IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed journal ⁜ Vol. 12, Issue 10, October 2023

DOI: 10.17148/IJARCCE.2023.121004

DEPLOYMENT OF 5G-ADVANCED ARCHITECTURE FOR FUTURE APPLICATIONS

Okorogu Victor Ndubuisi[1], Alumona Theophilus Leonard[2]

Electronic and Computer Engineering, Nnamdi Azikiwe University Awka, Anambra State Nigeria[1]

Electronic and Computer Engineering, Nnamdi Azikiwe University Awka, Anambra State Nigeria[2]

vn.okorogu@unizik.edu.ng, tl.alumona@unizik.edu.ng

Abstract: In comparison to current 4G LTE networks, the ultimate objectives of the upcoming 5G wireless networking are to have relatively fast data speeds, incredibly low latency, significant increases in base station efficiency, and significant changes in expected Quality of Service (QoS) for customers. The use of broadband data has increased quickly as a result of the need to deal with cutting-edge technologies and connectivity, such as smart cell phones, internet of things (IoT) devices, autonomous vehicles, virtual reality equipment, and connectivity in smart homes. Furthermore, a significant increase in system bandwidth is required to support the most recent applications. Utilizing a contemporary spectrum with higher data levels will enable this development. Globally, 5G network commercialization is accelerating. 5G communications are viewed from the perspective of industry development drivers as being essential for improvements to personal consumption experiences and digital industrial transformation. Globally significant economies need 5G to be a crucial component of long-term industrial development. Thousands of industries will adopt 5G both commercially and technically. Further DOICT and other technology integration is required for 5G. As a result, this white paper suggests ongoing research on the continued development of 5G networks. Full consideration of architecture evolution and function enhancement is required, along with 5G-Advanced. Using the three characteristics of artificial intelligence, convergence, and enablement, this white paper analyzes the network evolution architecture of 5G-Advanced before elaborating on the technical development direction of 5G-Advanced. Artificial intelligence refers to network AI, which makes full use of machine learning, digital twins, recognition, and intention networks to improve the network's ability to operate and maintain itself intelligently. 5G and industry network convergence are examples of convergence. In order to realize the integration development, there is convergence in the home network as well as the space-air-ground network. Enabling allows for the improvement of deterministic and interactive 5G communication capabilities. It improves current technologies like network slicing and positioning to better aid the industry's digital transformation..

Keywords: 5G Network , 5G Architecture, 5G Deployment, AI, 5G APPLICATION

I. INTRODUCTION

The term "5G" refers to the fifth generation of wireless telecommunications, which will revolutionize many areas of daily life. Due to new mobile technologies like virtual reality applications, high definition video streaming, and cloud gaming, mobile network traffic is still expanding very quickly. The speed of the increase in traffic and the anticipated demands of new scientific technologies, such as autonomous vehicles, virtual reality, and Unmanned Aerial Vehicles (UAVs), would unquestionably be beyond the capabilities of 4G services in a few years. As a result, numerous efforts have been made by academic and industrial researchers to make 5G systems a reality soon.. Both academia and business have agreed that software-defined networking (SDN) and network function virtualization (NFV) will be used by 5G systems to accomplish their objectives. The transmission speed of 5G is significantly faster than that of the current network. Data transmission rates up to 10Gbps, which are 10 to 100 times faster than 4G and 4G-LTE, will be available through 5G. In order to support the development of novel services, 5G is anticipated to surpass ultra-broadband networks and integrate existing technologies like the Internet of Things (IoT), cloud, big data, artificial intelligence, and blockchain. Lower latency is another important aspect of 5G, in addition to increased speed. In fact, the delay time is less than one in the 5G era. Additionally, 5G is anticipated to unleash a massive Internet of Things, unlike current IoT services. Additionally, an ecosystem where "smart networks" can be used for large medical devices and provide real-time interactivity can be established based on the super bandwidth of 5G per unit area, connectivity per unit, coverage (nearly 100%), and device connectivity. The race for the upcoming fifth-generation (5G) cellular technology, which is anticipated to be the most signifTicant source of revenue in the future, has recently been won by multinational corporations.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⋇ Peer-reviewed journal ⋇ Vol. 12, Issue 10, October 2023
DOI: 10.17148/IJARCCE.2023.121004

The 5G network will initially be widely deployed as a basic framework for highly connected mobile devices before eventually developing into a cutting-edge 5GaaP (5G platform) platform. Future technology in the 5G environment would develop a "intelligent virtual power plant" that would incorporate energy use, production, and trading while optimizing resource usage. Additionally, it is anticipated that 5G technology will significantly alter the energy sector. The advent of 5G is expected to ease the resolution of some of society's most pressing issues, including traffic congestion, disaster safety, and climate change. It will also raise awareness of the idea of smart virtual power plants in the energy sector. Real-time energy transactions between production and consumption resources, demand management of factories and buildings, and distributed resource management across the nation are all possible with the help of 5G technology. Because of this, patterns of energy production and consumption can be analyzed and predicted using artificial intelligence engines and current big real-time data.

1 .1 Development of 5G

The commercial deployment of 5G networks on a global scale has already begun. By April 2021, 162 5G networks in 68 nations and regions would have gone live commercially. Additionally, it has been predicted that more than a thousand applications tailored to particular industries will profit from 5G's benefits, including its high bandwidth, low latency, and robust connectivity. According to the GSMA, 5G will increase connectivity specifically, from 200 million connections in 2020 to 1.8 billion connections in 2025. In general, network building for the 5G industry is still in its early stages. The majority of the industry thinks "the future 6G technology" won't be used until 2030. Therefore, the next three to five years will still be crucial for 5G development in terms of business scenarios, network technology, industrial progress, deployment pace, etc.For this reason, 3GPP initially determined 5G-Advanced as the concept of 5G network evolution at the PCG #46 meeting held in April. In the future, all aspects of the telecommunications industry will gradually improve the framework and enrich the content for 5G-Advanced starting from R18. The evolution of the core network is crucial to the end-to-end evolution of the 5G Advanced network. The core network, which is the focal point of the entire network industry and the catalyst for future business growth, is connected to a variety of services and applications. On the other hand, the entire network topology is connected to the core network through a variety of standard terminals and access networks. The entire body is moved by the center. As a result, encouraging the development of 5G core network technology and architecture based on real-world business requirements will assist operators in increasing return on investment and assisting industry users in making better use of 5G networks to achieve digital transformation.

1.2 Motivating Factors and Industry Need

The digital transformation of the industry is thought to be anchored by 5G, which is unlike earlier generations of communication networks. The major economies of the world have called for 5G as a necessary component of long-term industrial development. The 2030 Digital Compass (Digital Compass) plan, for instance, was put forth by the European Union and provided guidelines for the digitalization of public services and commercial enterprises. Industry 4.0 was built on top of 5G. South Korea, the first nation to use 5G, has accelerated the development of a 5G+ network.

ecosystem and 5G united services promotion. Japan is still working to spread awareness of the benefits of B5G (Beyond 5G) for society and daily life. A long-term objective for 2035 has also been proposed by China, which is motivated by its insistence on advancing scientific and technological advancement as well as the "5G + Industrial Internet" as a key current goal.

Therefore, 5G-Advanced needs to fully consider the evolution of the architecture and enhance functions, from the current consumer-centric mobile broadband (MBB) network to the core of the real industrial Internet. However, it is currently possible to use network slicing, MEC (Multi-access Edge Computing), and NPN (Non-Public Network) to serve the industry. Whether it is network deployment status, business SLA (Service Level Agreement) guarantee capabilities, easy operation and maintenance capabilities, and some auxiliary functions needed by the industry, the current capabilities of the 5G network are still insufficient. Thus, it needs continued to be enhancements in 3GPP R18 and subsequent versions. First, in the future, XR (Extended Reality) will become the main body of business carried by the network. Not only will the definition of XR be upgraded from 8K to 16K/32K or even higher, AR (Augmented Reality) business scenarios for industry applications will also evolve from single-terminal communication to multi-XR collaborative interaction and it will develop rapidly beyond 2025. Due to the impact of business traffic and business characteristics, XR services will put forward higher requirements for SLA guarantees such as network capacity, delay, and bandwidth. For example, corporate employees can access the corporate office environment with virtual images at any time at home and communicate with them. Colleagues communicate efficiently. Therefore, 5G-Advanced needs to provide an upgraded network architecture and enhanced interactive communication capabilities to meet the business development needs of the existing clear voice-based communication methods evolving to full-aware, interactive, and immersive communication methods. It should also enable consumer experience upgrade.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed journal ⁜ Vol. 12, Issue 10, October 2023
DOI: 10.17148/IJARCCE.2023.121004

Second, industry digitization has brought about a much more complex business environment than consumer networks. Businesses in different industries, such as the Industrial Internet, Energy Internet, Mines, Ports, and Medical Health, need the network to provide them with a differentiated business experience and provide deterministic SLA guarantees for business results.

1.3 Evolution of Network Technology

The 5G-Advanced evolution is technologically presented as a comprehensive integration of ICT technology, industrial field network technology, and data technology. The communication network after 4G fully introduces IT technology, and the telecom cloud is generally used as the infrastructure. In the actual telecom cloud landing process, technologies such as NFV (Network Functions Virtualization), containers, SDN (Software Defined Network), and API (Application Programming Interface)-based system capability exposure have all received actual commercial verification.

On the other hand, the network edge is the center of future business development. Still, its business model, deployment model, operation, and maintenance model, especially resource availability and resource efficiency, are different from the centralized deployment of cloud computing. Therefore, the evolution of 5G-Advanced needs to integrate the characteristics of cloud-native and edge native, achieve a balance between the two through the same network architecture, and finally move towards the long-term evolution direction of and cloud-network integration.

In addition to ICT technology, there will be more demand from production and operation in the future, and OT (Operational Technology) will bring new genes to mobile networks. For example, the Industrial Internet for industrial manufacturing is different from the traditional consumer Internet. The integration of OT and CT will become an important direction for the development of mobile networks. 5G-Advanced networks will become the critical infrastructure for the comprehensive interconnection of people, machines, materials, methods, and the environment in an industrial environment, realizing industrial design, R&D, production, and management.

1.4 ADVANCED TECHNICAL TRENDS AND ARCHITECTURE FOR 5G

5G operations and commercial use have been complicated by the introduction of network resource virtualization, 5G service-oriented architecture, diversified services, and new 5G capabilities like slicing and edge computing. The use of intelligent technology and its integration into telecommunications networks can boost network performance, lower operating and maintenance expenses, and raise the bar for intelligent network operation. In order to advance network intelligence, continuous technical advancement has been made since 3GPP Rel-16.

standardization of network infrastructure (SA2) and network management (SA5). NWDAF is a standard network element introduced by 3GPP SA2 in 5G. It is an AI+ big data engine. It has the characteristics of standardization of capabilities, aggregation of network data, higher real time performance, and support for closed-loop controllability. 3GPP defines the location of NWDAF in the network and the interaction and coordination with other network functions and defines the flexibility of NWDAF deployment. The MDAS can mine data value in network management by processing and analyzing network management data. It can also generate analysis reports and provide suggestions on network management and operations to promote the intelligence and automation of closed-loop network management and orchestration. The evolution of 5G networks has increased the networks' complexity and, in turn, their O&M. Networks are required to be highly intelligent, automated, and autonomous. The networks need to automatically adjust to meet the rapidly changing service requirements according to changes in themselves and the environment. They also need to automatically perform the required network updates and management based on service and O&M requirements. To fulfill these requirements, the following AI technologies can provide reference for the intelligent development of 5G-Advanced network

To meet the needs of personal consumer experience upgrades and digital transformation of the industry. 5G-Advanced networks need to continue to evolve from the architectural and technical levels to meet diversified business demands and enhance network capabilities. At the architectural level, the 5G-Advanced network needs to fully consider the concept of cloud-native, edge network, network as a service, and continue to enhance network capabilities and eventually move toward cloud-network integration and computing-network integration.

Cloud-native is a further cloud enhancement based on the telecom cloud NFV to realize the flexible deployment of 5G networks and the flexible development and testing of functions more quickly. Cloud-native needs optimized software to improve the utilization efficiency of hardware resources, and a cloud-based security mechanism to achieve internal security of the infrastructure. Edge network is an efficient deployment form that combines distributed network architecture and edge services.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁒ Peer-reviewed journal ⁒ Vol. 12, Issue 10, October 2023

DOI: 10.17148/IJARCCE.2023.121004

The Network-as-a-Service model makes 5G systems highly flexible and can adapt to various customized solutions for vertical industry needs. The specific implementation form can be 5G network slicing or independently deployed networks.

A. Machine learning

As a basic network intelligence technology, machine learning can be widely used in various nodes and network control and management systems in 5G networks. Based on the large amount of subscriber and network data in the 5G system, combined with professional knowledge in mobile communications, a flexible machine learning framework has been adopted to build a network intelligent processing system that will be widely used and support distributed and centralized deployment.

B. Digital twin

Digital twin technology can improve the monitoring and control of the network and prediction of its condition, for example its status and traffic, simulate and evaluate the necessary network changes in advance to help greatly improve digital network management.

C. Cognitive network

The technology uses algorithms empowered with mobile communications expertise and fully utilizes the big data analytics generated by the 5G network, enhance the intelligence of network operations to enable complex and diverse services.

D. Intent-based network

Intent-based network technology enables operators to define their network goals, which the system can automatically convert into real-time network operations. The network is continuously monitored and adjusted to ensure network operations remain consistent with the service intent. In the future, a company can introduce advanced frameworks such as federated learning to support the joint learning and training of multiple network functional units. This can effectively enhance the training effect and protect data privacy. In addition, NWDAF can be deployed in layers, flexibly build a distributed intelligent network system, that responds better to different needs.

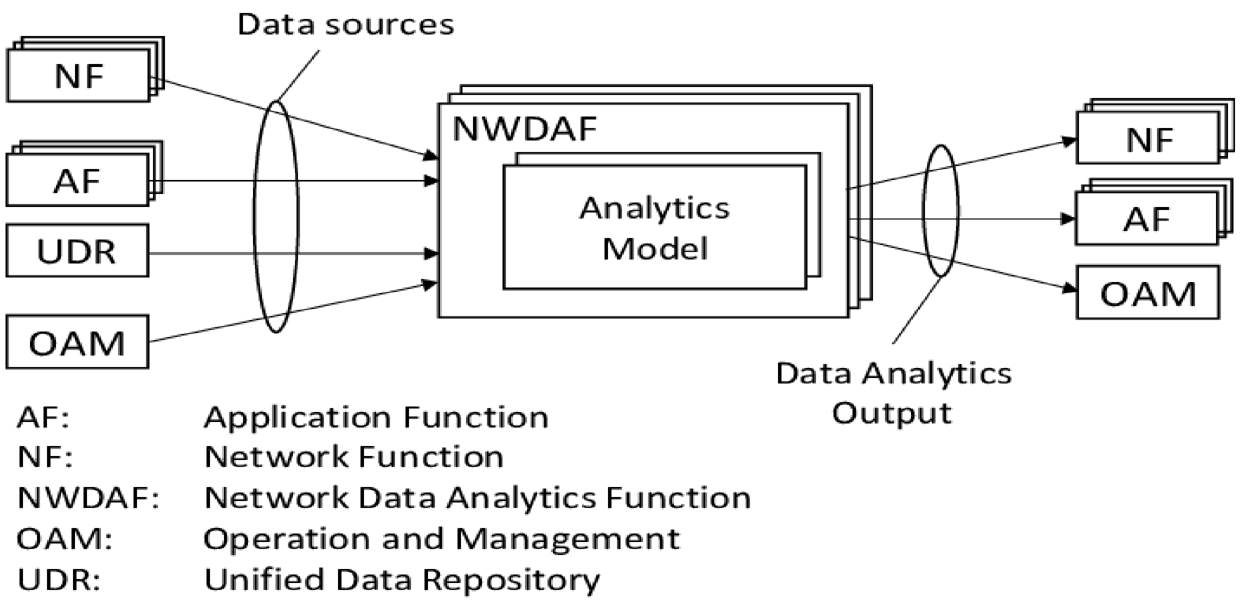

Figure 1.1: General framework for 5G network automation

1.5 Use of the 5G network

5G networks need to continuously introduce AI in order to realize the construction of intelligent networks and enable the digital intelligence transformation of the industry. Internally, it can provide better management, security, and connection support, and it can use AI algorithms to turn cloud-based big data resources into intelligent planning, analysis, fault-finding, and adaptive optimization tools. AI can assist 5G networks in realizing closed-loop service experience optimization. User experience is carefully monitored before being assessed. Next, based on service requirements and network capabilities, a comprehensive, intelligent analysis is used to recommend the best strategies. In order to balance network costs and service experience, policy adjustment and closed-loop tracking are finally put into place through the service experience feedback mechanism. For instance, using intelligent data analysis, a relationship model between user experience indicators and QoS indicators is created. Based on this model, the user experience of existing services is tracked and assessed in real time. Additionally, by examining and mining users' communication patterns, differentiated QoS parameters are created that are the best fit for users, services, and networks.. Moreover, network slicing resources and services are intelligently scheduled and optimized through reinforcement learning and other optimization algorithms to ensure premium experience of services delivered by network slices. What is more, AI-based multi-access collaboration can ensure that multi-access resource is fully utilized with improving user experience. Externally, network intelligent technology makes full use of the computing power, data, and scene advantages of the telecom industry to redefine the end-tube cloud ecology and build a new business model of the telecom industry. Many 5G applications require the cloud, the edge, and end devices to work together to implement and orchestrate services with the assistance of data collection, model training, and intelligent inference. Additionally, reinforcement learning and other optimization algorithms are used to intelligently schedule and optimize the resources and services used in network slicing to guarantee a premium service delivery experience. Additionally, multi-access collaboration powered by AI can guarantee that multi-access resources are fully utilized while enhancing user experience. In order to redefine the end-tube cloud ecology and create a new business model for the telecom industry, network intelligent technology externally fully utilizes the computing power, data, and scene advantages of the telecom industry. With the aid of data collection, model training, and intelligent inference, many 5G applications require the cloud, the edge, and end devices to collaborate in order to implement and orchestrate services. AI must be used to predict computing and network loads, as well as to optimally schedule computing, storage, and network resources across the cloud, the edge, and devices, in order to make better use of the currently available and constantly evolving computing and networking capabilities. In order to ensure that services can be practically and flexibly deployed and migrated on heterogeneous cloud-edge-device resources to provide the required service quality with optimal resource utilization, domain twin models can be used to simplify multi domain orchestration problems..

A Sector-Specific Networks

The integration of 5G and industry networks will become a key scenario for 5G-Advanced networks for vertical industry customers. In the industry network, 5G network can bring more business value, such as personnel protection, production flexibility, and advantages in wireless and mobility. From the perspective of networking, it can not only greatly reduce the complexity and labor cost of wired networking but also help industry customers realize the ideal of "one network at the end." For example, in the field and workshop networking in the industrial manufacturing field, 5G can simplify the multilevel wired network level at the vertical level to achieve network flattening. Based on the differentiated guarantee of 5G deterministic capabilities, 5G can realize the IT network of the field network (Such as equipment operation and maintenance data collection) and OT network (such as PLC control) into one. The characteristic of the private industry network is to provide third-party customers with a flexible and on-demand customized network within the scope of their operation and management. The 5G industry private network can integrate the enterprise's network system with the 5G network to build unified management and seamlessly integrated industry networks. Convergent industry-specific networks have been enhanced in the following three aspects:

1) Improvement of network connectivity

5G-LAN technology can use 5G networks to replace local area networks in the current industrial field. Solve cable mobility limitations and high optical fiber laying costs in existing industrial networks, and provide industry users with the ability to build private mobile networks quickly and flexibly. 5G-LAN defines a virtual network through the concept of a group and supports point-to-point and point-to-multipoint communication within the group.

The 5G-LAN group can deploy one UPF or multiple UPFs and supports local exchanges within UPFs and intra-group communication across UPFs. At present, 5G-LAN only supports one group to be served by a single SMF. In the future, it will be expanded to one group spanning multiple SMFs, thus realizing wide-area interconnection. -Convergence of fixed network and mobile network, 5G-LAN needs to communicate and converge with traditional industrial wired LAN. In addition, in the 5G industry private network networking, enterprises can conduct unified management and plan for terminal addresses. Constructing the N3IWF network function can also support the integration and switching of the industry's existing networks and 5G private networks.

2) Management

A central network management monitoring system replaces the siloed management systems, simplifying network management.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed journal ⁜ Vol. 12, Issue 10, October 2023
DOI: 10.17148/IJARCCE.2023.121004

3) Security

The networks will meet enterprises' requirements for security and reliability. The network for enterprise can be deployed isolated from the public network and one possible way is to support industry-specific network (e.g. PNI-NPN). In terms of security, they will further support the network topology hidden. An enterprise can also incorporate a firewall to filter all data in its private network to ensure that confidential data remains in the campus. The reliability of access, dedicated resources, and connections is also improved

B. Networks at home

Home networks will be a focus for developing 5G-Advanced. Already now, many operators see a peak in mobile data traffic when people are at home. This is likely to be even more so with new services for consumers (e.g., mobile gaming, or high-definition mobile TV) that require every higher data rates. High data rate services such as interactive applications are best served at higher frequency bands, where more capacity is available.

However, these higher frequency bands make providing indoor coverage a challenge. It may not be possible to provide enough indoor capacity with outdoor base stations, relaying or indoor base stations may be needed to give consumers an ubiquitous coverage experience. Unlike other areas where networks are deployed, there are more devices of different types in home networks, though they move around in much smaller areas. In addition, home network users do not require extremely high reliability, but have stringent requirements on protocol conversion and bandwidth. In the future home intelligent IoT network, there will be various devices and types of collected data. Finding the optimal way to synchronously transmit this data, use AI algorithms to pre-judge user behavior accurately, predict device status, and implement intelligent adjustment will become the focus for the next generation home network.

C. Ground Networks in Space

In addition to offering fast network speeds, the 5G network was designed to enable ubiquitous mobile network access. Building and maintaining a 5G terrestrial network is very expensive, so it is not possible to provide 5G network coverage in remote areas like mountainous regions, deserts, and the ocean. Fortunately, the advancement of aerospace technology makes it possible for satellite-based broadband communication systems to offer radio coverage to significant geographic areas—or even the entire world—at a significantly lower cost.. As such, the 5G network will deeply integrate with the satellite communication system to constitute a convergent communication network that provides seamless coverage on the planet, meeting various service requirements anywhere in the world.

Current 5G networks supports the base station to adopt 5G NR system, allowing terminals to access the unified 5G core network through the satellite base station, and satellite base stations working in transparent mode, but there are some limitations on the support of voice service and higher data rate. In the future, the 5G-Advanced network will comprehensively integrate with satellites and provide the following features: - Support for the integration of the terrestrial 5G network with satellite networks in orbit at different altitudes, for example, different mobility management strategies for low, medium, and high orbit.

When providing wireless access, the satellite can work in bent-pipe or re-generative modes to forward data transparently and process on-board data, respectively. The 5G-Advanced network can support networking for satellite ground and satellite-satellite, in order to support terminals to use both satellite access and ground access to optimize data transmission no matter whether the satellite access and terrestrial access belong to a single operator or different operators.

The 5G network can support enhanced mobility management mechanisms for terminals connecting via satellite access , such as access control based on terminal location to meet regulatory requirements, terminal seamless switching between satellite access and ground access, , policy and QoS control based on the type of satellite access, and network-based positioning to enable positioning of non-GNSS terminals and to fulfill reliable UE location requirements for regulated services.

When the base station uses the back-haul service provided by the satellite network or satellite enabled NG RAN, the core network shall be able to perceive the status of the satellite network (such as time delay, bandwidth, etc.) to facilitate policy and QoS control considering the movement of satellites and the entire constellation. This can also help to expose the back-haul capability to the application layer to assist the application adaptation.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed journal ⁜ Vol. 12, Issue 10, October 2023
DOI: 10.17148/IJARCCE.2023.121004

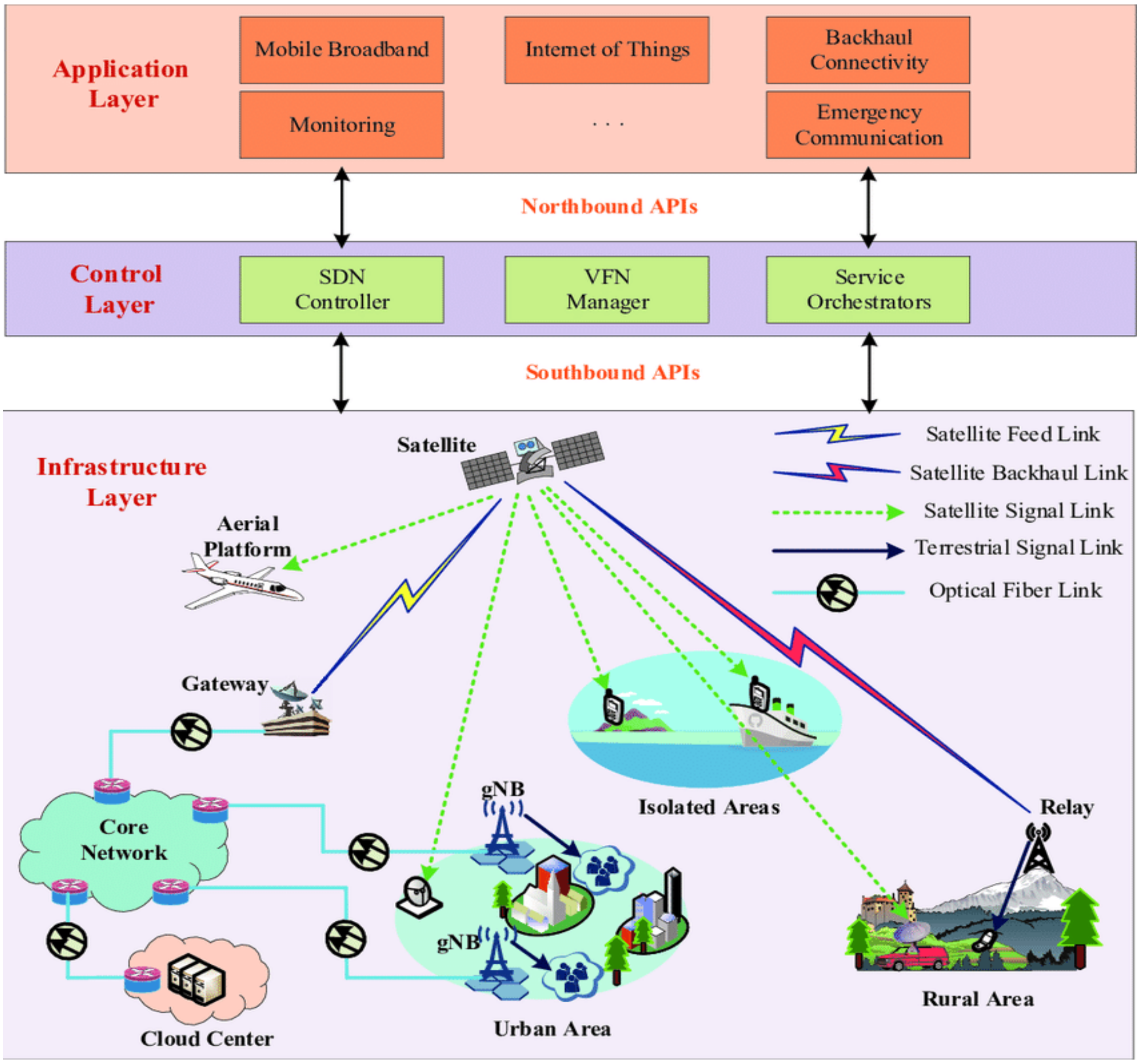

Figure 1.2: 5G network integrated with a satellite system

D. Interactive Communications

Smart terminal screens get bigger as 5G coverage spreads, and AR/VR/XR technology advances quickly. Consumers increasingly want to engage in digital, highly interactive, and multisensory experiences and have higher expectations than they previously had for traditional voice and video services. By using HD video, AR/VR, and other cutting-edge technologies, real-time communications are becoming more immersive. This shift not only enhances individual services, such as personalized calling, remote collaboration, AR social media, and VR communications, but also helps enterprises establish their image and carry out marketing more efficiently. For example, enterprise information can be displayed to consumers in calls from enterprises, improving the call connection rate, and interactive menus can replace audio instructions in customer services, helping customers select service options. Moreover, exposing network capabilities help enable a new wave of application innovation. Applications like ride-hailing, enterprise campus communications, and remote education have been influencing people's work and lives.

New specifications, including 5QI and other QoS parameters, are defined in 3GPP Rel-17 for cloud gaming, XR, and other interactive services. The following essential technical assistance is also required for interactive communication in the 5G-Advanced stage:

1. **IMS data channels:** Existing real-time communications networks are overlaid with IMS data channels, which enable screen sharing, AR effects, and enhanced interactions with environments and things in them.

2. **Distributed convergent media:** A unified convergent media plane is established to upgrade basic audio and video services and facilitate new media services like collaborative activities and AR/VR. The media plane is deployed in a distributed manner, so that the nearest media resources can be scheduled for services to ensure the lowest possible latency and largest uplink bandwidth.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁙ Peer-reviewed journal ⁙ Vol. 12, Issue 10, October 2023
DOI: 10.17148/IJARCCE.2023.121004

3. **Programmable call applications:** Terminals are enhanced so that their web browser engine can process service data in the IMS data channels in real time and display the results on terminal UIs. This increases the flexibility of services to an unprecedented level.

4. **Enhanced QoS:** Multi-flow services are coded and transferred at different layers, and the QoS of each layer is assured based on a specific 5QI. Moreover, QoS control is implemented for different data packets at a finer granularity, such as latencyor reliability-based control. In addition, new QoS parameters, including latency, reliability, and bandwidth, are introduced to help ensure that all types of data, including that from tactile

5. **Collaboration of multi-media communication data flows:** All data representing service features is collected, facilitating smooth coordination and central scheduling of different service flows. This ensures that data packets synchronously arrive at servers or terminals.

6. Enhanced network capability exposure mechanism: For strong interactive business scenarios such as AR/VR, the 5G system and AF directly support better user experience and fulfillment and QoS from end to end has not been ready

II. CONCLUSION

Mobile communication is constantly evolving and developing. The first phase of 5G standards have been commercially deployed today, and the technology is still developing. The 3GPP has given the 5G evolution the official name "5G-Advanced."To enable the creation of greater social and economic value through network evolution and technological advancements, the 5G-Advanced network will define new goals and capabilities for the 5G evolution in the hopes of serving as a guide for the development of the 5G-Advanced network. This work primarily introduces the network architecture and key technologies for the next stage of the 5G network evolution, known as 5G-Advanced. To meet the demands of quick deployment of network functions and on-demand iteration, the network architecture will develop alongside the ideas of cloud native, edge network, and network as a service. The three components of "Artificial Intelligence, Convergence, and Enablement" will continue to be improved in 5G-Advanced network technology. Enhancing network intelligence, lowering operating and maintenance costs, promoting the use and integration of intelligent technology in the telecom network, and conducting research on distributed intelligence are the main goals of artificial intelligence. architecture and terminals' and networks' cooperative intelligence. Convergence will encourage coordinated 5G network development with industry, residential, and space-based networks. The 5G network supporting the vertical industry will be supported by enablement. The 5G-Advanced network will support interactive communication and broadcast communication in addition to improving the representative capabilities, such as network slice and edge computing, to make network services "more diversified". Based on the end-to-end quality measurement and guarantee, as well as the scheme simplification, the network will become "more certain". The network's capabilities in terms of time synchronization, location services, etc. can be "more open". In order to encourage industry consensus and jointly promote the development of the 5G-advanced network, this work is expected to provide reference scenarios, requirements, and technical directions.

REFERENCES

[1]. ftp://PCG/PCG_46.www.3gpp.org
[2]. GSA's April 2021 5G Market Snapshot
[3]. According to the 3GPP, "Procedures for the 5g system; stage 2", release15, v. 15.1.0. On page TS 23.502, March 2018.
[4]. (2016). Bianchi, G., Biton, E., Blefari-Melazzi, N., Borges, I., Chiaraviglio, L., de la Cruz Ramos, P.,... and Niculescu. A flexible functional architecture for 5G networks is called superfluidity. 27(9), 1178–1186 in Transactions on Emerging Telecommunications Technologies.
[5]. Q1 2021 Global 5G Landscape from the GSMA.
[6]. LF Sharpening the Edge: LF Edge Taxonomy and Framework Overview.
[7]. He, Qi, Yunxia, Wang, Jianguo, Zhao, Gang, Kai, Zhou, Yilan, Li, Min, and Dong, Qi. (2018). Resilience and High Availability in 5G Mobile Telecommunications are Made Possible by Network Slicing. Conferences on the MATEC Web. 10.1051/matecconf/201824603028, number 246.
[8]. (2016). Resource distribution in NFV: A thorough analysis, Herrera, J. G. and Botero, J. F. IEEE Transactions on Network and Service Management, 13(3), 518-532.
[9]. Mohammad Abu-Lebdeh, Diala Naboulsi, Roch Glitho, Constant Wette, and Tchouati. (2017). Placement of the NFV Orchestrator for Geo-Distributed Systems. 10.1109/NCA.2017.8171391.
[10]. TR23.791 Study of Network Automation Enablers for 5G.
[11]. China Mobile Research Institute, 5G VoNR+ White Paper, November 2020.```