as stated in "A Service Instance is a service." It is also possible to use a Service Instance to represent a third-party service provided by an operator. NGMN also envisaged that network operators would make use of a Network Slice Blueprint in order to construct an NSI (NSB). NSIs are responsible for providing the network properties required by a Service Instance. It is possible for a network operator to share an NSI with many Service Instances. An NSI is a "collection of network functions, and resources to run these network functions, forming a complete instantiated logical network," according to the Service Instance(s). The Network Slice Blueprint defined all parts of the NSI's structure, configuration, and plans/workflows on how to instantiate and control the NSI. In order to establish a Network Slice, the Blueprint outlines the physical and logical resources required. NGMN definitions are comprehensive and well-written, but they were created from a network operator's perspective, so they emphasize end services and don't distinguish between different domains. It describes the system architecture, network lifecycle/management and resource/infrastructure components in detail in Network Slice Blueprint.

II. Literature Review

Ibrahim Afolabi et. All (2018) This article provides an in-depth examination of the current state of 5G network slicing maturity. This article takes a look at how network slicing got its start as a network sharing mechanism and how it has evolved into the cornerstone of 5G technology. Technologies like network functions virtualization (NFV), software-defined networking (SDN), and cloud computing make network slicing possible (cloud computing). 5G services and business drivers are discussed in this article, as well as the impact of slicing on the RAN, core network, and transport networks. [1]

Alcardo Alex Barakabitzea et. All (2020) Researchers and businesses alike are embracing new technologies like SDN (software-defined networking) and NFV (network virtualization) to address the challenges of 5G network resource management and orchestration. A programmable, cost-effective, and adaptable 5G network management and administration is expected to be made possible by SDN/NFV in the future. Slicing networks is at the heart of 5G, helping to meet ever-stricter service level agreements (ELA/SLAs) and business-critical needs in the vertical industries it is designed to serve. By combining SDN and NFV, authors provide a comprehensive look at the most cutting-edge network slicing technologies in 5G. [2]

P. Iyyanar et. All (2012) Whether it's prerecorded or live, video is king in real-time multimedia networking. streaming technique does not necessitate downloading the complete video file; rather, the video file is played while the video file's content is received and decoded. In order to send video over the Internet, compression and protocol design are two approaches that can be used. A low-bit-rate coder and UDP encryption are two possible solutions to this issue. To design a new transport protocol, you could employ the utilization of video encoding techniques. There must be a high degree of security for streaming applications. Video communications over untrusted client–server networks can be securely encrypted, according to this study. [3]

Huifen Huang et. All (2020) In order to provide online video applications with a quality of service (QoS), network congestion must be avoided because it increases packet loss and transmission latency. The network topology and connection bandwidth consumption condition can be easily obtained by the controller in SDN. This study proposes an SDN-based video multicast routing solution, known as CAVM, based on the foregoing advantages. Using OpenFlow, a well-liked SDN southbound interface, CAVM gathers network topology data, keeps tabs on bandwidth usage, and calculates link delays. An SDN-based multicast routing solution for online video applications is presented in this research. The OpenFlow specification is used to keep track of the network and calculate link delays. The DCMCCMR problem and a function for evaluating congestion degree were both introduced in this study. A NP-hard DCMCCMR issue. To approximate a polynomial-time solution, we devised a new algorithm. Video Quality of Service (QoS) may be guaranteed with our solution's ability to prevent congestion. In the future, we'd like to provide the option to reroute some multicast paths if they become clogged with following traffic as part of our solution. Knowledge discovery-based link use frequency evaluation is an additional goal. [4]

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Xenofon Foukas et. All (2017) The new 5G networks, which are multiservice environments capable of dynamically launching services with a wide range of performance needs, will be used by mobile network operators, verticals, and over-the-top (OTT) service providers. To achieve this goal at a fair cost, mobile network virtualization is essential. When it comes to mobile core virtualization, RAN virtualization is a relative newcomer. On the fly virtualization of base stations, flexible modification of slices to meet particular service requirements, and use in an end-to-end network slicing environment are all features of the Orion RAN slice system introduced here. Orion maintains functional and performance isolation while allowing for efficient distribution of RAN resources among the slices. [5]
Rafael Montero et. All (2019) Network slicing with Quality of Experience/Quality of Service (QoE/QoS) guarantees is a key enabler of future 5G networks. There are still certain difficulties that need to be solved in order to guarantee effective service delivery from beginning to end. Network slice deployments that consider operation across numerous domains and network segments necessitate inter-domain settings, constant monitoring, potential actuations, and inter-slice isolation in order to deliver and maintain their stated Key Performance Indicators (KPIs). In this scenario, optical networks are crucial because they allow the connecting of several distant segments and Points of Presences (PoPs). [6]
Christelle Al Hasrouty et .all (2018) As the amount of video data is enormous, video conferences put a lot of demand on the network. Upgrades to network operators' video conferencing systems save considerable bandwidth, allowing them to serve more customers while simultaneously improving their quality of service (QoE). SDN, or software-defined networking, is opening new possibilities for video management. SDN-enabled networks can be used to reduce bandwidth consumption in the core network while still delivering the best possible visual quality to customers, according to the study presented in this paper. Video streams are tailored to the user's access network characteristics while being sent via multicast trees via SVC layer changes in the network. [7]
R. Pereiraa et. All (2016) Processing, storage, networking, compression, and mobile computing have all contributed to the widespread adoption of technology-mediated communication as a new way of life. It has resulted in a shift in people's daily routines, from work to leisure, education and social contact to commercial transactions and healthcare: people's everyday lives have become increasingly digital. Media-rich networked and mobile applications are the driving force behind this paradigm shift in global lifestyles. In this case, video streaming is used extensively for everything from movie and TV streaming to videoconferencing, education, video telephony, gaming, and social network video sharing. A wide range of industries are being pushed to new heights by challenges like these. [8]
Alexander Hefele et. All (2020) Modules for 5G mobile backhaul that are ultra-reliable and low-latency (URLLC) are discussed here. In this proposal, URLLC communications will be implemented via SDN-based network slicing. This paper describes the network slicing components and procedures in detail. An imaginary Mobile Backhaul network will be used to show the concept in practice. It was discovered in this research that SDN might be used to provide mobile backhaul network slicing. Measurement and monitoring tools can be used for OpenFlow-enabled networks, according to this article. This data is used to determine reliable and low-latency URLLC paths that can be given to the URLLC group. The suggested controller application is put to the test on overburdened network lines. That SDN-managed Backhaul networks may provide alternate channels for URLLC group packets once they are detected to be crowded illustrates their ability to react to changes in topology. [9]
En-zhong et. All (2016) An MCU (multipoint control unit) is now used to bridge the current standard video conferencing connection, which can result in significant delays and communication bottlenecks. Software-defined networking (SDN) allows for the implementation of video conferencing systems, increasing the system's controllability, scalability, and flexibility. The scalable video coding (SVC) approach, which encodes video, can also aid. An SVC-enabled multicasting video conferencing architecture is proposed in this work, which eliminates the traditional IGMP and MCU. [10]
Qiang Gao1 et. All (2015) In distributed shared memory systems, synchronization strategies such as broadcast or multicast are frequently employed. A lack of transparency about the time spent synchronizing is caused by interrupting unrelated activities in the same multicast group at the same time. Synchronization for distributed shared memory can be improved by using an SDN multicast forwarding rule and dynamic core-based tree approach. Experiments with the prototype system in a homogenous testing environment demonstrate that it is capable of delivering better response times and process planning than a traditional Ethernet-based solution. Our goal was to determine whether SDN multicast may aid DSM synchronization, therefore we ran an experiment. [11]
Shalitha Wijethilaka et. All (2021) The Internet of Things (IoT) is a rapidly evolving technology that can be put to a variety of useful ends. Five-generation (5G) wireless networks will be used to connect IoT devices during the next few years. That's why it was built with the Internet of Things in mind, allowing for quick expansion (IoT). In the 5G architecture, slicing is an essential technology that allows the physical network to be partitioned into numerous logical networks (i.e. slices) (i.e. networks). Consequently, network slicing is an essential part of 5G IoT development. If you have multiple IoT apps, you may utilise network slicing to create a different slice for each one. According to this report, IoT implementation requires network slicing. [12]
Alcardo Alex Barakabitzea et. All (2019) As a result of the rise of high-quality multimedia services and customer demand, the way we manage networks has undergone a fundamental transformation, with forwarding, control, and

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administration being abstracted, separated, and mapped. With 5G, industry and academia alike are embracing next-generation vertical applications with a wide range of service requirements. This 5G network vision can only be realized by segmenting the physical network into a number of independent logical networks, each with a different scale and architecture to fulfil the specific needs of various service types (e.g., a slice for massive IoT devices, smartphones or autonomous cars, etc.). The control and management gap left by traditional networks is projected to be filled by 5G's Software-Defined Networking (SDN) and Network Function Virtualization (NFV). [13]

Christian Koch et. All (2017) Internet service providers' networks see the majority of their traffic as video. More and better quality films are in high demand, yet network bandwidth is constrained. Content delivery networks (CDNs) now provide the majority of OTT video content (CDNs). IP multicast is an efficient method of delivering ISP-internal videos such as IPTV channels. This approach is rendered useless by the sheer volume and Zipf-distributed popularity of OTT videos. SDN-based multicast can be used by ISPs to provide content based on network-level multicasting. OTT video-on-demand (VoD) hasn't used it yet. There are three ways in which this work contributes to our understanding of the topic. To begin, "VoDCast," a novel multicast approach for delivering OTT video, is unveiled for the first time. A trace-based simulation of our network is the next phase in our process. [14]

Ahmed Khalid et. All (2017) SDN is poised to exceed the inflexible and static restrictions of traditional Internet architecture and deliver network layer multicast for live video streaming. Internet service providers (ISPs) and content delivery networks (CDNs) can both benefit from mCast, an SDN-based architecture for live streaming that is described in this paper (CDNs). For mCast to work, we suggest an inter-ISP and inter-CDN communication mechanism that protects both user privacy and the confidentiality of their data. Because of mCast's transparency, CDNs are kept in check on user sessions. We developed a test bed in order to perform a thorough evaluation and comparison. [15]

Xiantao Jiang et. All (2021) To achieve the quality of experience (QoE) objectives for video streaming applications in smart city, smart education, immersive service, or connected automotive scenarios, a number of challenges must be overcome, including ultra-high bandwidth and massive storage. MEC, a service that can supply video streaming services that require a lot of computation and caching, can meet the standards of Quality of Experience (QoE). Thus, a comprehensive analysis of the most recent developments in MEC-based video streaming is provided. To begin, an examination of the pertinent overview and prior information is conducted. Moreover, there have been debates on the optimum way to allocate the available resources. Video streaming is made possible by a combination of caching, processing, and networking. [16]

Xenofon Foukas et .all (2017) Mobile network operators, verticals, and over-the-top (OTT) service providers will all be able to launch services with varying performance requirements on the new 5G networks that are expected to emerge. Virtualizing the mobile network in a cost-effective manner is critical to this vision's success. RAN virtualization is still in its infancy compared to mobile core virtualization, which has been explored extensively. Our new RAN slicing system, Orion, allows base stations to be dynamically virtualized on the fly, and slices can be easily customized to fit the specific service requirements for each base station. It can also be used to slice the entire network from end to end. Slices are functionally and performance-isolated using Orion, and RAN resources can be shared efficiently across them. [17]

Panagiotis Georgopoulosa et. All (2015) Streaming live and on-demand video online has become a crucial element of many people's daily routines. Because of this, video streaming places a significant strain on network resources. This is due to the fact that it must be able to provide consumers with large amounts of data in a timely manner. An autonomous flow for each user request is used in the Video-on-Demand (VoD) model of delivery. As a result, numerous copies of the same video files run through the network, increasing the load on the infrastructure. In this paper, we offer OpenCache, an in-network caching service that is highly flexible, efficient, and transparent, with the goal of improving the efficiency of VoD distribution by storing video assets as close as possible to end users. Improve network efficiency and user satisfaction by using OpenCache's Software [18]

Algimantas Venčkauskas et. All (2018) The old cloud and host computing architectures cannot address the many new issues posed by the Internet of Things (IoT). Fog computing, a new architecture for bridging technological and security gaps, is on the rise. When it comes to solving new security concerns in fog computing end devices, where energy and computational resources are restricted, traditional security paradigms like Transport Layer Security (TLS) and client/server point-to-point protocols are no longer the ideal options. For the "Fog Node-End Device" layer of fog computing, we provide a lightweight, secure streaming protocol in this work. Authentication, integrity and confidentiality are all provided by this lightweight and connectionless protocol, which allows broadcast and multicast operations. Cryptographic methods such as HMACs and symmetrical cyphers are used, and modified User Datagram Protocol packets are used to encode authentication information into streaming data. [19]

Johanna Andrea et. All (2022) In order to achieve 5G and 6G networks, Network Slicing and Deep Reinforcement Learning (DRL) are essential. It is possible for a 5G/6G network to have a variety of different network slices from different tenants. To achieve the quality of service and quality of experience criteria of 5G and 6G use cases, network operators must undertake intelligent and efficient resource management. The task of resource management is anything but simple. Controlling admittance and allocating, scheduling and orchestrating resources is a difficult and dynamic task.

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In order to manage resources intelligently and effectively, it is necessary to anticipate the demand for services from tenants (each of whom has several requests for network slices) and achieve autonomous behavior from slices. [20]

B. Susila et. All (2015) Today's networks are expanding at a breakneck pace, driving up demand for bandwidth. Demand for bandwidth has increased due to streaming, multimedia, and cloud computing. The ever-changing needs of networks necessitate a shift in the design of the internet itself. The reliability of a network's architecture is enhanced by decoupling the control plane from the data plane. Even yet, the sheer number of protocols makes it nearly impossible to maintain complete command over the network itself. [21]

III. Network Slicing

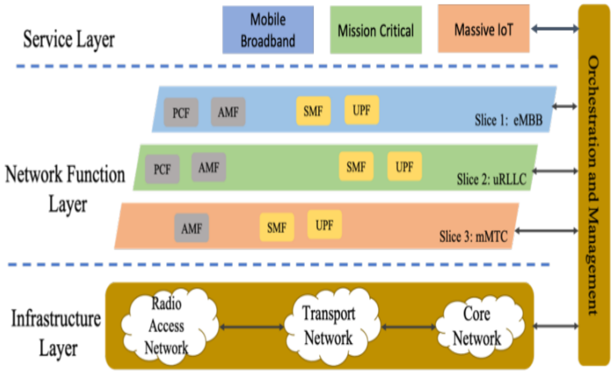

Figure 1: Network slicing

Mobile broadband (eMBB), ultrareliable and low-latency communication (uRLLC), and massive machine type communication (MMTC) are some of the services, applications, and scenarios that wireless communication systems demand (mMTC). eMBB services, such as virtual reality and video streaming, necessitate high bandwidth. For important services like self-driving cars, uRLLC services require low latency and minimal mistakes. mMTC services, such as sensing and monitoring devices, provide high connectivity to a large number of devices and users. The current network cannot accommodate all services, necessitating a single network that can accommodate them all. Using network slicing in 5G networks, different services with varying requirements can be delivered over the same network. In Figure 1, the network slicing framework may simultaneously conduct access, transport, and core network slices. The control plane and the user plane are both included in the core network slice, which has both shared and non-shared functionality. SMF, MMF, UPF, and PFC are only a few examples of these functions (PCF). Network slicing solutions have been suggested and designed by a number of firms, notably Ericsson and Nokia, to meet the needs of their respective industries. For the first time in history, a new paradigm for infrastructure sharing has been suggested. Multi-technology service delivery is made possible by the use of a single physical infrastructure and a number of separate logical networks. All of these new technologies are projected to offer a wide range of customized services with specific requirements in security, dependability and data throughput as well as latency and resources. The network performs better when specific resources are assigned to certain services, rather than when resources are provided indiscriminately. A high throughput and tolerable latency may be required for one service, while a low latency may be required for another. Other services may demand a low data rate, while others may require a low latency.

3.1 Architecture

The network slicing architecture can be shown in three ways in Figure 2, including domain, plan, and layer. In terms of network slicing, the radio access, transport, and core networks are the three domains or sub-slices. There must be an easily sliceable and segregated RAN, as well as an efficient allocation and scheduling of resources, in order to slice RAN sub slices. When a specific spectrum is designated to slices requiring high levels of protection, there are more security concerns. With network slicing technology, the management of physical and virtual resources as well as physical and virtual network operations have all benefited (PNF,VNF). PNF (hardware resources) and VNF (virtual network functions) are two distinct things (protocols and functions). The transport sub-slice is made up of the physical and virtual routers that link the core sub-slice to the outside networks through SDN. NFV architecture provides a virtual core network for customized services that may be scaled up and down according to demand. As a core slice, it corresponds An instance's slice template is used to build RAN sub slices, which are then linked to the proper RAN slices. Both conventional and specialized network functionalities are included in this system. Service infrastructure generally shares network functions, although some network operations are only available to certain service infrastructure. network slices include all aspects of infrastructure, control systems, and management strategies. As part of the infrastructure plane, controllers in each domain handle the security and service needs of the service providers. Resource allocation, slice

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formation, and slice deletion are all management plane actions. Orchestrators track resource usage and slice instances in real time and send out reports.

3.2 End-to-end security

An end-to-end security solution that encompasses radio access, transport, and core networks is needed for slicing networks. It's critical to isolate and coordinate each component of a system correctly. Each network slicing layer in the management and orchestration (MANO) process is linked to three key functions. It aims to manage the slice life cycle as well as automate the allocation of virtual resources. Inter-slice resource allocation in the 5G innovative radio multi-service adaptive network (IRMAN) could benefit from an SDN orchestrator (SDN-O) (NORMA). This can be done by using security measures that are suited to the specific needs and capabilities of the service that is being provided. The use of AI to automate resource management while keeping some level of security has been researched.. For an orchestration to be secure, it must be capable of adjusting its security measures in response to dynamic services and changing requirements. By using E2E network slicing security, multiple deployment scenarios can be accommodated while still receiving the necessary level of protection. An E2E architecture is required to ensure that data does not leak outside of the slices at any time. Before a network slice can be deployed across shared physical infrastructure, a SLA contract must be negotiated between the slice's resource supplier and the slice's service provider. The SLA contract contains additional information, such as the QoS standards for a specific service's quality of service delivery. Blockchain-based solutions for E2E security using smart contracts have been presented for many different scenarios. The authors created a trusted Blockchain architecture to protect network slicing. A single Service Level Agreement (SLA) between the parties is all that is needed to manage E2E security in the architecture proposed here. For secure network slicing, the authors proposed a Blockchain-based E2E trusted architecture. This architecture is able to guarantee E2E security and establish a trustworthy connection by utilizing anonymous transactions and SLA management between the required parties. It is possible for a variety of parties to be involved in the management of SLAs. It is possible to dynamically lease resources by slicing the network via slice brokering. The security of network slicing was ensured through the usage of decentralized storage systems acting as a broker for network slices. One of these platforms is Storj, which uses end-to-end encryption.

IV. Architecture for Video Streaming

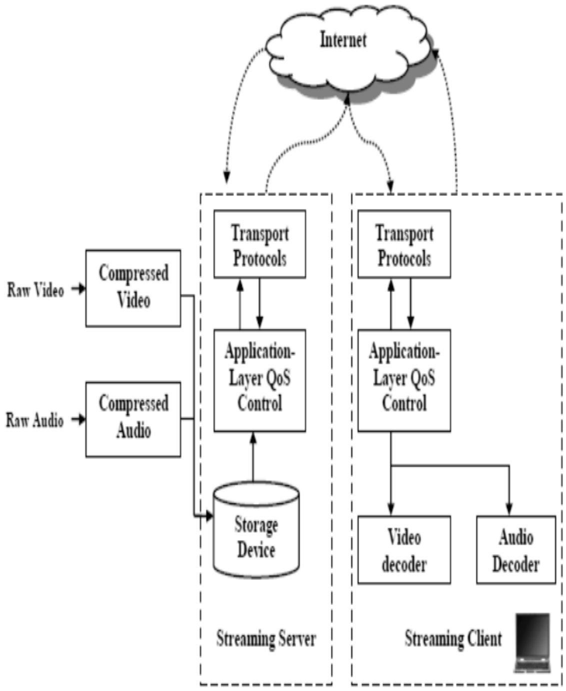

Figure 2: Video Streaming Architecture

Media compression, application-layer quality-of-service control, media distribution services, streaming servers, receiver-side media synchronization, and streaming media protocols are all shown in Figure 2.

4.1 Media compression: The high volume of raw multimedia data places a heavy burden on the network's bandwidth. As a result, compression is extensively used to improve transmission efficiency. The loss of audio is more aggravating to humans than video, despite the fact that video has larger bandwidth requirements (56 kbps-15 Mbps) and human beings are more irritated by audio loss. The data is subsequently saved in a storage device. By leveraging the similarities and redundancies that naturally occur in a visual signal, video compression can be achieved. Reduces the amount of

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unnecessary information in a visual signal by coding just those aspects that are perceptually significant. As a rule, video compression compresses multimedia content at a set playback rate.

4.2 Streaming servers: In order to provide streaming services, streaming servers are critical. streaming servers must be able to handle multimedia data in real time, perform VCR-like features, and retrieve media components simultaneously in order to provide improved streaming services. Real-time streaming protocol (RTSP) requests are typically sent by viewers to streaming servers. After receiving an inquiry, the server searches for a suggested media file with the desired name in it. RTP (Real-time Transport Protocol) streams are used if the requested media is in the folder.

4.3 Existing Streaming Networks: In order to offer a streaming service via the Internet, there are three main methods to choose from. In the first method, streaming media is cached and replicated for web distribution. Streaming content is provided over a Content Delivery Network (CDN) for large-scale services, increasing the scalability of online content distribution. The second approach is to make advantage of a network that has been built expressly for the distribution of streaming media. Many networks have been proposed that specialise in delivering video streams on a pay-per-view basis. On-demand Multimedia Streaming Networks are the name given to these networks. As a third option, clients can use broadband Internet connections at their homes to simultaneously view a number of television stations via live streaming.

4.4 Structure of a Video Stream

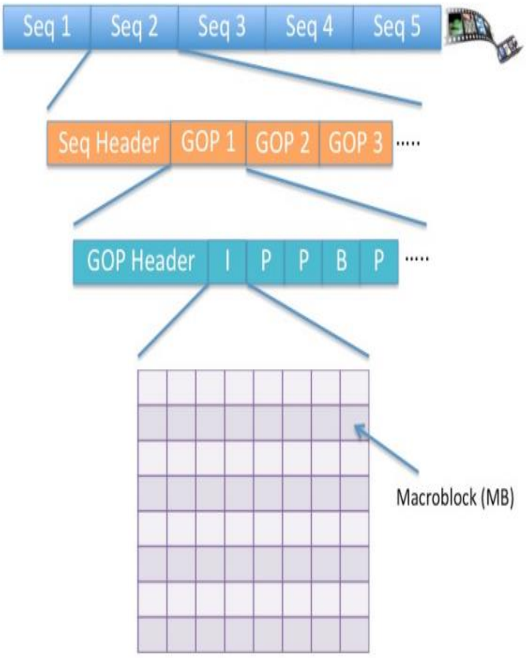

Figure 3: The structural overview of a video stream. A video stream contains multiple segments and each segment contains multiple GOPs. A frame in a GOP includes a number of macroblocks (MB)

Streaming video is made up of a sequence of smaller clips, as shown in Figure 3. Each Group Of Pictures has a section header at the top of the page (GOP). The segment header also includes information about the segment's GOP composition, such as the number and type of GOPs present. A GOP is a video's collection of frames. The first I (intra) frame is followed by several P and B (bi-directional anticipated) frames. macroblocks are separated from GOP frames using slices (MB). As the primary processing unit for video encoding and decoding, the MBs are used. There are two types of GOPs: those that are closed, and those that are open. It is not associated with any other Republican Party in the first scenario. It is now possible to process closed-GOPs independently. A Republican Party cannot be dealt with on its own when employing open-GOP because each Republican Party relies on the other. Segment, GOP, frame, slice, and macroblock are just few of the levels of video that can be split down. The sequence level allows for the processing of many GOPs independently. Because of the sequence's size, transmission and processing delays become bottlenecks. Frame, slice and macroblock-level spatial-temporal interactions demand complicated processing. Video stream providers often do processing on the segment or GOP level. For the purposes of this definition, we'll use the term "GOP."

V. Network Slicing in The 5G Architecture

For a flexible 5G architecture that can support a wide range of scenarios, this section focuses on the importance of network slicing. It then presents a generic framework that represents a wide range of proposals and will be used as a reference for our literature review on 5G network slicing in the following sections.

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5.1 Use Cases and Requirements

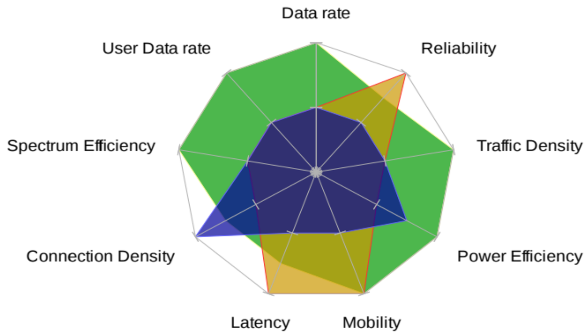

Figure 4: Key 5G use cases and their requirements

A wide number of sectors and use cases are expected to benefit from 5G. There are three key use case families described by the ITU and 5G-PPP: better mobile broadband, massive machine type communications, and essential communications. Specific use cases can be identified for a wide range of these technologies, from ubiquitous broadband connectivity to highly mobile sensor networks. These needs can't be met with a one-size-fits-all design because of the stark disparities between different scenarios. There have been a wide range of innovative architectural approaches to accommodate a variety of use cases, and the following sections illustrate two of them.

5.2 Architecture

Networking at NGMN has a flexible, softwarized architectural philosophy. According to this hypothesis, network slicing facilitates the coexistence of several vertical businesses on the same physical infrastructure. Since its inception, NGMN has advocated for a "end-to-end" scope (E2E) that encompasses both the radio access network (RAN) as well as the core network (CN). In order to realize this and provide the essential context awareness for users, devices, and use cases, it is important to separate both pieces into numerous superimposed instances. The entire process must be overseen by an E2E MANO entity with a major role in the architecture. The three key components of the NGMN design are infrastructure resources, business enablement, and business application. Network slice blueprints in this proposal provide the structure, configuration and work-flows for instantiating and controlling the network slice instance for the service throughout its lifecycle. Some services, such as those built on the blueprint, may require several sub-networks, each with their own unique configurations of network functions and resources to meet the requirements of their respective services.

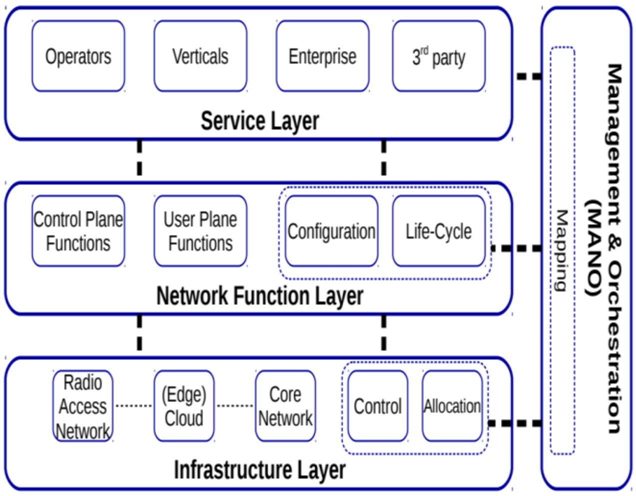

Figure 5: Generic framework representing various 5G architectural proposals. We review and appraise the 5G network slicing literature with respect to this framework

The 5G-PPP architectural vision takes a more in-depth look at the roles and connections among the many components that make up 5G networks. It is generally agreed that a hypothetical architecture for 5G must include softwarization and employ slicing in order to accommodate a wide range of application scenarios. Infrastructure, network function, orchestration, business function, and service layers make up the company's architectural proposal. As opposed to NGMN's single business application layer, which is divided into two parts (business function and service), 5G-separate

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PPP's orchestration/MANO layer is considered as a separate layer. Both solutions are based on layers of infrastructure and network function. More and more people agree that 5G services must have native support for softwarization and network slicing in order to be really 5G. ' By chaining network operations, mapping them to infrastructure resources, and setting up each slice's setup and monitoring, MANO also provides an entity that translates use cases and service models into network slices.

VI. CONCLUSION

This paper focuses on a survey and comprehensive analysis of a 5G network in the cloud resource slicing by applying network function virtualization, according to the detailed information. There is a lot of emphasis in this study on factors like resources, virtualization, and isolation, which are all important for implementing the network slicing concept in a practical manner. To far, there is no defined 5G network security specification that can be used to analyze network slicing systems. Emerging technologies and services, such as network slicing, may provide more security threats, which necessitates further efforts to build improved solutions for the predicted and unexpected vulnerabilities. As the popularity of video-on-demand on the Internet grows, so does its share of overall Internet traffic. Delivering video streaming services that are both high-quality and uninterruptible is a difficult task that necessitates a range of different technologies, from video streaming creation through video streaming playback. In the last decade, video streaming services have become increasingly dependent on the many cloud-based services that have emerged. For this study, it can be concluded that a comprehensive survey and analysis of the 5G cloud resource-slicing network employing network function virtualization is the primary focus, as outlined in the paper. For this study to be useful, the scope and problem definition and objective of the study must be clearly defined, and this study also gives a comprehensive foundation on 5G Network Slices and Network Function Virtualization. Additionally, 5G Network Slicing Technology, which makes SDN and other similar technologies like it possible, was examined in depth.

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