

Documentation and Educational Website Weekly Report

EE/CprE/SE 492 WEEKLY REPORT 04

4/07/2023 - 4/21/2023

Group number: 31

Client &/Advisor: Dr. Hongwei Zhang

<i>Team Members</i>	<i>Majors</i>
Adam Kruger	Software Engineering
Danny Cao	Electrical Engineering
Ethan Gabriel	Electrical Engineering
Zachary Miller	Software Engineering

Sphinx Development

- o Adam Kruger
- o Zachary Miller

Website Design

- o Zachary Miller
- o Ethan Gabriel

Willingness to learn about 5th Gen Wireless Networks

- o All team members

Tech Writer Skills

- o Danny Cao
- o Ethan Gabriel

Experiment Design

- o Danny Cao

Git

- o Zachary Miller

Surveying Experience

- o All team members

Weekly Summary:

The team mainly focused on transferring the text we wrote for each of the topics below onto the website, and began to format the website. We were able to get it hosted on readthedocs, and used Sphinx to make it look professional. We had a meeting with our client, and were given some pointers on how to better format the information, and even what information we were lacking in the website. Below is the current structure of the website that was in our previous report:

- Overall Basic 5G Network Structure
- User Equipment and Other Equipment
- RAN Overview
- NG-Core Overview:
- 5G Networking in Rural Locations
- ARA Related Topics

- “Hello World!” in ARA
- Utilizing UEs to interact with the ARA network
- Determining which base station is online and active within the ARA network
- Transmitting, Receiving, and Visualizing Waveforms using UHD and GNURadio

In terms of website layout, the following layout has been updated to learning modules and testbed to reflect these changes and have been set to working on getting it implemented into the current website.

5Gdocumentation
latest

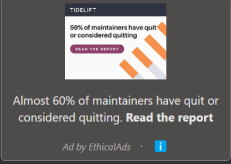
Search docs

GETTING STARTED!
Starting your learning

LEARNING MODULES
Overall Basic 5G Network Structure
User Equipment
Technical Details of RAN Systems

ABOUT US
About Us

EXPERIMENTS
Introduction



Read the Docs v: latest

🏠 / Welcome to the 5Gdocumentation site!

[Edit on GitHub](#)

Welcome to the 5Gdocumentation site!

Welcome to our beginner-friendly 5G technology platform! Our mission is to provide you with an easy-to-understand introduction to the world of 5G, offering essential resources, interactive learning modules, and exciting experiments that will help you grasp the basics of this groundbreaking technology.

Our website covers a wide range of topics, such as User Equipment (UE), Radio Access Network (RAN), and Next Generation Core (NG-Core), which form the foundation of 5G networks. We also explore various applications and challenges, like deploying 5G in rural locations.

Designed with beginners in mind, our platform ensures all concepts are accessible and straightforward. You can test your understanding with quizzes and engage in hands-on learning modules that make 5G technology come alive. Plus, our comprehensive reference page offers definitions for all underlined terms, making it easy to navigate through technical jargon.

Join us on this exciting journey as we unravel the wonders of 5G technology, and together, we'll unlock a new era of connectivity.

If you're new, be sure to look at the [beginner](#) page!

Getting Started!

- [Starting your learning](#)
 - [Sample subheading](#)
 - [Sample subheading2](#)

Learning Modules

- [Overall Basic 5G Network Structure](#)
- [User Equipment](#)
- [Technical Details of RAN Systems](#)

About Us

- [About Us](#)
 - [Our Team Members](#)
 - [Our Team](#)

Experiments

- [Introduction](#)
 - [Getting Started](#)

Next ↗

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Introduction

- Now must add experiments and documentation from the official ARA website

Module Links

- We are now going to be adding more stuff from the ARA official site onto the modules, testbeds, and experiments sections of the documentation website
- Overall Basic 5G Network Structure
 - User Equipment (UE)
 - Radio Access Network (RAN)
 - Mobile Core (NG-Core)
- User Equipment and Other Equipment
 - Devices - Phones, Drones, and Cars
 - Applications such as agricultural advancement

- Antenna
- Routers and Switches
- Small Cells: Used to provide wireless coverage in areas with poor coverage and can be deployed indoors or outdoors.

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Search docs

GETTING STARTED!
Starting your learning

LEARNING MODULES

- Overall Basic 5G Network Structure
- Introduction
- User Equipment
- Radio Access Network
- Core Network
- Quiz

User Equipment

Technical Details of RAN Systems

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Manage less. Build more. Simplify your data infrastructure with MongoDB Atlas.

Aid by EthicalAds

/ Overall Basic 5G Network Structure [Edit on GitHub](#)

Overall Basic 5G Network Structure

Introduction

The 5G network architecture is designed to provide a reliable high-speed, low-latency wireless connectivity source. When looking at the basic overall 5G network structure, at its core, it consists of three main components.

User Equipment

Also referred to as UE's, these are the end-user devices typically used to establish a connection or access the network. They serve the role of enabling users to access high-speed wireless communication as well as other advanced applications and services. Some common examples of UE's include laptops, smartphones, desktop computers, or any device that can connect to the network through wireless communication technologies such as Wifi and cellular data. Refer to page: "User Equipment" for more information.




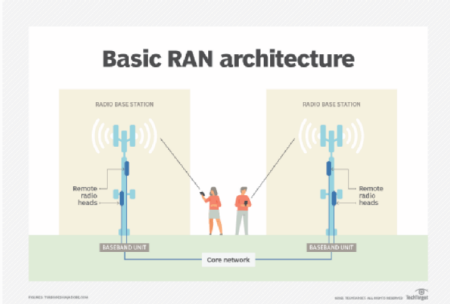
Image Source: <https://www.8.hp.com>

This picture depicts sample user equipment (UE)

- RAN Overview
 - Radio Spectrum
 - Base Stations
 - Millimeter-wave frequencies

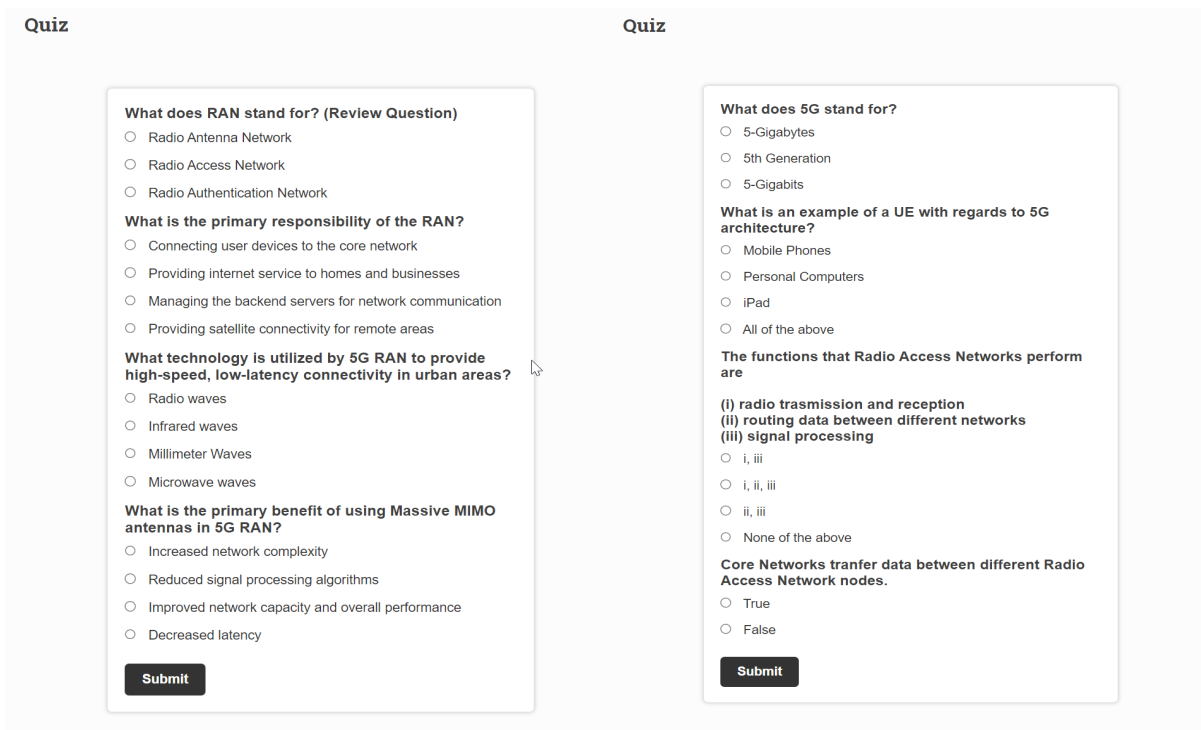
Radio Access Network

The radio access network, or RAN, is the component that links the user equipment to the core network (a component that is mentioned below). It consists of a network of base stations, or radio access nodes, communicating with the aforementioned user equipment using radio frequencies. UE's can be provided wireless connectivity by transmitting and receiving radio signals through the radio access network. Some of the functions performed by the RAN include radio transmission and reception, signal processing, resource management, and security. Refer to page: "Radio Access Network" for more information.



This picture depicts basic RAN architecture

- Quizzes
 - We implemented a handful of quizzes to test the learning of our testers and users. These quizzes are related to the topics we have on the website.



Test Bed

- More relevant ARA features will be implemented within Test Bed as an ISU associated 5G application. We can implement this using some resources from the ARA site.
- Implement:
 - “Hello World!” in ARA
 - Utilizing UEs to interact with the ARA network
 - Determining which base station is online and active within the ARA network
 - Transmitting, Receiving, and Visualizing Waveforms using UHD and GNURadio

How to Get Started

- Inclusion of O-RAN application, inclusion of ARA-RAN, PowderWireless
- ARA will be active within the following weeks, software and application guide will be provided to support this.
- “Hello World” - ARA

Sphinx Website layout change to look more professional as client request

- The structure of our website has completely changed, and now has a much more professional file structure and styling to it, as requested by our client who is satisfied with the current look of it.

ReadTheDocs.org website hosting

- ReadTheDocs implementation has been added to git repo and the website is now officially hosted on ReadTheDocs @ <https://5gsitedocumentation.readthedocs.io/en/latest/>

Past Week Accomplishments:

- Zach Miller: Added ReadtheDocs to git, started embedding the ReadTheDocs implementation into the code base to get it to be hosted on ReadTheDocs.org
- Danny Cao: Populated outline and learning module with content and information referring to UEs, RAN, overview of 5G network, and other equipment supporting 5G network. We will have to do a review over content.
- Adam Kruger: Adding information to the website from our written documents. Created small quizzes for the website at the end of each module.
- Ethan Gabriel: Created documentation for NG-Core and Rural area. Created and started documentation of sources and references.

Pending Issues:

- Zach Miller: Officially hosted the website via Readthedocs.org, completely reorganized the entire project layout and structure.
- Danny Cao: Need to work with Ethan on being provided feedback on learning modules. Will also have to work closer with our client to discuss other possible avenues for testbeds.
- Adam Kruger: Fill out the rest of the remaining modules as well as add test beds and experiments.
- Ethan Gabriel: Need to finalize documentation on site, and specifically make sure that all sources are cited properly and neatly. Need to ensure we incorporate feedback from users back into the site.

Individual Contributions:

NAME	Individual Contributions <i>(Quick list of contributions. This should be short.)</i>	Hours this week:Hours cumulative
Zach Miller	Finished website hosting, website is now Publicly accessible Completely changed CSS layout, added Learning module content to website	10 34

Adam Kruger	Added information to module pages Made quizzes for modules 1 and 2 Researched Sphinx architecture	10 34
Danny Cao	Worked on populating information for the topics that will be discussed. Given feedback, incorporated changes and updates as per requested.	10 34
Ethan Gabriel	Worked on populating information for modules to be hosted on website using outline Started documentation of resources/references to be cited	10 34

Plans for Upcoming Week:

- Finish populating website content including learning modules
 - Adam Kruger and Zach Miller
- Riff off of some of the ARA experiments and select which ones to put (since they are new this is late stage addition)
 - Danny Cao, Zach Miller
- Continue to discuss and populate learning modules with advisor/client present
 - Danny Cao, Adam Kruger, Zach Miller, and Ethan Gabriel
- Host website from GitLab after advisor figures out repository visibility
 - Zach Miller
- Finish documentation of references and sources, ensuring all are cited properly
 - Ethan Gabriel and Danny Cao
- Beta test for ARA's testbeds and experiments on the site
 - Danny Cao, Adam Kruger, Zach Miller, and Ethan Gabriel
- Get test subjects to go through our website and give feedback
 - role : All
- Populate two more additional learning modules regarding 5G network protocols, and other avenues of open source platforms.

Summary of Weekly Advisor Meeting:

This week's meeting with our advisor prior to finishing up the semester consisted of last minute changes and request as well as an overview and review of the current state of project. In terms of visuals and layout, our advisor was satisfied on that front, but with regards to content, wanted to go a little more in depth on the technical front of 5G such as discussing network protocols stacks, adding an overview summary for each testbed with a pointer towards the page, mentioning other open source platforms such as OAI and srsRAN.

We had previously mentioned that the team was waiting on being involved in the beta test of the ARA platform, but due to delays, will have to wait a little longer and this may pose an issue for the team as the deadline approaches. The number of testbed options will definitely be limited as a result as the team won't have too much experience with the platform and won't be able to effectively generate simulations or tests users can perform with the ARA platform. We were also advised that it may prove to be beneficial to include URLs and embedded youtube videos within the documentation project to further support our work (with proper credit applied).

With that, the weekly meeting has concluded.