SERVICE FUNCTIONS IoT OF 5G PLATFORM

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Abstract

Researched 5G network platform, which provides operators with significant advantages, expressed primarily in expanding the functionality and performance of the network (performance) and increasing user satisfaction (User Experience). As a result, 5G is a system, or "platform," which refers to a software platform, not a hardware platform. It is known that 1G / 2G / 3G / 4G networks were built on the basis of hardware solutions (equipment), and the 5G platform is built on the basis of software solutions, with software-configured networks technologies SDN (Software Defined Network), virtualization of network functions NFV (Network Function Virtualization). The 5G network architecture is not based on the classic definition and content, as "network architecture", which is based on hardware implementation. On the 5G network, it is no longer relevant.

The 3GPP (The 3rd Generation Partnership Project) consortium, which develops specifications for mobile telephony, is working to improve GSM (Global System for Mobile Communications, originally Groupe Special Mobile) and LTE (Long-Term Evolution) in terms of Internet Access Things (IoT). These are primarily the answers to the challenges: penetrating power, low power consumption, efficiency and scalability. The upcoming improvements are related to Release 13 and are declared as worthy of competition with LoRa and SigFox. According to the 3GPP consortium, it was almost possible to solve all the stated problems, including on energy saving.

Advantages of GSM, LTE: functioning on the existing infrastructure of cellular operators,

widespread in the world, high data transfer rate, support personal and social networks, high comprehensive security, roaming.

Disadvantages of GSM, LTE: licensed frequencies, high tariffs. The 3GPP (The 3rd Generation Partnership Project) consortium, which develops specifications for mobile telephony, is working to improve GSM (Global System for Mobile Communications, originally Groupe Special Mobile) and LTE (Long-Term Evolution) in terms of Internet Access Things (IoT). These are primarily the answers to the challenges: penetrating power, low power consumption, efficiency and scalability. The upcoming improvements are related to Release 13 and are declared as worthy of competition with LoRa and SigFox. According to the 3GPP consortium, it was almost possible to solve all the stated problems, including on energy saving.

NB-LTE and NB-CIoT. Nokia Networks, Ericsson and Intel have teamed up to promote Narrow-Band Long-Term Evolution (NB-LTE) technology. Sprint, Verizon Wireless, Alcatel-Lucent, Qualcomm, Samsung, Sony and ZTE also became part of this initiative.NB-LTE is seen by some experts as a direct challenge to Huawei Technologies, which is developing Narrowband Cellular IoT technology (NB-CIoT). NB-CIoT has already received the support of such heavyweights as Vodafone, T-Mobile, TeliaSonera and China Unicom.

The main difference between NB-LTE and NB-CIoT is how well existing LTE networks can be reoriented to IoT. Huawei declined to comment on this, but critics of the clean slate approach (NB-CIoT) note that this technology requires new chipsets and does not seem to be backward compatible with LTE networks older than Release 13.

Otherwise, both technologies managed to solve the problem of energy saving: the declared duration of the device operation from the battery is 10 years. In addition, penetrating power in dense buildings has been

improved several times, and the number of possible device connections has been increased by 2 orders of magnitude. The cost of the M2M module is estimated at $ 4 in 2019.

The advantages and disadvantages of these technologies naturally grow from GSM and LTE. LTE networks, in turn, are developing in the direction of 5G networks, the appearance of which is expected by 2020. VoLTE technology can naturally be used in 5G networks, thus VoLTE will become the foundation for providing voice and video calls with "carrier" quality in 5G networks.

5G functions are implemented in virtual software functions VNF (Virtual Network Function), which work in the NFV infrastructure. The difference between these sounding concepts is that VNF is a function, and NFV is a technology. In turn, NFV is implemented in the physical infrastructure of data centers (data center, DC, data center, data center), based on standard commercial equipment COTS (Commercial Off The Shelf). COTS equipment includes only three types of standard, relatively inexpensive devices — a server (computing device), a switch (network device), and a storage system (storage device).

The need to move to 5G is also due to the fact that the cost of passing the ever-increasing traffic through the networks of fixed-line and mobile telecommunications operators / providers, as of 2019, is not covered by income from traditional services.Meanwhile, the main growth in traffic and revenue does not occur in the device sector of people, but in the device sector of the Internet of Things (IoT), which is one of the basic goals of the 5G services platform. Therefore, 5G networks can be considered as one of the necessary components of the digital transformation and digital economy.

The global powers with advanced economies of the USA and China are rapidly leading the development of the 5G services platform. Australia, Japan, Korea and Russia are already doing early 5G projects. The governments of these countries understand that the 5G services platform is indeed an important not only national information infrastructure (NII, National Information Infrastructure), but also in the future successful development of new generation services at the level - global information infrastructure (GII).

Standardization of technologies and solutions of 5G should be completed by 2021, so the term 5G so far indicates only fragmentary solutions that will be part of the full-scale IMT2020 solution in the future. Such solutions are already deployed in different countries, but they still have a local and test character, and don't provide the entire planned functionality of the IMT2020 standard networks. The main standardizing organizations of the 5G services platform as of 2019: 3GPP is an alliance of seven organizations that are developing various telecommunication standards, which, in turn, include other partners. The goal of 3GPP is to formulate technical requirements, evaluate proposals and final adoption of standards. In middle 2017, a version of the general standard Release 15 was adopted, and Release 16 is currently being developed, which will be adopted in 2019. In addition to developing a common architecture, 3GPP is also developing standards for 5G New Radio (NR), radio technology for new frequency bands allocated under 5G, ETSI (European Telecommunication Standard Institute), which is a member of 3GPP, and is most active in the development of 5G standards; The Internet Engineering Task Force (IETF) develops IP retrofit solutions to support of the Network Fucntion Vitrualization (NFV).

For example, the IETF has developed Service Function Chaining (SFC), which combines the virtualized components of the 5G architecture, such as base stations, service gateways, and data packets in a single route. This allows the dynamic creation and linking of virtual network functions VNF (Virtual Network Functions). The IETF works closely with 3GPP; ITU (International Telecommunication Union) is a UN agency based in Geneva that is engaged in the standardization of a wide range of telecommunication technologies. In particular, it coordinates the work on sharing the radio frequency spectrum, include for 5G networks.

In addition to these three main coordinating organizations, there are a number of others that carry out systematic practical work on the development of IMT2020 (5G) standards: 5GPPP (5G Infrastructure Public Private Partnership), is considered one of the leading 5G standardization partnerships.

The organization sets powerful goals for the development of 5G network requirements, for example, entrainment of network capacity by 1000 times, reduction of power consumption of user devices by 90%, a significant reduction in the creation time of new services and services, complete and secure network coverage and with negligible data transmission delay. and so forth; NGMN (Next Generation Mobile Networks) Alliance. The next generation Mobile Network Alliance standardizes the full range of 5G solutions. The alliance includes the leadership of leading US operators: AT & T, U.S. Cellular and Verizon.

In addition to these, there are industry and regional organizations, such as the 5G Americas, Small Cell Forum, which also make a great contribution to the development and standardization of solutions for the 5G services platform.

They coordinate their work with ETSI and ITU, but sometimes they are ahead of these organizations. Therefore, the decisions of these operators often form the basis of the ETSI and ITU standards.

Mobile networks of previous generations had the following functions and functions: 1G: Voice over analog services, 2G: Voice over digital network services, low-speed data services (GPRS, EDGE), 3G: High-speed data services (HSPA), with the ability to transmit voice over an IP network, mobile Internet access MBB (Mobile Broadband), 4G: Mobile broadband access MBB based on LTE, LTE-A, voice transmission (VoLTE), 5G networks significantly expand the limited functionality of previous generation mobile networks.

The main functional features of 5G networks are as follows: Enhanced mobile broadband eMBB (enhanced MBB), Ultra Reliable Communication with Low Delay ULLRC (Ultra Low Latency Reliable Communication), Massive machine-to-machine communications Massive IoT / IIoT, mMTC (massive Machine Type Communication).

On the basis of these three generalized types of functional, the whole variety of services and capabilities of the IMT2020 (5G) networks is built, the most characteristic of which are shown in fig.1. data transmission through various radio access technologies (RAT), and through the use of new radio frequency spectra 5G NR (New Radio). The user receives almost unlimited bandwidth, both for home use of various services, and for the purposes of enterprises (Immersive Telepresence, Industrial IoT, etc.)

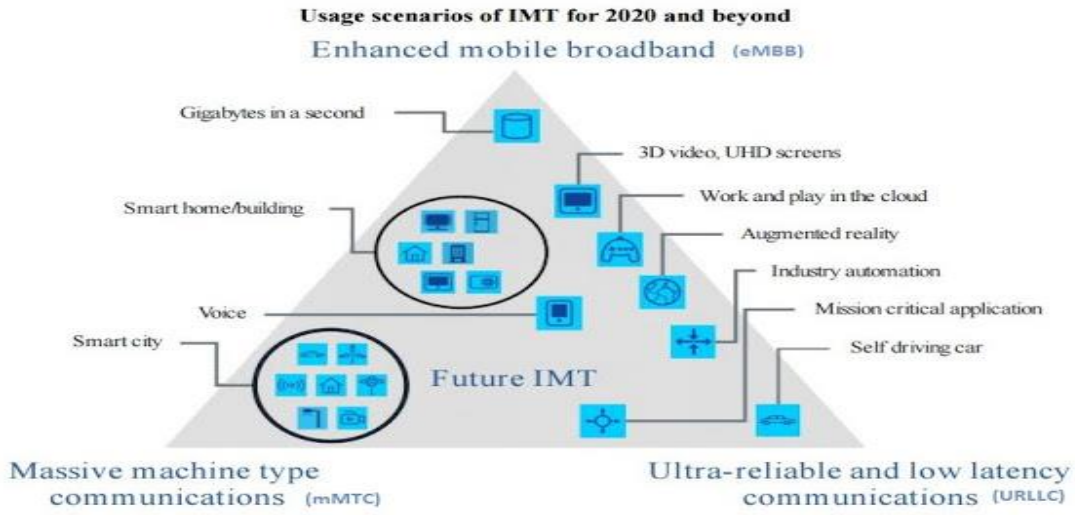

Fig.1. Diversity of IMT2020 / 5G Network Functionality

Smart House. A whole range of different Internet of Things (IoT) services will be available for the Smart Home and Smart Building solutions: video surveillance, home appliances management and automation, security systems management, content storage, air conditioning, etc.

Smart city. The “Smart City” solution is horizontal and vertical scaling of the functional and spectrum of services of the “Smart Home”. The main services of the “Smart City”: Safe City, e-Government e-Government, e-Health e-Health, e-Education e-Education, e-Bank e-banking, electronic Smart Meters utilities, smart grids, Smart Grid, etc.

New video services 4K / 8K: Volumetric video, ultra-high definition screen (UHD), the possibility of the effect of presence.

Work in the cloud. The service makes it possible not only to store data in the cloud storage and retrieve it from there, but also to use application programs that work directly from the cloud. Moreover, with the possibility of their use on any device and from any location. In addition, it’s possible to use APIs for application programming interfaces through, which cloud service providers can provide their services to subscribers of the 5G network operator.

The Augmented Reality AR (Augmented Reality) service combines a real environment with virtual objects for the user. These services are suitable not only for entertainment, games, virtual communication in the "telepresence" mode, but also can significantly improve the learning process, when students with the help of VR glasses can, for example, visually see the internal structure of a person at an anatomy lecture, the master in the workshop can study the assembly order of a complex assembly, etc.

Industrial automation. The 5G network, coupled with the Internet of Things technology IoT, using industrial sensors IIoT (Industrial Internet of things), as well as using artificial intelligence AI (AI, Artificial Intelligence) can significantly increase the degree of automation of production. In this case, it becomes possible to analyze in real time large volumes of heterogeneous data (Big Data) and on the basis of the findings (insights) and using machine and deep learning (Machine learning, Deep learning).

Business Critical Applications (Mission Critical Applications). These applications may include, for example, electronic medicine (e-Health), emergency communications (Mission Critical Communication), tactile Internet (Tactile Internet), and others.

Unmanned vehicles (Driverless Vehicles). Unmanned vehicles can act as part of the "Smart City" service, however, it can be provided on its own platform. It includes not only driverless cars, but also unmanned tractors for Smart Agriculture, unmanned trains for subways and suburban railways, drones, and other types of public and special transport.

Conclusion

Unlike the networks of previous generations, the range of services of which was severely limited and somewhat expanded in 4G, the services of the 5G platform are synergistic and scalable, and are not limited to the functionality once specified. In fact, 5G plays the role of a platform for the development mode of new services and applications of DevOps, when new functions are created by developers (Development) in close coordination with the teams that are responsible for their implementation and operation (Operation).

In general, it can be said that the 5G network incorporates not only mobile, but also fixed communication services, as well as high-speed Internet access with low latency in addition, specialized and corporate networks for vertical industries.

Reference

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