IMEC's IDLAB-UGent Cutting-Edge 5G/6G Research Infrastructure

At IMEC's IDLAB-UGent, we are at the forefront of innovation, paving the way for the future of wireless communication with our state-of-the-art 5G/6G research infrastructure. Our comprehensive setup is designed to empower researchers, engineers, and industry leaders with unique capabilities in exploring the vast potential of next-generation networks.

We've invested in the latest technologies to create a groundbreaking research environment that encompasses the best of 5G and is primed for 6G exploration.

Key components

5G Portable All-in-One flight cases:

The IMEC's IDLAB-UGent 5G research testbed stands out for its unique combination of flexibility and openness through the O-RAN framework. Our research infrastructure includes two portable all-in-one

flight cases, ready to deploy a (beyond) 5G network anywhere you need it. It supports both open-source solutions like srsRAN/OpenAirInterface and the commercial dRAX system by Accelleran. These 5G units fully support the O-RAN framework enabling flexibility for extensions and customization beyond features offered in 3GPP releases and capability for end-to-end experimentation involving business-critical and/or mission-critical applications with demanding QoS requirements in dynamic wireless environments. The testbed comprises Software Defined Radios (SDR) for complete low-level radio design, complemented by commercial Benetel Radio Units to enhance coverage and stability. The portable 5G units can be used both as User Equipment (UE) and as open-RAN (O-RAN) compatible base station (small cell) in combination with the 5G core network either as a system in a box or running the 5G core on a central data server. With battery support and a compact all-in-one-box design, it offers exceptional portability for conducting on-site and mobile testing.

The 5G units include:
- The Accelleran O-RAN solution, which provides the Accelleran dRAX lab kit consisting of the software for the Central Unit (CU), the Distributed Unit (DU) and the near real-time RAN Intelligent Controller (RIC)
- The Benetel outdoor Radio Unit (RU) that is O-RAN compatible
- COTS 5G router (5G UE)
- COTS 4G router (LTE UE)
- A powerful computing unit with GNSS support and accurate timing synchronization
- A power unit that allows the equipment to run over a battery or the power grid
- An SDR USRP 2943R that can be combined with open-source LTE/5G solutions, such as srsRAN and OAI
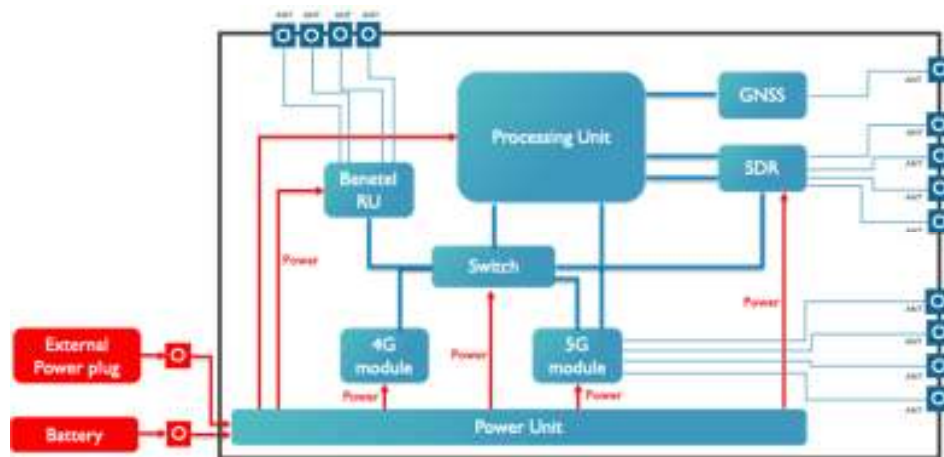- The srsRAN O-RAN framework using the USRP 2943R Radio Unit

Figure 1: Overview of the portable 5G unit

5G User Equipment flight case: Our user equipment is designed for both lab and on-site 5G network evaluation, allowing you to test and optimize your applications in a real-world environment. The portable 5G UE unit is mounted in an easily transportable case for performing 5G tests and experiments on location. This UE unit can be combined with the two other portable units or can be used as standalone UE equipment for testing and evaluating private or commercial 5G networks. The portable 5G UE unit is shown in Figure 50. As it can be observed, the unit consists of:

- COTS 5G modem (5G UE) - Quectel RM502Q
- OnePlus 10 Pro Android smartphone
- COTS 4G router (LTE UE) for remote access, management, and logging purposes
- A Gigabyte computing unit with GNSS support and accurate timing synchronization
- A 1Gigabit network switch
- A portable screen

V2X Hybrid Setup: The future of connectivity isn't just about 5G; it's about the convergence of technologies. Our infrastructure supports multi-Radio Access Technology functionality, including C-V2X-PC5, ITS-G5, and 5G cellular connectivity. Explore the potential of vehicular communication, smart cities, and beyond.

Network evaluation tools:

An advanced set of software tools has been developed to perform 5G network evaluation for a number of networking KPIs. On top of some well-known open-source network measurement tools (such as IPerf and ping), IDLAB-IMEC developed its proprietary tools to allow for real-time logging of several metrics in a structured way. Moreover, some in-house developed tools were implemented to measure one-way latency, packet delivery rate (PDR) and reliability. The IDLAB-IMEC tools support both offline local logging, as well as real-time storing logdata over 4G into a central MySQL database, to speed up the post processing analysis. The latter avoids manual copying and importing of CSV files from the

end-devices and IPerf server. To visualize the logged data stored in the database, Grafana dashboards have been implemented. Using Grafana, several statistics taken from the measured logdata are calculated and can be presented to the user in a graphical interactive and intuitive way.

Research objectives

At IMEC's IDLAB-UGent, we're on a mission to shape the future of wireless connectivity through cutting-edge research across various domains. Our pursuit of innovation is focused on several key areas that promise to revolutionize the way we communicate, connect, and interact. Here's a glimpse into the groundbreaking research that is empowered by our 5G/6G research infrastructure:

1. Mission-Critical Communication and Vehicular Connectivity:
Developing of robust solutions that ensure seamless connectivity, low latency, and high reliability in situations where every second counts.

2. Multicast Broadcast Technology:
Optimizing cellular-based Multicast Broadcast technology to ensure that users receive data with maximum reliability and minimal network congestion.

3. Technology Recognition and Traffic Characterization:
Revealing the characteristics of the wireless environment to optimize networks and improve user experiences.

4. Optimal Wireless Technology Selection and Traffic Steering:
Working on intelligent solutions that enable seamless technology selection and traffic steering, ensuring the best user experience available at any given moment.

5. Wireless Technology Optimization:
Developing mechanisms to efficiently manage network resources, reduce latency, and enhance overall network performance.

Why Choose IMEC IDLAB-UGent?

Innovation Hub: IMEC IDLAB-UGent is at the forefront of technological innovation. By choosing our infrastructure, you're gaining access to a world-class research environment that's constantly evolving.

Real-World Testing: Move beyond simulations and test your applications in a real-world setting. IMEC's setup allows you to validate and optimize your solutions in a practical environment, ensuring reliability and performance.

Expertise: Our team of experts is here to support your research endeavors. Whether you're an academic institution, a corporation, or a visionary individual, we're here to help you unlock the full potential of 5G and beyond.

Join Us in Shaping the Future:

The future of connectivity is here, and it's at IMEC. We invite you to explore our 5G/6G research infrastructure and be a part of the innovation that will redefine how we connect, communicate, and collaborate in the digital age.

Get in touch with us today to learn more about our research infrastructure, collaboration opportunities, and how we can help you pioneer the future of wireless communication! Together, let's transform the way we connect with the world.