SSY 145 Research Project Planning Report

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1   Preliminary Title

5G New Radio (NR): Next Generation Radio Access Technology

2   Background

This is a research work in partial fulfillment of the requirements for completing the Wireless Network Course, SSY145. The project is built on 5G New Radio (NR) solution, as an innovation in Wireless Access Networks. This is to acquire the needed knowledge of the 5G network, and other related specifications around it.

3   Introduction

The mobile communication network has grown over the years and these growths has been represented as generational technological innovations. This encompasses 1G, 2G,3G,4G and 5G. The G standards for generation. Each generation has it own unique architecture, advantages, as well as its challenges. Mobile services have been broadly classified into voice, video and data, with other sub-sets breaking out of these three. 5G NR (New Radio) is a air interface developed for 5G. An air interface is the radio frequency part of the radio access network, between the mobile device and its base station. It is using the wireless channel to connect mobile devices, mobile stations and, generally, user equipment to the base station. There a couple of base stations that make up the network and are geographically spread out. This helps to achieve expected service coverage and hand off of service from one base station to another, thus enabling service accessibility even with mobility.

Furthermore, 5G NR, as a new radio access technology (RAT), was developed by 3GPP (3rd Generation Partnership Project) for the 5G (fifth generation) mobile networks. It was designed to be the global standard for the air interface of 5G networks. A Radio Access Technology or (RAT) is the underlying physical connection method for a radio-based communication network. 5G also uses OFDM (orthogonal frequency-division multiplexing), a spectral efficient technique already being used by WiMAX, LTE and IEEE 802.11 (Wi-Fi).

The 5G System architecture is defined to support data connectivity and services enabling deployments to use techniques such as e.g. Network Function Virtualization (NFV) and Software Defined Networking (SDN).5G performance requirement is higher than 4G, including the capability to support between 100Mbps to 1Gbps user experience speed, 1 million connections density per kilometer square, millisecond level of end-to-end latency of less than 10ms, Tbps level of traffic flow density per kilometer square, mobility of up to 500km/h. All of these make up to the top three (3) key performance indicators of 5G network (user experience, connection density and latency). Meanwhile, 5G is required to improve the efficiency of network deployment and operation maintenance. To compare with 4G, the spectrum efficiency improved between 5 to 15 times, and the cost efficiency improved more than hundred times.

4 Main Objective

This research will investigate the uniqueness of the 5G network as regards the New Radio (NR) solution. It will be compared with the older and existing mobile access technologies, to further buttress on the dividends of this technology. It will also point out its various unique features, key performance indices, and applications, as a huge improvement to the telecommunication work space.

5 Scope

This research will cover the following specific topics, but not limited to them.

- Architecture of the 5G network
- Review of the Radio Access Network of 1G, 2G,3G and 4G
- 5G Radio Access and NR
- 5G NR Key Features
- Frequency Spectrum and Licensing for 5G NR
- 5G NR Standards and Specifications
- 5G Network Deployment and Roll-out
- 5G NR Service Interfaces
- 5G Backward Compatibility

6 Limitations

This is a research project based on theoretical findings on 5G NR. There was no specific simulation or bench test. Also, there were no real-life data gathered from the network service operators that are already using 5G.

7 Project Risk

5G NR is new technology and yet to be deployed across all the mobile service operators. Hence, every day there will be a new idea and a lot of published research works. Therefore, to avoid miss-match, the work load will divided between group members depending on sub-section of research.

This also means the group members will have to do a lot of personal reading and cross-referencing to acquire the needed theoretical background to support this project. This also means critical feedback will be needed from the examiner in-charge and the teaching assistant as we progress. This will require proactive knowledge gathering and continuous involvement of the supervisors.

8 Time Chart

Below is our time sheet towards a successful project execution.

Group's Deadline	Task	Outcome	Examiner's Deadline
4th April 2020	Based on group research studies, a draft will be created for professional review	Initial Draft	-
11th April 2020	Review of the Radio Access Network of 1G, 2G,3G and 4G	Conclude sub-section	-
18th April 2020	Architecture of the 5G network	Conclude sub-section	-
25th April 2020	Frequency Spectrum and Licensing for 5G NR 5G NR Standards and Specifications	Conclude sub-section	-
1st May 2020	5G Network Deployment and Roll-out 5G NR Service Interfaces 5G Backward Compatibility	Conclude sub-section	-
8th May	Pre-liminary Review of the Project	Final Draft for review	-
16th May 2020	Completion of the final report	Final report	Monday 18th May 2020
23rd May 2020	Finalize the preparations for the Oral defense	Oral Presentation	Monday 25th May 2020
23rd May 2020	Finalize the development of the presentation slides and materials	Presentation slides	Monday 25th May 2020
23rd May 2020	Finalize the details of the logbook	Logbook	Monday 25th May 2020