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**К.т.н. Рыхлик Анджей**

**5G ... 7G И ЧТО ДАЛЬШЕ?**

**Ph.D. Rychlik Andrzej**

**5G ... 7G AND WHAT NEXT?**

The QoS parameter is used to determine the quality of digital transmission of both stationary and mobile data. The measure of this parameter is the ratio of the number of lost packets to the sum of the lost and transferred [10]. The lower the value, the better the network. Comparing the network based on this parameter when other parameters have different values is troublesome. For example, if the QoS is  $10e-9$ , then for a narrow data transmission band it is technologically easy to obtain, but for the wide band extremely difficult [6]. The narrow bandwidth is 9.6 kbps, broad 1Tbps. For the NGN network, a new QoPE parameter is introduced, which we define as the space-time distance of virtual reality from natural reality. This parameter is of great importance in an environment where part of the action takes place in a virtual and a part in a

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natural reality. This parameter characterizes both networks mobile and stationary [3].

For example, the training of pilots of communication planes, forces the collection of data about the aircraft from one plane, and from the other data about airports, and from elsewhere data about the weather. The airplane emulator in which the pilot in a natural reality steers the object in virtual reality uses all this data [7].

For the purpose of more precise assessment of mobile networks, a classification in the form of a generation has been introduced. Each mobile network, in order to compare, should first be included in the appropriate generation, because the measures of quality and energy parameters are different in each generation.

The notion of generation for fixed-line networks is not introduced, because at the current stage of technology development, we use copper in the form of twisted pair and coaxial cable as well as fiberglass in the form of optical fiber for digital data transmission. There are not enough classes for fixed networks to share them for generations. In contrast, in the case of mobile networks [1].

The first mobile networks were marked as 2G, because 1G was used for the definition of analogue cellular networks used for voice transmission. Comparative qualitative parameter was then bandwidth data and measure bps. In 3G networks, the qualitative parameter changed its name to spectral efficiency, and it was measured at bps/Hz. This parameter, when using QAM modulation, is a function of SNR, i.e. the ratio of the signal's power with the transmitted information to the power of the noise signal [8]. In networks 4G/LTE the qualitative parameter have been extended to the concept of density spectral efficiency in a particular territory, and measure was the bps/Hz/m<sup>2</sup>. Changing the parameter measurement and interpretation was necessary, because the distribution of subscribers in the area has become uneven, and the network should secure the quality of mobile data regardless of the number of mobile devices in the area. Sensitive areas were stadiums, religious sites, communication routes, skyscrapers [4].

Mobile devices have battery power, so it is very important to transfer data using the minimum amount of energy. For this reason, an energy unit has been added to the 5G network for the measure. The measure of the quality parameter for 5G takes the form bps/Hz/m<sup>2</sup>/J. Note that for fixed-line networks this parameter is of little importance, as there is no problem with the supply of energy in fixed-line networks [5].

The emergence of flying unmanned drones, which very much use the mobile digital data transmission in 6G networks, has once again modified the quality-energy parameter from the plane to the space. For 6G we have bps/Hz/m<sup>3</sup>/J [2]. Also this measure turned out to be insufficient to fully measure

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the phenomenon. The networks are built and operated in an economic environment. It is not enough that they operate; they still need to generate cash for their development and ongoing exploitation. The most economical are networks where demand equals supply. In order to measure the distance of the network supply from the demand for applications for 7G technology, we introduce a currency unit for a measure of quality and energy parameter. This measure now takes the form bps/Hz/m<sup>3</sup>/J/\$. It is estimated that the 7G network appears until 2045. The development of mobile networks for digital data transmission will not end on networks in 7G technology, as they may still be used for quantum computing, multi-valued arithmetic, data transfer with less power than noise and many other technologies [4,9].

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