Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 2, Issue 4, April, 2021

STANDARDS FOR THE FIFTH-GENERATION NETWORKS FOR IoT

Toliev Khurshid Ilkhamovich
Nukus Branch of Tashkent University of Information Technologies
Named after Muhammad al Khwarezmi

Summary
Talking about the imminent appearance o f the fifth-generation networks are actively conducted the last 2-3 years. What is most interesting, not all understand why we need 4G network is not everywhere they are implemented, and where they are, the return on investment is not expected until 2020. At the beginning of 2016 to cover the share of LTE cellular networks around the world is more than 15% e. So do we need to 5G?
According to experts, the existing global telecommunications infrastructure in the form of LTE over time reaches technical ceiling. This will contribute to the rapid development of a variety of devices with Internet access. Currently, mobile networks provide data rates up to the client side 1 Gbit/s. However, there are difficulties with a clear reference to specific bands of the frequency spectrum and their aggregation. Any questions and delays the signal. All these questions must decide 5G standard.

Keywords. Standard, generation, IoT, WiMAX, LTE, orthogonality, multiplexing, demultiplexing.

Introduction

The main theme of the new time- is the development of the Internet of things and maintain their network fifth generation- 5G. The popularization of connected devices is a powerful catalyst in the development of the telecom industry, especially for high speeds, virtualization and cloud services.
When 5G, the fifth generation wireless technology networks, there will come in 2020 year, engineers expected that the network will be able to handle about 1000 times more mobile data than current cellular networks. It will also become the basis for the Internet of Things (IoT), linking fixed and mobile device-machines, and becoming part of a new industrial and economic revolution.
The new architecture, new communication technologies and new equipment will make this transformation possible.

Standards for the fifth-generation networks for IoT

WiMAX (Worldwide Interoperability for Microwave Access) refers to carrier grade technology that is based on the IEEE 802.16 family of standards developed by the International Institute of Electrical and Electronics Engineers (IEEE). The IEEE 802.16 standards define the physical layer and the level of access control for fixed wireless broadband access systems of a city scale [2, 4].
OFDM Orthogonal Frequency Division Multiplexing is a combination of modulation and multiplexing. Typically, multiplexing refers to independent signals derived from different sources. In OFDM, the multiplexing task is applied to individual signals, but these individual signals are the set of one main signal [3].

OFDM is a special case of frequency division multiplexing. The main concept of OFDM is subcarrier orthogonality.

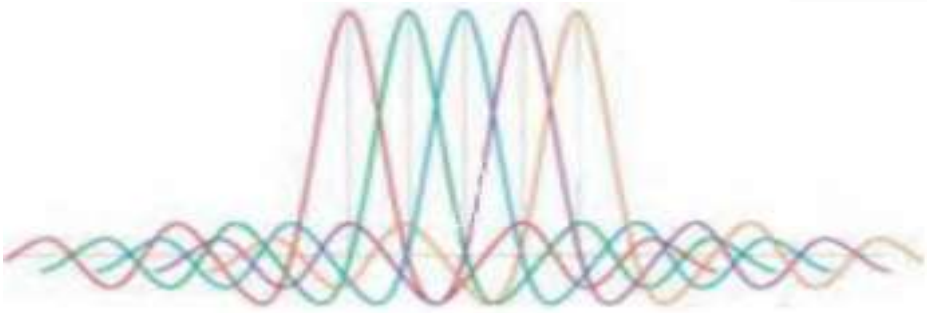

Figure 1 - Example of overlapping frequency channels with orthogonal carriers

The IEEE 802.16 standard describes the construction of networks of regional scale in the range up to 66 GHz. At the physical level, the standard provides for three different methods for transferring data:
1. Single carrier modulation method.
2. Method of modulation by means of orthogonal carriers (OFDM)
3. Method of multiplexing by means of orthogonal carriers
OFDM mode is a method of modulating a data stream in a single frequencychannel 1-2 MHz wide or more [3].
At such a frequency range, the widespread use of this modulation will allow to over-speed the speed of already existing networks.

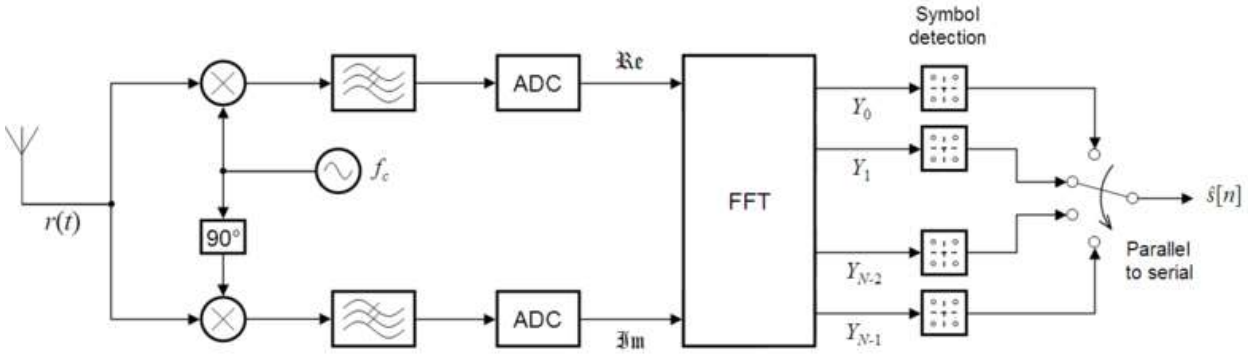

Figure 2 - Implementation of the OFDM method

In the networks of the fifth generation, the frequency spectrum will be used from 1 GHz down to the millimeter range.
For the Internet of Things, the suggested frequencies are below 1 GHz. Low frequencies will ensure reliable reception over long distances, which currently interferes with LTE in the field of the Internet of things. Increased by several orders of magnitude, the admissible density of nodes, together with IPv6 support, will allow to bring a huge number of new devices to the Network.

The use of OFDM signal at the physical layer of the WiMAX network. In WiMAX systems, a broadband Orthogonal Frequency Division Multiplexing (OFDM) signal is used, formed from a variety of narrow-band signals separated in the frequency spectrum.

The use of an OFDM signal provides WIMAX systems with the highest BWA spectral efficiency in the class (data transmission rate in one Hertz of the frequency spectrum band), the ability to work out of direct visibility, the highest power communication parameters providing high communication range, and the ability to efficiently service mobile subscribers [8].

The most important difference of OFDM technology from simple division of a radio signal into several parallel frequency channels is the orthogonality of subcarriers in the group spectrum of an OFDM signal. The physical meaning of orthogonality is mixed, in the structure of each subcarrier special tags -FIND unique number of sinusoidal oscillation signal differing in phase by 90 deg., (Orthogonal functions) allowing the demultiplexer based on a label data analysis signals share subcarriers even in the case of a partial overlap of their frequency spectra. The selection of carriers in the general spectrum of a conventional multi-channel signal due to the limited technological capabilities of modem band-pass frequency filters requires a sufficiently large frequency separation of the carriers, which limits the increase in their number in a given frequency band. The selection of carriers in the group spectrum of an OFDM signal during demultiplexing is performed using orthogonal signal transforms. This allows the possibility of overlapping spectra of adjacent subcarriers, which allows to significantly increase the frequency density of their placement in the signal spectrum and to increase the spectral efficiency.

Table 1.

Standard Specification

Standard	802.16	802.16 / a / d (802.16-2004)	802.16e
Frequency range	16-66 GHz	2-11 GHz	2-6 GHz
Network type	Stationary	Stationary	Movable
Coverage area	Line of sight	Out of sight	
Radius of coverage	2-4 km	4-6 km (15-20 m in open space)	4-6 km
Data transfer rate	32-134 Mbit / s with a band of 28 MHz	Up to 75 Mbps with 20 MHz band	Up to 15 Mbps with 5 MHz band
Modulation	QPSK, 16 QAM, 64 QAM	OFDM 256, OFDMA, BPSK, QPSK, 16QAM, 64QAM	
Channel width	20, 25, 28 MHz	Election width from 1.25 to 20 MHz	

From the outset, the IEEE 802.16 standard was conceived in such a way as to develop as a set of radio interfaces based on a common media access control protocol (Medium Access Control, MAC), but with different physical layer specifications depending on the part of the spectrum used. The MAC level of the protocol was developed for access networks with a point-to-multipoint topology in order to achieve a high signaling rate both in the ascending Up Link stream (the flow from the subscriber to the base station) and in the descending Down Link- flow (flow from the base station to the subscriber). The network structure of the IEEE 802.16 standard is very similar to traditional mobile networks: there are also base stations that operate within a radius of up to 50 km. To connect the base station with the subscriber, you need to install subscriber equipment in the room. From this unit, the signal goes over a

standard Ethernet cable, either directly to a specific computer, or to an IEEE 802.11 access point, or to a local wired Ethernet network. One base station in the IEEE 802.16network can serve a large number of subscribers and provide them with services at various levels [1, 8].

Conclusion

IEEE 802.16 protocol designed for wireless access at the level of cities, and aims to solve the problem of the "last mile", as well as to reduce the financial costs and time spent on deployment of new connections, thanks to the unification of solutions. If today to connect to a single enterprise network can leave a few months, then in the future it will be possible to do in a few hours or days. IEEE 802.16 access points are installed on tall buildings and masts of cellular networks. By working in the frequency range of 2 to 11 GHz, they can deploy a wireless channel with a width of up to 70 megabits per second on a single sector base station and to provide data transfer out of sight. The bandwidth allocated to customers, can be controlled on the side of the provider, which will, for example, to provide individuals channel level DSL, and organizations to the level Tl. Also worth noting is that the IEEE 802.16 protocol provides not only data but also voice and video (in the form of the same data), which will be organized on the basis of this protocol mobile networks with video telephony (parallel exchange of voice data and video) as well as access to the Internet.

References

1. Alexander Hellemans. Why IoT needs 5G. https://spectrum.ieee.org/tech-talk/computing/networks/5g-taking-stock
2. Ian Poole IEEE 802.16 WiMAX standarts http://www.radioelectronics.com/info/wireless/wimax/ieee-802-16-standards.php
3. C. Richard OFDM and MCCS http://http//www.ni.com/white-paper/3740/en/
4. Semenov Yu. A. Broadband wireless standard IEEE 802.16 http://citforum.ru/nets/semenov/4/41/802_16.shtml
5. Vasiliev V. G. Fixed broadband wireless access technology WiMAX 802.16 http://http//unidata.com.ua/add/WiMAX_technology.pdf
6. Ivan Kusch Theory and Practice 5G: http://nag.ru/articles/article/28884/teoriya-i-praktika-5g-obretaet-korni.html
7. Orthogonal frequency division with many subcarriers OFDM: http://systemseti.com/wimax/peredacha_signalov/4.3.html
8. Andrev Arkhipkin WiMAX Standard http://www.wireless e.ru/articles/wifi/2006_3_14.php
9. I. Shakhnovich IEEE 802.16 Broadband Access Standard for bands below 11 GHz http://www.electronics.ru/journal/article/830
10. Sergey Pakhomov High-speed connection without wires or Standard 802.16: http://compress.ru/article.aspx?id=9948