

A View on Cellular Technology Beyond 5G

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Abstract

The first phase of 5G standardization has been completed and 3GPP is now addressing the next set of features beyond Rel-15 of 3GPP specification. 3GPP 5G System (5G New Radio (NR) and 5G Core) provides a unified, flexible radio and core network capable of supporting various 5G vertical applications such as automotive, healthcare, industry, smart city, etc. beside mobile broadband. In the next phase of 5G standardization, Rel-16 and Rel-17 will address several new features such as Integrated Access and Backhaul (IAB), MIMO enhancements, Industrial IoT, 5G beyond 52.6 GHz, Non-Terrestrial Network (NTN). In this article, we look even further into the future to what comes Beyond 5G (B5G). While 5G started out with “**Internet of Everything (IoE)**”, we propose that B5G extends this vision to “**Internet of Everything, Everybody, and Everywhere (IoE³)**” having an even stronger focus on human needs and covering all of Earth (and even space).

Keywords: Industrial IoT (IIoT), Network Automation, Converged Edge & Core Clouds, Non-Terrestrial Network (NTN), Artificial Intelligence (AI), Open source.

1. Introduction

The first phase of 5G standardization has been completed and 3GPP is addressing the next set of features beyond Rel-15 of 3GPP specification. In this article, we provide a look at what comes next i.e. Beyond 5G (B5G). In Section 2, we start with a discussion on what are the requirements and use cases for a B5G system and how it will help to expand the human possibilities of the technology to make our lives better. In Section 3, we address the timeline for B5G and the spectrum needed to make this technology come to fruition. In Section 4, we move on to describing the major technology components needed to meet the B5G requirements covering both radio access and core network architecture. This includes, for example, improving spectral efficiencies over 5G NR systems through enhanced CoMP and beam management techniques; further reducing one-way, end-to-end latency to the sub milliseconds range; providing coverage to the world using terrestrial and non-terrestrial networks; exploiting the high mmWave and Terahertz bands to increase capacity; and using automation in network slicing operations. The paper will further discuss how AI boosted network automation can be used to improve operator and user experience and to simplify network ownership. Finally, conclusions are drawn in Section 5.

2. B5G Requirements and use cases

The drivers towards B5G can be classified based on

trends and scenarios. The next frontier in trend includes i) enabling the Internet of Humans (from everything in 5G to everybody in B5G; ii) extending coverage to uncovered areas of earth and even space; iii) embracing energy and green KPIs into all network management functions; and iv) enabling new demanding eco-systems and supply models (open specs to open source, faster time to market, embracing specialized scenarios and customization). The B5G drivers based on scenarios are i) full earth coverage with maximum capacity for outdoor wide area networks; ii) optimized cost, capacity and coverage for indoor networks; iii) customized private networks for e.g. industrial automation and iv) support for sub millisecond latency, high reliability and determinism for specialized outdoor and indoor networks.

The proposed requirements are summarized in Fig. 1.

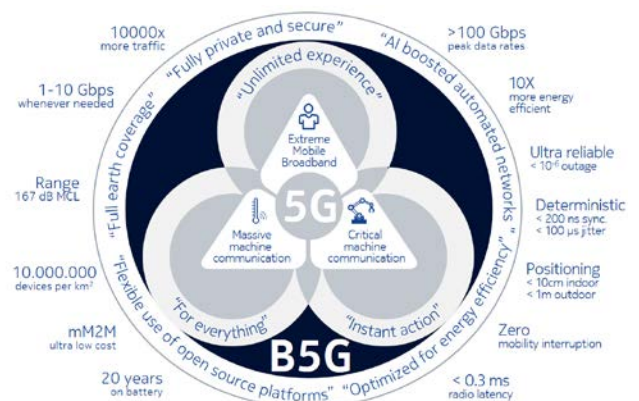


Fig. 1: Requirements for B5G.