Parameterizing 5G NR to Enable Novel Mobile Use Cases

Sebastian G. Grøsvik
Department of Information Security and Communication Technology
NTNU - Norwegian University of Science and Technology
Trondheim, Norway
sebastian.grosvik@ntnu.no

***Abstract*—The introduction of 5G brings significant advancements over LTE. At the same time, these changes enhance performance and introduce considerable complexity in configuring core and radio domains, particularly for use case-specific deployments in campus and industrial networks. Understanding the impact of newly introduced configuration parameters is crucial for optimizing 5G New Radio (NR) to meet diverse service requirements for new categories of mobile devices.**

To this end, we explore the configuration space of 5G NR using both open-source and commercial standalone deployments based on OpenAirInterface (OAI), srsRAN (SRS), and Nokia. We aim to conduct a detailed study on the impact of Next Generation NodeB (gNB) configurations on the uplink and downlink throughput and latency, as well as reliability and availability aspects, comparing multiple unique 5G NR implementations.

***Index Terms*—5G, new radio, critical communication, network softwarization**

Introduction. As the 5G rollout progresses, the technology is increasingly presented as a relevant option for wireless network connectivity for institutions and industries. Private 5G has the potential to completely replace WiFi and wired networks in campus use cases. The overlapping coverage zones, seamless handovers, and improved performance of 5G are attracting more industries to consider 5G technology for their communication needs. However, this transition would require a large capital investment upfront, which in turn requires a large degree of certainty that such a transition would be worth the cost. We aim to provide knowledge on this topic by researching the expected performance of a private 5G system. To this end, we have defined three goals for our project: **G1.** Create a framework for understanding the new configuration options introduced with 5G NR. **G2.** Compare open-source and commercial 5G systems. **G3.** Build general models for cost-efficient 5G performance predictions.

By achieving these goals and providing new knowledge within these three areas of 5G NR, we aim to reduce the 5G system implementation threshold among researchers and engineers.

Methodology. For accomplishing the defined goals, the applied methodology consists of three main steps: **1.** Design and implement a vendor-independent 5G performance measurement system. The measurement system has to be automated, accurate, and reproducible. **2.** Conduct thorough performance measurements across systems. These measurements aim to uncover the impact of 5G configuration parameters and to define the systematic behavior across different 5G implementations. **3.** Build general models of the 5G NR system that can be applied to predict the performance of a 5G system.

This work has received funding from the Research Council of Norway through the SFI Norwegian Centre for Cybersecurity in Critical Sectors (NORCICS) project no. 310105.

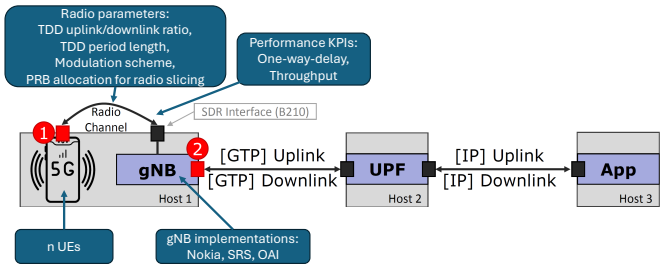

Fig. 1: Testbed for campus 5G measurements. Measurement points: (1) Radio interface of UE and (2) Backhaul interface of gNB.

Parameter space. We have defined a parameter space of interest in Fig. 1. Furthermore, the space includes the specific set of parameter mutations we are interested in investigating. The combination of parameters was chosen to provide a basis for understanding the performance of 5G and the influences of these factors on the 5G NR system.

Preliminary results. The current results of this project can be found in the papers [1] [2]. However, these only begin to cover the goals, and more research in all three directions is needed.

Concluding remarks. We aim to reduce the threshold for deploying 5G systems by providing knowledge of 5G parameterization and 5G implementation options. This project seeks to enable a new and reliable communication option through 5G for our partners in critical sectors and industries, such as smart grid deployments and industry automation.

References

[1] S. Raffeck, S. G. Grøsvik, S. Lange, T. Hossfeld, T. Zinner and S. Geissler, "Parameterizing 5G New Radio: A Comparative Measurement Study on Throughput and Delay", International Conference on Network and Service Management (CNSM), Prague 2024

[2] S. Raffeck, S. G. Grøsvik, L. A. Becker S. Lange, S. Geissler, T. Zinner, W. Kellerer and T. Hossfeld, "A Discrete-Time Model of the 5G New Radio Uplink Channel", The International Teletraffic Congress (ITC-36), Trondheim 2025