OPTIMAL 5G RESOURCE ALLOCATION FOR ULTRA-RELIABLE LOW LATENCY COMMUNICATION (URLLC) AND ENHANCED MOBILE BROADBAND (eMBB) USE CASES

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ABSTRACT

Due to the development of wireless networks for communication, a new issue has emerged. Users have become more organized (especially in 5G) by applications to ensure relatively easy spectrum access. The coexistence of eMBB and URLLC traffic has given rise to puncturing issues. The burstiness of URLLC traffic, which affects eMBB traffic by forcing its packets to wait until the spectrum is briefly free of URLLC traffic, is the main cause of this puncturing. In addition to Q-learning, resource block allocation was done in addition to joint power in order to get around this issue. The scheduling of resources was done using Q-learning in order to get the best multiplexing possible without puncturing eMBB resources. As a result, a scheduling pattern was created that enhanced reliability by increasing throughput and reducing latency. The suggested algorithm was implemented using MATLAB 5G and Deep Learning toolboxes. The algorithm (OLRT-Q) was compared to three other algorithms and there were some favourable conclusions. According to analysis, a 16% throughput boost over LRT-Q and a 47.7% increase over LR-Q at 2 Mbps (the case with the highest load) were recorded. At 1.5 Mbps, we noticed an increase of 12.2% and 33.16% in performance over LRT-Q and LR-Q, respectively. It outperformed LRT-Q and LR-Q in the case of a 1 Mbps load scenario by 9.44% and 19.09%, respectively. There is an improvement in throughput by 13.36% compared to LR-Q and a 9.58% increase compared to LRT-Q under the lowest load scenario permitted by the standard (0.5 Mbps).

Keywords: *eMBB, Latency, OLRT-Q, Reliability, Throughput, URLLC.*

1 INTRODUCTION

When it comes to mobile networks, the fifth generation (5G) technology, which has reportedly been introduced in several regions of the world while many others are still awaiting its introduction, has shown promise. Even better, a variety of application areas have been suggested, some of which are currently being used like; unmanned aerial vehicles (UAVs), smart cities, and self-driving cars. In the situations of these applications, the benefit of 5G technology would result in an exponential improvement.

All communication profiles used in industrial settings are supported by the wide area network (WAN) technology utilized in the 5G network. According to the industry 4.0 paradigm, a top priority in the design of factories is agility. Networked workforce solutions, automated guided vehicles, drones, and autonomous robots are among the main technologies that facilitate adaptability in factories.

In accordance with International Telecommunication Union (ITU) standards, these applications have now been divided and classified into three use cases or service types. They are:

1) eMBB (Enhanced Mobile Broadband)

2) uRLLC (Ultra Reliable Low-Latency Communications)

3) mMTC (Massive Machine-type Communications) (Massive Machine-type Communications) (Sanou, 2018)

The ITU has gradually implemented a number of standards in the information technology (IT) sector to control how people interact with technology while taking into account maximum performance. The ITU also established standards before 5G was available to control how consumers interacted with technology and applications in general.

These numerous use cases are supported by the various quality of service (QoS) needs for 5G wireless networks in terms of data rate, dependability, and latency. By adopting network slicing in cloud radio access networks, mobile network operators (MNOs) may virtualize network resources such as transmit power and physical resource blocks (PRBs) in the shared physical network (C-RANs). Given the restricted resources in the remote radio heads (RRHs) and to increase system throughput and yet satisfy user QoS requirements, it is crucial to properly distribute resources among network slices. (Pocovi et al., 2018).

The ability to accommodate cordless internet and communications with ultra-reliability and minimal latency (or non-bursty and bursty traffic) on the same network without necessarily favouring one over the other is a need for 5G wireless systems to perform well.

Broadband traffic, or eMBB, is capable of supporting data speeds in gigabit per second (with a few hundred MHz of bandwidth) and low delay. Alternately, traffic of URLLC users requires very low latency (0.25–0.3 ms per