5G Evolution: A View on RAN Technologies Beyond Rel-15

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Abstract

The 5G system is the foundation to conquer new markets and create new economic value. The 5G System (5GS) based on Release 15 ("Rel-15"), comprising of 5G Core (5GC) and 5G New Radio (NR), is currently being commercially deployed throughout the world both at sub 6 GHz (FR1) and at mmWave (FR2) frequency bands. The initial 5G systems are focused on extreme mobile broadband (eMBB) use cases geared towards Communication Service Provider (CSP) deployments. The next natural extension of 5G is the development of new services for the existing customer base, on the back of 5G's low latency capabilities providing experiences via the network that go beyond plain eMBB. To that end, 3GPP Rel-16 will offer new features for URLLC (Ultra-Reliable Low Latency Communication) and Industrial IoT (IIoT), including Time Sensitive Communication (TSC), enhanced Location Services, and support for Non-Public Networks (NPNs). In addition, some crucial new features, such as 5G NR on unlicensed bands (NR-U), Integrated Access & Backhaul (IAB) and NR Vehicle-to-X (V2X), are also being introduced as part of Rel-16, as well as enhancements for massive MIMO. In this paper, we discuss the Rel-16 RAN features and provide an outlook towards Rel-17 and beyond, covering both new features and enhancements of existing features.

Keywords: New Radio (NR), Extreme Mobile Broadband (eMBB), Ultra-Reliable Low-Latency Communications (URLLC), Integrated Access and Backhaul (IAB), Vehicle-to-Everything (V2X), Non Terrestrial Networks (NTN)

1. Introduction

The End-to-End 5G system will redefine human existence and industrial productivity[1][2]. 5G New Radio (NR) comprises three major use case domains, namely enhanced mobile broadband (eMBB), URLLC, and massive machine type communications (mMTC). The 5G system, based on 3GPP Release 15 ("Rel-15") is currently being deployed across the globe and focuses on eMBB use cases. The second phase of 5G is currently being standardized as Rel-16 which is scheduled to be completed by March 2020. In addition to enhancing the basic Rel-15 features, Rel-16 focuses on enabling full support for the Industrial Internet of Things (IIoT) for Industry 4.0, including enhanced URLLC and Time Sensitive Communication (TSC), introducing support NR V2X and operation in unlicensed spectrum, and deployment enhancements by means of Integrated Access and Backhaul operation mainly for mmWave (FR2) systems. With Rel-16 design work ongoing in 3GPP, planning for the feature content of Rel-17 is already underway, targeting specification availability in mid-2021.

In this brief article, we provide an overview of key NR enhancement features being introduced in Rel-16 and those expected to be introduced in Rel-17. In Section 2, we briefly describe on how 5G connectivity fabric builds on existing LTE deployments. Section 3 outlines the NR features in Rel-16 and Rel-17. Finally, conclusions are drawn in Section 4.

2. 5G Connectivity Fabric

The 5G connectivity fabric builds on existing LTE deployments and the full promise of 5G is projected to be realized through 3GPP evolution.
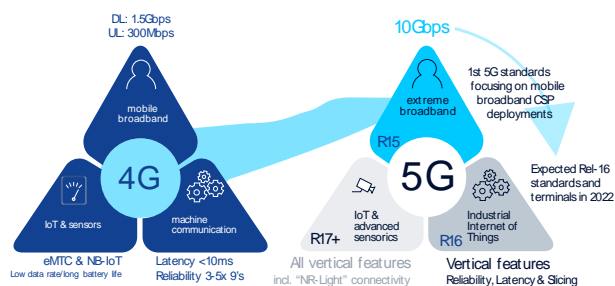

Figure 1. Realizing the full promise of 5G through 3GPP Evolution

As illustrated in Figure 1, Rel-15 of 5G NR focuses on eMBB with peak rates greater than 10 Gbps which is order of magnitude higher than LTE. Additionally, 5GNR