srsRAN Project

Open-source 5G, Open-RAN and Software Radio Networks

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LauzHack, May 2024

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- srsRAN Project
- Developing in Industry
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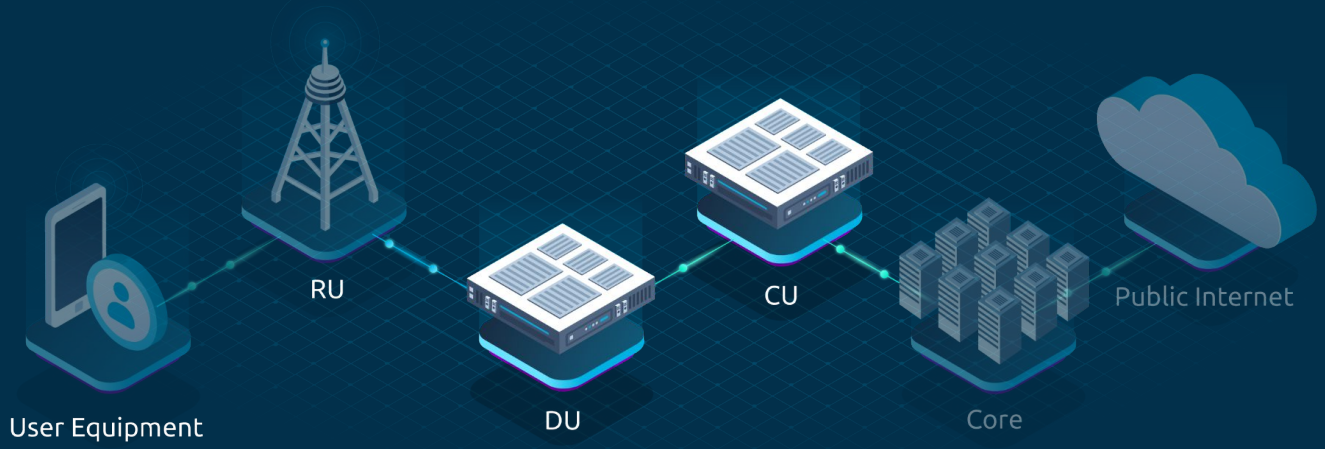


Company Overview

Who we are, and what we do…

SRS

Who we are…

- Private company founded in 2012
- Headquartered in Ireland
- Offices in Ireland and Spain
- Global customer base
- 25 Full-time employees
- 100% Software radio
- 100% Organic growth

SRS

Areas of expertise

We focus on 4 main areas:

- Software Radio
- Telecommunications
- Software Engineering
- Signal Processing

What we do…

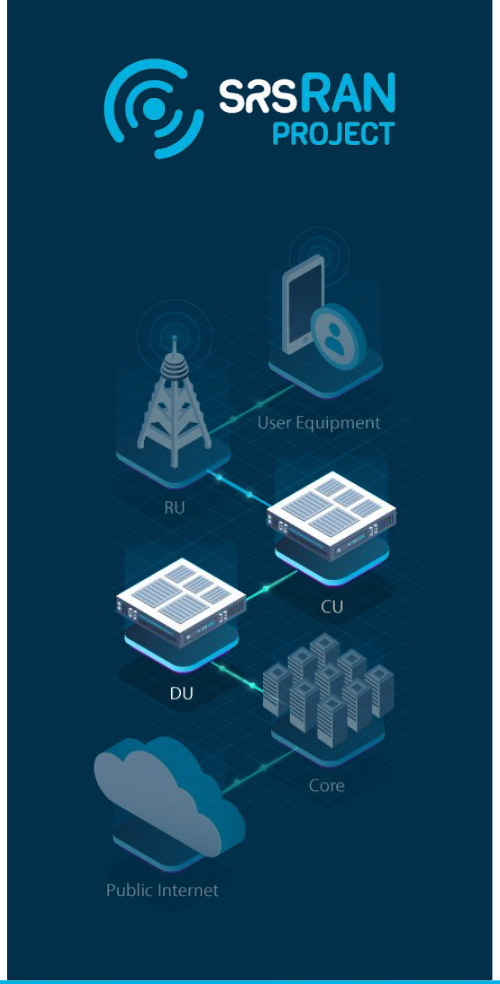
srsRAN

SRS builds 4G and 5G mobile wireless software radio systems

- Available as both open-source and commercial products.

Two main open-source products:

- srsRAN 4G
  - An open-source 4G software radio suite
- **srsRAN Project**
  - An open-source CU/DU



What we do…

Publicly Funded Projects

We act as a platform provider in multiple publicly funded projects:

- Stardust (Horizon-JU-SNS-2022)
- Trantor (Space-01-11)
- AI@EDGE (Horizon2020)
- DAEMON (Horizon2020)
- 6GBLUR (Unico)
- 6GDAWN (Unico)
- 6GOASIS (Unico)

What we do…

Commercial Engagements

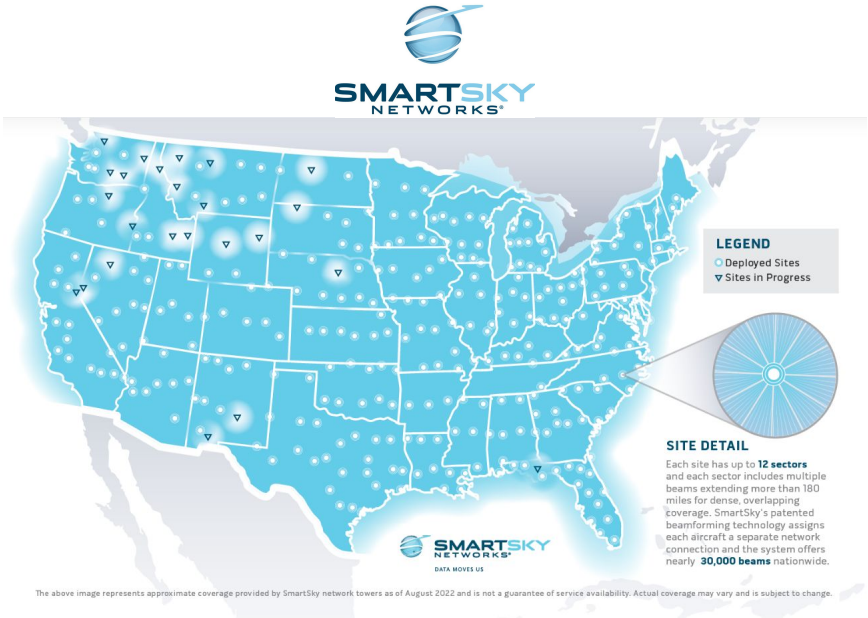
Two of our most interesting projects:

- Smartsky Networks
  - Commercial air-to-ground network in 2.4GHz band
- AST SpaceMobile
  - Unique direct-to-mobile 4G/5G network

Commercial Engagements

SmartSky Networks

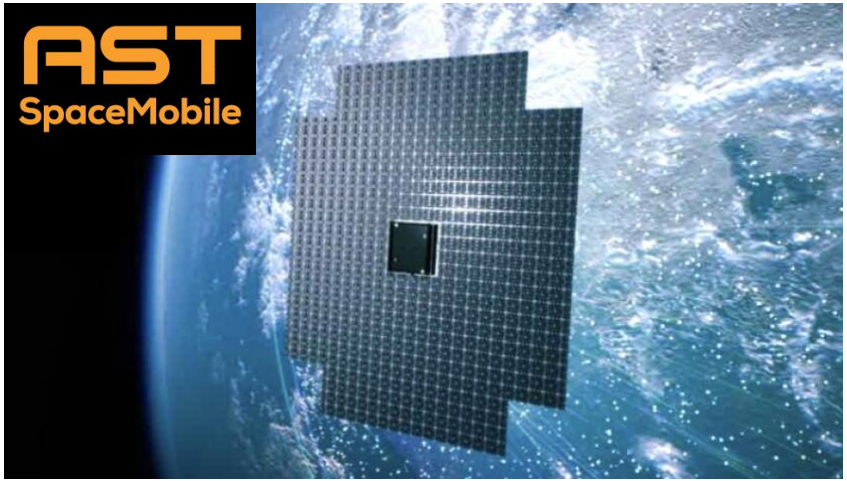
- Commercial air-to-ground network in 2.4GHz band
- SRS developed and delivered 3 products:
  - **Smartcart** - lightweight SDR testing eNodeB
  - **Rocket** - production eNodeB L2/3 with FAPI on NXP QoriQ platform
  - **Smartscope** - drone-mounted scanner and signal analyzer



Commercial Engagements

AST SpaceMobile

- Unique direct-to-mobile 4G/5G network
- Large phase-array LEO satellites
- Beamformed cells roughly equivalent to terrestrial cell sizes
- Launched successfully 10 september 2022
- Successfully tested end-to-end with SRS eNodeB
- SRS eNodeB and tools will be used for testing and MNO demonstrations



Open-source Vs Commercial

How does it work?

Open-core, dual-license model

Source Licensing

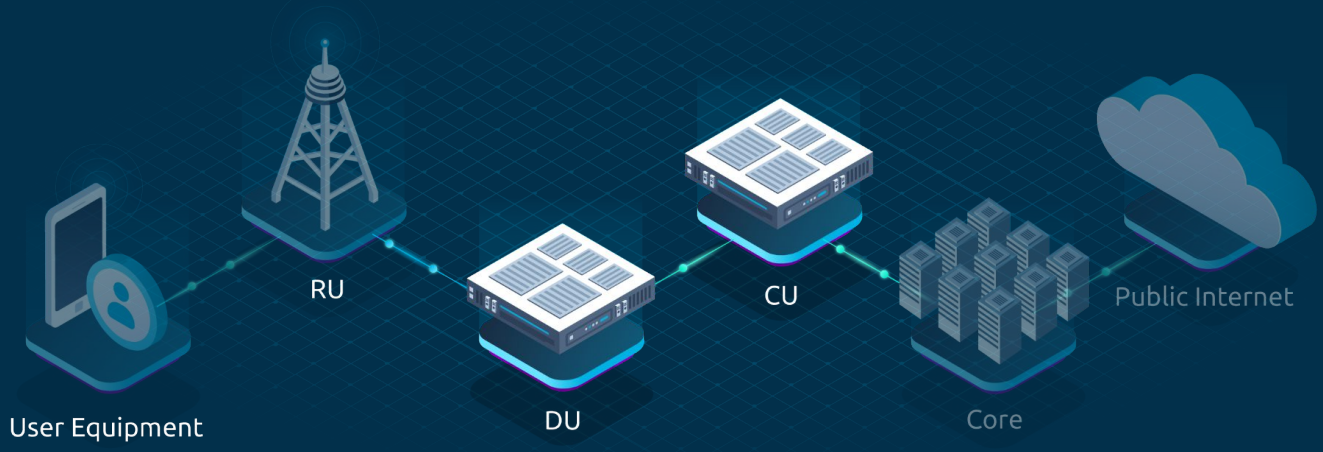
srsRAN_Project Public

Open source O-RAN 5G CU/DU solution from Software Radio Systems (SRS) https://docs.srsran.com/projects/project

C++ ☆ 389 125

AGPLv3 - R&D

Commercial - Production Deployments



5G & OpenRAN

How did we get here and why is it important?

5G & OpenRAN

What is 5G?

- **LTE** (4G) was defined in 3GPP Release 8 in 2008
- **LTE-A** (4G+) was defined in 3GPP Release 10, in 2011
- **5G** was defined in 3GPP release 15 in 2018
- Currently standard is release 18

Release	Speed	Latency
8	100 Mbps	60 ms - 98 ms
10	100 Mbps - 1 Gbps	60 ms - 98 ms
15	1+ Gbps	> 5 ms

5G & OpenRAN

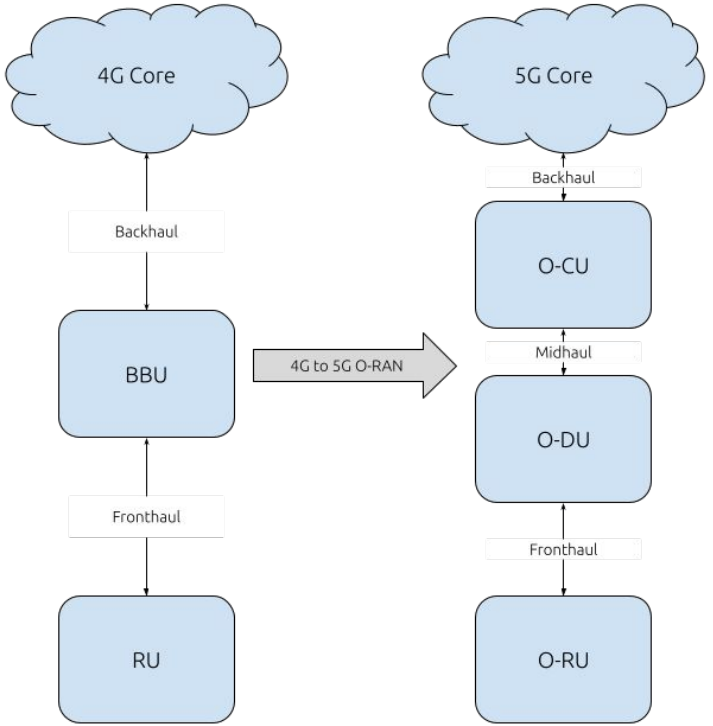
What is OpenRAN?

- O-RAN aims to define “open” interfaces and components for 5G Radio Access Networks.
- The following are the main 4 aims of O-RAN:
  - **Promote interoperability** - components should plug and play
  - **Reduce costs** - more competition means more competitive prices
  - **Increase flexibility** - operators can buy the exact hardware that meets their needs
  - **Enhance security** - open standards bring more scrutiny, increasing security

5G & OpenRAN

4G vs 5G OpenRAN Architecture

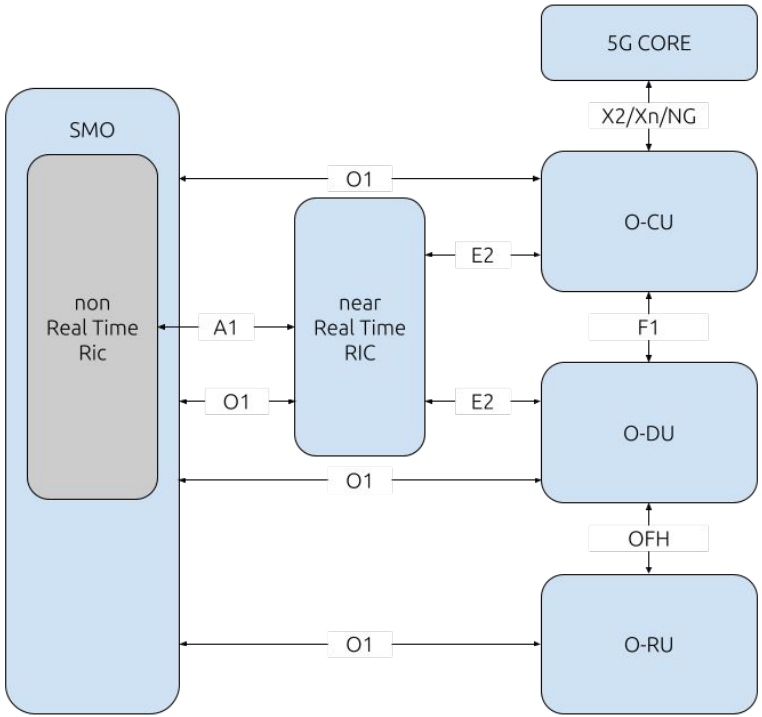
- Release 15 introduces the “Functional Split” to the 5G gNB
  - BBU splits into the O-CU and O-DU
- O-RAN defines further “splits”:
  - Split 8 (as shown)
  - Split 7.2x

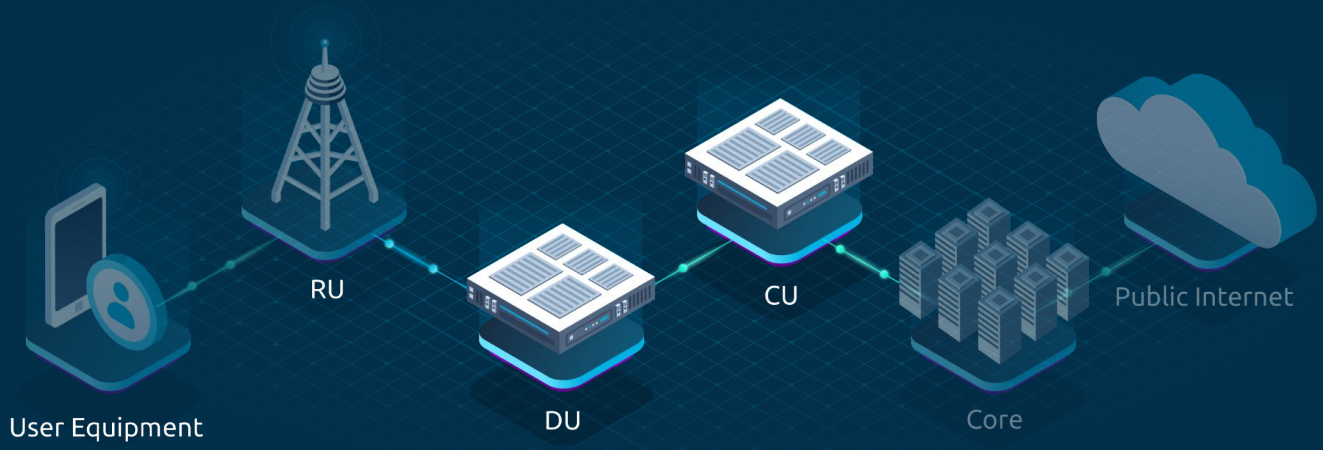


O-RAN Architecture

The whole picture

- O-RAN is more than just a gNB “redesign”
- Adds the following main blocks:
  - nearRT RIC
  - nonRT RIC
- Adds the following new interfaces:
  - To the core: X2, Xn, NG
  - In the gNB: F1, OFH
  - To the nearRT RIC: E2
  - To the SMO: A1, O2





Open-source

What is open-source, and why is it important?

Open-source

What is open-source?

Open-source refers to source code that follows these principles:

- Free distribution
- Open access to source code
- Transparent development
- Collaboration among developers and users
- Community-driven development

Open-source

Why is it important?

Open-source is vital for new and emergent technologies. In 5G and O-RAN development it is key to enabling the following:

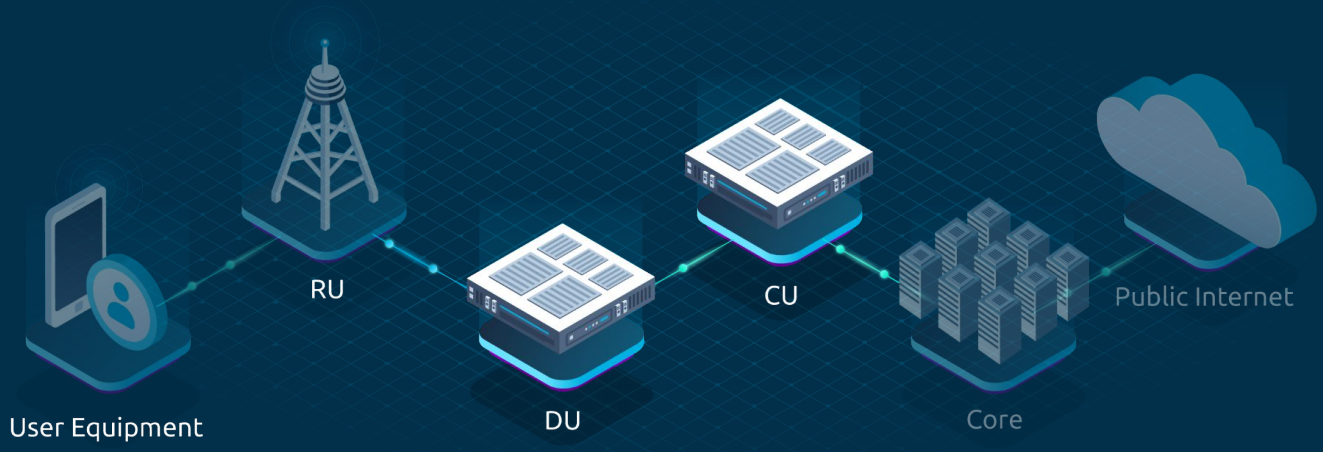
- Innovation
- Interoperability
- Transparency
- Cost-effectiveness
- Flexibility and customization

Open-source

Who benefits?

Many stakeholders in the world of 5G and ORAN benefit from the use of open-source software, specifically:

- Operators
  - More flexibility
  - Reduced costs
  - Faster Innovation
- Vendors
  - More market opportunities
  - Reduced costs
  - Differentiation
- Developers
  - Access to the latest features
  - Collaboration
  - Clear development process
- End-users
  - Improved services and experiences
  - Higher security
  - Lower costs

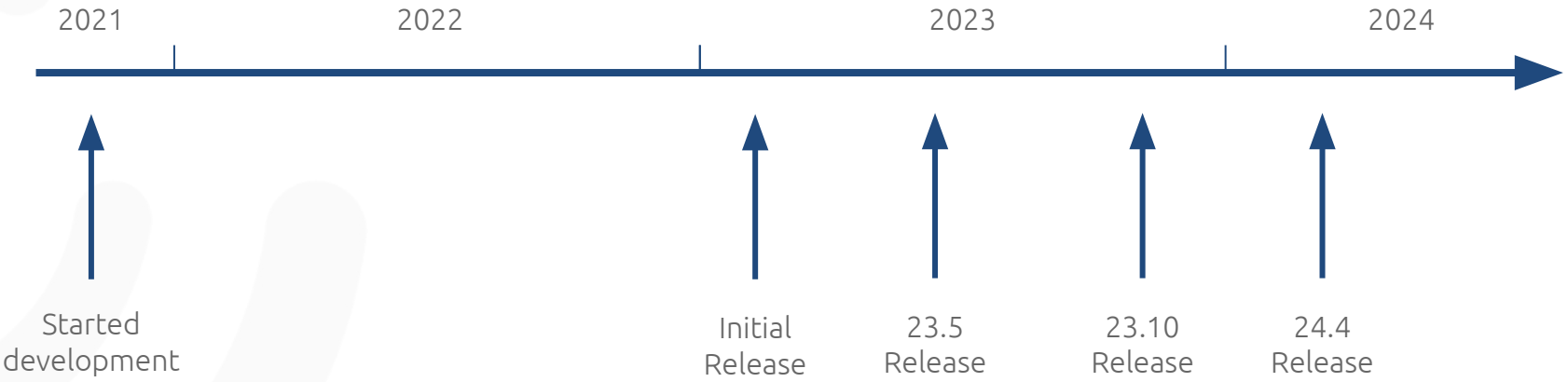


srsRAN Project Overview

An open source O-RAN 5G CU/DU solution from SRS

srsRAN Project

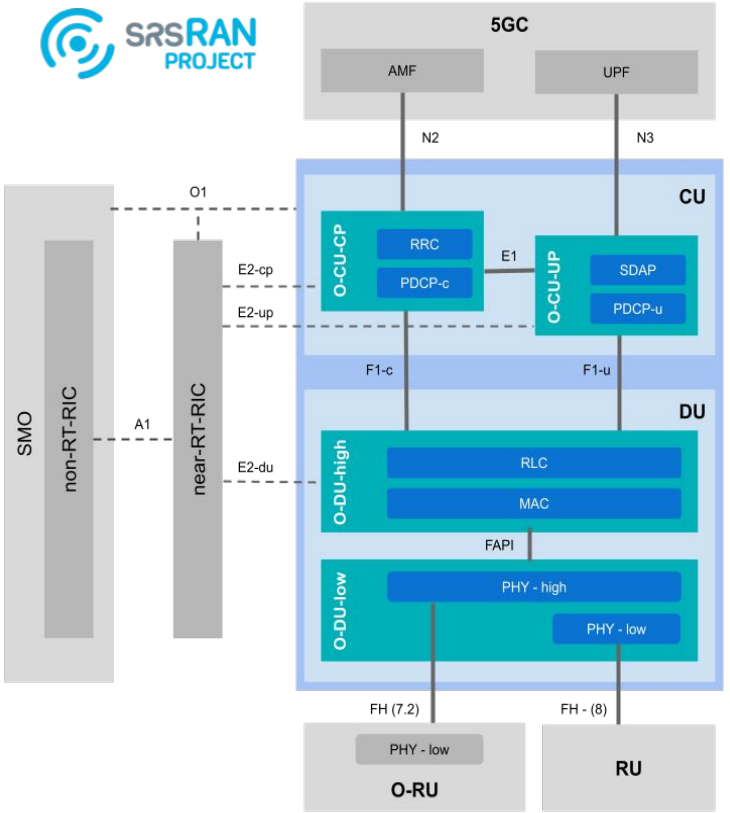
Development Timeline



srsRAN Project

Architecture

- srsRAN Project was developed with 6 core tenets:
  - Complete
  - Portable
  - Performant
  - Open
  - Flexible
  - Interoperable



srsRAN Project

Current Features

- General Features:
  - 100 MHz TDD, 50MHz FDD
  - 15 KHz and 30 KHz SCS (FR1)
  - MIMO 4T4R (4 layers DL, 1 UL)
  - 256-QAM DL and UL
  - Intra-gNB Mobility
  - NTN GEO support
  - E2 KPM and RC service models
  - Custom Open Fronthaul Interface for Split 7.2
    - (no Intel/DPDK dependencies)
  - HW acceleration support
- Performance:
  - 64 UEs, +24h operation
  - 1500 Mbps DL, 200 Mbps UL

srsRAN Project

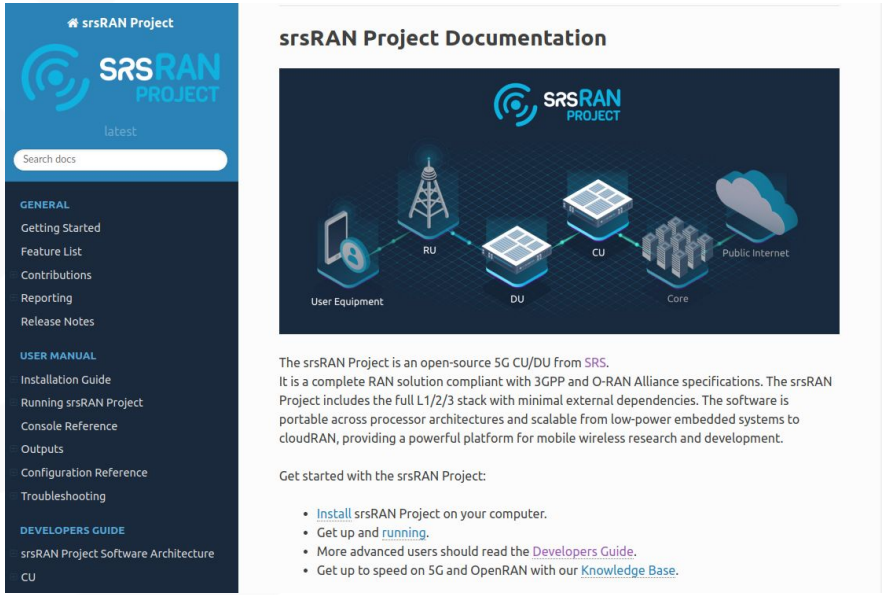
Roadmap

- New Features
  - CU/DU split
  - QoS
  - NTN Rel 17
  - NRPP
  - Closed loop power control
  - X2 Handover
  - RAN Slicing
  - O1 Interface
  - Beamforming
  - MU-MIMO
  - 8-layer MIMO
  - FR2
- Interoperability
  - F1: 3rd party CU/DU
  - E2: test with other RICs

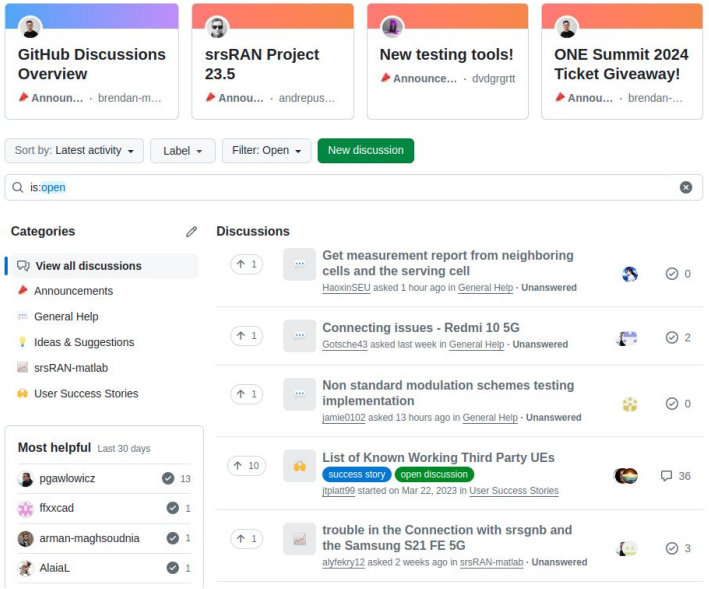
srsRAN Project

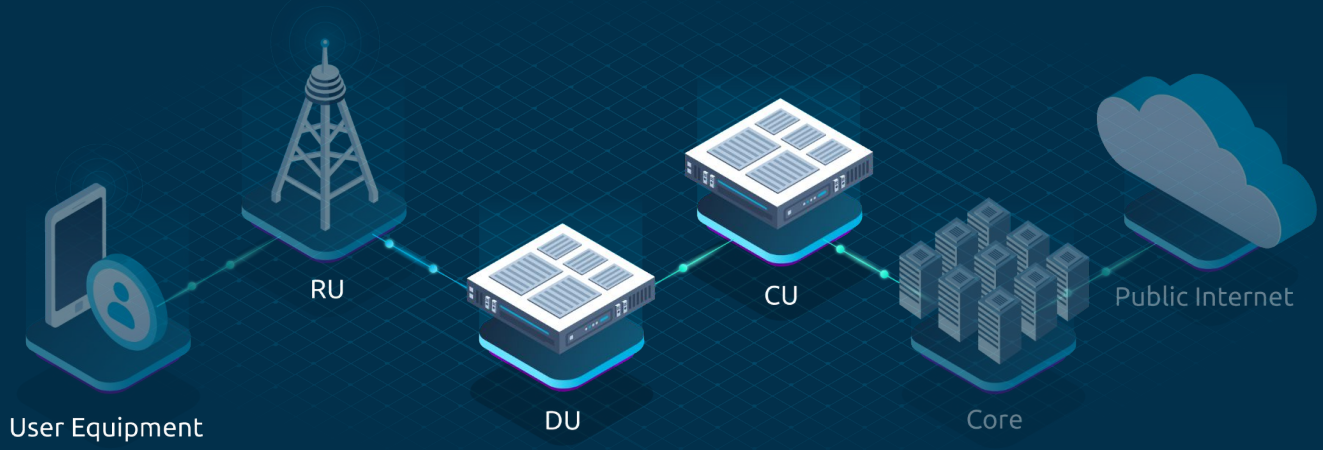
Important Resources

- Documentation



- Discussions





Developing in Industry

Small teams, big results

Developing in Industry

How does it work?

- We have a team of 22 engineers focused on development and testing.
- Three main teams:
  - Development
  - Testing
  - Integration
- Everything is written in C++, with some MATLAB and python for testing and scripting.

Developing in Industry

What languages and tools do we use?

Main Languages:

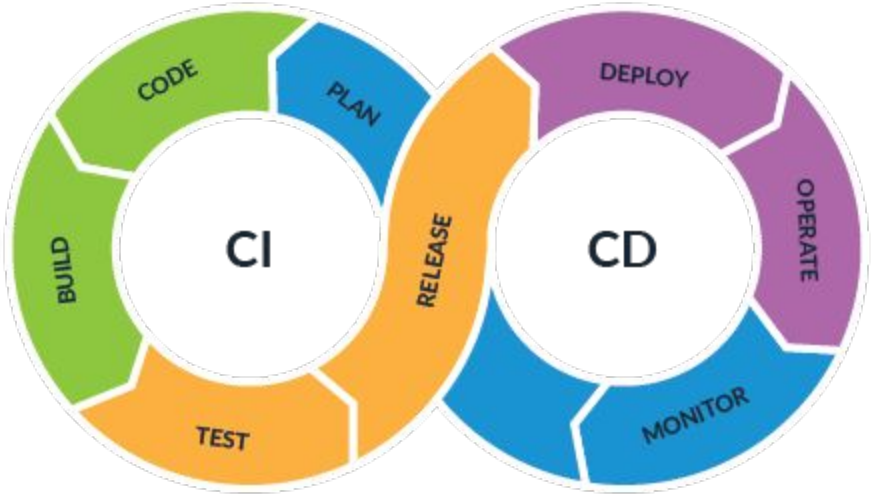
- C++
  - Main coding language
- CMake
  - Build Environment
- MATLAB
  - Testing and prototyping (PHY)
- Python
  - CI/CD
  - Emulation
- Bash
  - Scripting

Main Tools:

- Git
- GitLab CI/CD
- K8s
- Docker
- GDB
- Valgrind
- Google Test
- ASAN & TSAN

Developing in Industry

CI/CD - The most important step



Developing in Industry

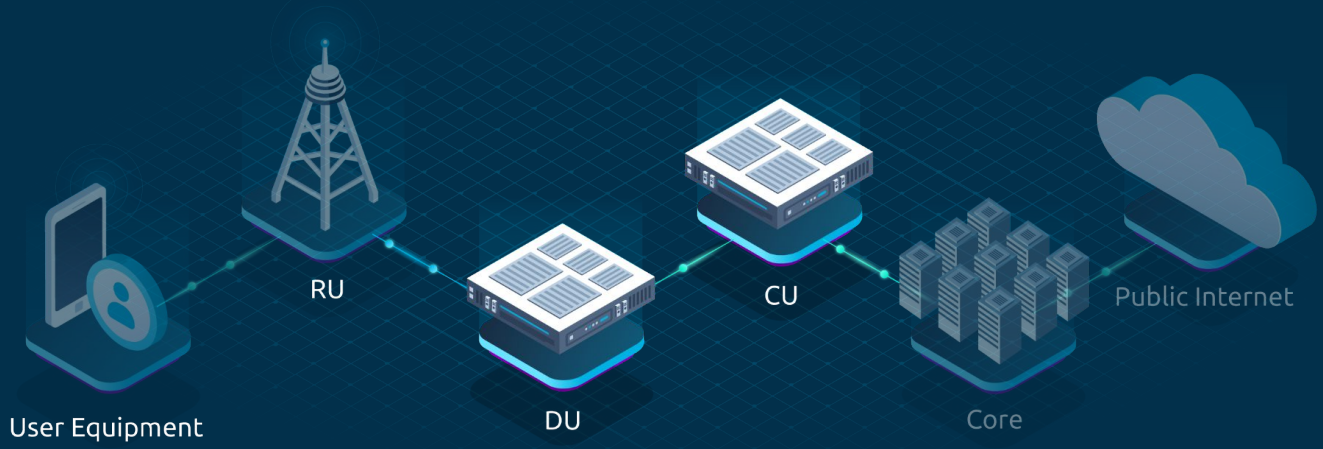
Things they don't tell you…

- Learn how to review your own code and that of others
- Linux and the command line - get comfortable with it
- Focus more on tools than data-structures and algorithms
- Get comfortable with scripting and analysis
- Learning the logic is more important than learning the language - think like a programmer
- Pick an IDE and learn how it works - VS Code or CLion

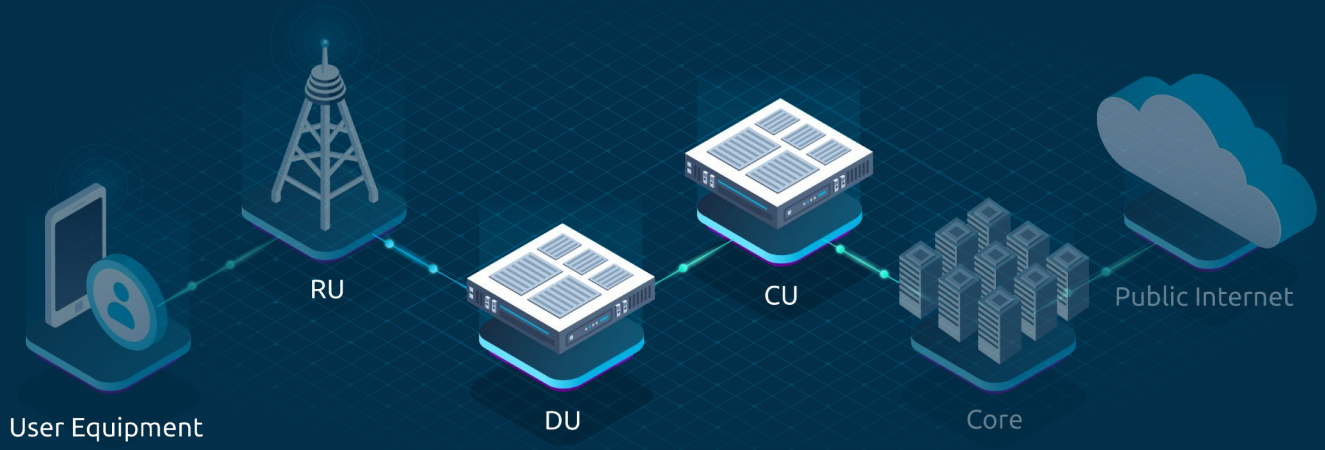
Developing in Industry

What do / do?

- Documentation
  - Essential to the user-experience.
  - Requires a deep understanding of the code and its features.
- Project management
  - Understanding user needs, but also the features and limitations of the code.
  - Have to be able to communicate efficiently with the development team.
- User Support
  - Understanding how to fix issues - from simple to complex.
  - Know where and how to find solutions to these issues.



Questions?



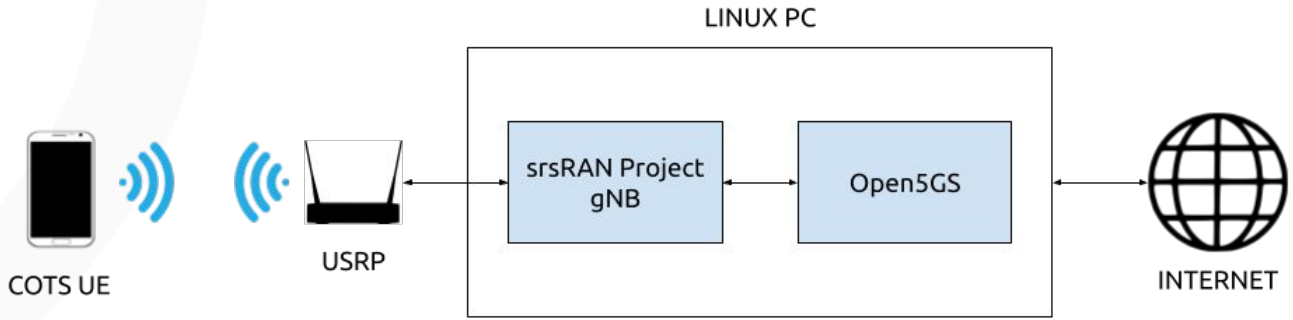
Demo

Private 5G with srsRAN Project

Demo

Private 5G with srsRAN Project

- Software requirements:
  - srsRAN Project (latest version)
  - Docker for 5GC, Influx, Grafana (included with srsRAN Project)
- Hardware requirements:
  - PC with Linux based OS
  - USRP B210
  - 5G capable COTS UE



Thank you!

srsran.com

github.com/srsran/srsRAN_Project

docs.srsran.com