# **Skills Analysis**

* **Familiarity with O-RAN Architecture / Specifications**
  + MAC protocol
  + PHY (physical layer) protocol – modulation schemes, coding schemes, and multiple access techniques such as OFDMA
  + RLC (Radio Link Control) protocol – provides reliability and error correction over the radio interface
  + Interface protocols including E1, F1, and S1, all of which perform different connectivity and communication functions between different network components
  + Near-RT and non-RT Radio Interface Controller functions
* **4G/5G/LTE Technologies and Standards**
  + Deployment scenarios such as network slicing and network function virtualisation (NFV)
  + Knowledge of core network protocols such as NGAP and S1AP for communication between the RAN and core network
  + Proficiency in configuring and managing RAN elements such as base stations, radio units, distributed units, and central units
  + 5G functional splits including 7.2, 7.3, and 7.2x splits, all of which define how base station functions are accomplished by different elements of the network
  + Familiarity with wireless propagation models and radio frequencies
  + PDCP (Packet Data Convergence Protocol)
  + RRC (Radio Resource Control)
  + SCTP (Stream Control Transmission Protocol)
  + GTP-U (GPRS Tunnelling Protocol – User Plane)
* **Network Protocols and Networking Concepts**
  + TCP
  + UDP
  + IP
  + IP routing
  + VLANs
  + Subnetting
  + QoS
  + SSL/TLS
  + Ethernet
  + DHCP
  + DNS
  + SNMP
  + SFTP / FTP
  + TCP/IP and OSI Protocol Suite
  + IPsec
  + Advanced Encryption Protocols
  + Software defined networking
* **Operating System Knowledge**
  + Ubuntu 22.04/Linux familiarity
  + General: Windows/Linux
  + Knowledge of hypervisors
    - Setting up virtualisation support in UEFI/BIOS settings
  + Creation and management of Virtual Machines
    - Disk partitioning
    - Installation of guest OSes
  + Containerisation technologies
    - Creating, pushing, pulling images to/from repositories
    - Familiarity with writing Docker files (i.e. Docker syntax) to define dependencies and the build steps of a container image
    - Container lifecycle and image management
  + Dual boot configuration of a guest and native OS
  + IDE familiarity (VS Code, VIM, PyCharm etc)
  + Shell scripting
  + Automation Tools (Ansible, Kubernetes)
* **Soft skills**
  + Comprehensive documentation abilities
  + Technical writing skills
  + Document design/outlining
  + Ability to create and modify test plans
  + Collaboration/teamwork
  + Knowledge of IT project management principles

## Skills Analysis Rubric

To create the following chart the team compiled a list of relevant skills for our project, categorizing each one based-on expertise levels using the provided colour scheme below:

|  |  |  |
| --- | --- | --- |
| **SKILL LEVEL** | **RUBRIC** | |
| No experience |  | No awareness of concept or very little usage |
| Basic Understanding |  | Introductory or theoretical understanding of the concept |
| Intermediate Understanding |  | Used for university work or basic personal projects |
| Advanced Understanding |  | Paid work or deliberate use on advanced/multiple personal projects |

## Team specific skills

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SKILLS LIST** | **PROFICIENCY** | | | | |
|  | Chris | Edward | Katarina | Samuel | William |
| **O-RAN ARCHITECTURE AND SPECIFICATIONS** | | | | | |
| MAC protocol |  |  |  |  |  |
| PHY (Physical layer) protocol |  |  |  |  |  |
| RLC (Radio Link Control) |  |  |  |  |  |
| Interface Protocols |  |  |  |  |  |
| Near-RT and non-RT Radio |  |  |  |  |  |
| **4G/5G/LTE TECHNOLOGIES AND STANDARDS** | | | | | |
| Network Function Virtualization |  |  |  |  |  |
| NGAP and S1AP Protocols |  |  |  |  |  |
| Manage/configure RAN |  |  |  |  |  |
| 5G functional splits |  |  |  |  |  |
| Wireless propagation models |  |  |  |  |  |
| Packet Data Convergence |  |  |  |  |  |
| Radio Resource Control |  |  |  |  |  |
| Stream Control Transmission |  |  |  |  |  |
| GPRS Tunnelling Protocol |  |  |  |  |  |
| **NETWORK PROTOCOLS AND CONCEPTS** | | | | | |
| TCP |  |  |  |  |  |
| UDP |  |  |  |  |  |
| IP |  |  |  |  |  |
| IP routing |  |  |  |  |  |
| VLANs |  |  |  |  |  |
| Subnetting |  |  |  |  |  |
| QoS |  |  |  |  |  |
| SSL/TLS |  |  |  |  |  |
| Ethernet |  |  |  |  |  |
| DHCP |  |  |  |  |  |
| DNS |  |  |  |  |  |
| SNMP |  |  |  |  |  |
| SFTP/FTP |  |  |  |  |  |
| TCP/IP and OSI Protocol Suite |  |  |  |  |  |
| IPsec |  |  |  |  |  |
| Advanced Encryption Protocols |  |  |  |  |  |
| Software Defined Networking |  |  |  |  |  |
| **OPERATING SYSTEM KNOWLEDGE** | | | | | |
| Linux/Ubuntu 22.04 |  |  |  |  |  |
| Windows/OSX |  |  |  |  |  |
| Hypervisors |  |  |  |  |  |
| Virtual Machines |  |  |  |  |  |
| Containerization technologies |  |  |  |  |  |
| Dual boot configuration |  |  |  |  |  |
| IDE familiarity |  |  |  |  |  |
| Shell scripting |  |  |  |  |  |
| Automation Tools |  |  |  |  |  |
| **SOFT SKILLS** | | | | | |
| Comprehensive Documentation |  |  |  |  |  |
| Technical writing skills |  |  |  |  |  |
| Document design/outlining |  |  |  |  |  |
| Create and modify test plans |  |  |  |  |  |
| Collaboration/teamwork |  |  |  |  |  |
| Knowledge of ITPM principles |  |  |  |  |  |

It was crucial for our team to compile a comprehensive skills list and for each member to transparently indicate their proficiency levels for several reasons (particularly within the context of our project). Firstly, this process allows us to assess our collective strengths and weaknesses, facilitating better resource allocation and task delegation as we navigate the complexities of implementing a 5G Indoor Testbed with O-RAN and SDRs. For instance, by knowing that one team member has advanced knowledge in Docker containerization while another excels in 5G networking protocols, we can allocate tasks accordingly to leverage their individual expertise more effectively. Moreover, having a detailed skills inventory enables us to identify potential knowledge gaps and develop tailored training plans for each team member, ensuring that everyone has the necessary capabilities to contribute effectively to the project's success.

## Training Plan

In developing our training plan, we understand that it may not be highly detailed or exhaustive due to only having the broad strokes of what we need to learn. However, we recognize the necessity of identifying and acquiring specific skills essential for our project's success. This includes a comprehensive understanding of 5G technologies, O-RAN architecture, and Software Defined Radios (SDRs), which form the backbone of our project. Additionally, proficiency in containerization technologies such as Docker and knowledge of virtualization and virtual machine (VM) management are crucial for setting up our testbed environment efficiently and repeatedly. By focusing on these key areas, we will ensure that our team is equipped with the necessary expertise to tackle the project's challenges effectively. Through targeted learning and practical application of the skills mentioned above, we aim to build a strong knowledge foundation, enabling us to navigate the complexities of our project with confidence.

We have already initiated knowledge-sharing efforts within our team and are committed to continuing this practice throughout the project. By facilitating knowledge transfer and sharing resources through various means such as documentation, crash courses, related articles, videos, and workshops, we ensure that everyone has access to relevant information and learning materials. This proactive approach to information sharing is crucial, especially for a project as technical as ours, where staying updated on the latest developments and acquiring new skills will be essential for success.