DEFENSIE
LA DÉFENSE

Royal Higher Institute for Defence

Defence-related Research Action - DEFRA

ACRONYM: BOLSTER

Title: Beyond 5G m**O**bi**L**e **S**tandalone **T**actical n**E**two**R**k

Duration of the project: 01/02/2023 - 01/03/2026

Key words: Beyond 5G, vehicle-mounted base station, tactile network, Dynamic Spectrum Sharing, zero-touch deployment, seamless interworking

Budget: 888 787 €

of which RHID contribution: 800 679 €

PROJECT DESCRIPTION

Over the past years, several major national crises have occurred, such as the storm during the Pukkelpop festival in 2016, the floods in Wallonia in the summer of 2021, the hunt for Jurgen Conings in 2021, the terrorist attacks at Brussels Airport and metro in 2016. Public Protection & Disaster Relief (PPDR) services take for granted that mobile communication infrastructure (cellular 2G/3G/4G/5G, TETRA) is ubiquitously available. Still, it became clear that fixed communication infrastructure was inefficient during such crises or even failed to provide reliable communication for mission-critical services. Several possible reasons for this inadequateness include lack of or damaged infrastructure, saturated network resources, suboptimal network coverage, lack of reliability and Quality of Service (QoS), etc. As communication is the most vital functionality during an operation process or intervention with the involvement of Belgian Defence, there is a significant need for a communication network on which you can rely.

In the context of the BOLSTER project, IMEC, a public research institute with international recognition in mobile and wireless communications, and the private company Citymesh, a Mobile Network Operator (MNO) and integrator of smart network infrastructures and drone solutions, join forces to design, develop and optimise a Beyond 5G (B5G) architecture for a private mobile standalone tactical network. The envisioned network will be able to be deployed in an automated and ad hoc manner by offering zero-touch commissioning, deployment, and configuration. It will enable reliable communication services in areas with otherwise untrusted or unreliable coverage. This network will be used by the responders carrying handheld terminals, surveillance drones and robots, track and trace equipment to enable mission-critical services such as push-to-talk/video, local dynamic maps and teleoperation of crewless vehicles, and provide interworking with existing fixed terrestrial and non-terrestrial infrastructures.

The designed network architecture will be able to reliably support multiple services with strict and diverse QoS requirements, such as data rate in downlink and uplink, end-to-end (E2E) bounded latency, packet delivery rate, etc. Moreover, the network can adapt to the wireless environment changes autonomously. The wireless spectrum will be monitored continuously through advanced AI/ML techniques to generate relevant data and statistics. Such information may include identifying potential co-located wireless technologies and their characteristics (e.g., packet transmission interval, packet duration, etc.), channel occupancy, etc. This data will be fed into the network, where advanced decision-making mechanisms (rule-based and AI-based) will exploit them to autonomously finetune the appropriate network parameters so that the wireless resources are used optimally and the QoS requirements of the different services are met.

The outcome of the project is (i) a design of the B5G architecture, (ii) an end-to-end solution realising the architecture, and (iii) validation of this solution for Belgian Defence use cases during a proof-of-concept (PoC). The customised standalone tactile network is highly optimised for defence operations, focusing on infrastructure equipment, radio modems, and user terminals. The tactile network infrastructure will work in standalone mode for local communication in the crisis area and be capable of interworking with remote crisis workers.

The BOLSTER project aims to substantially impact the Belgian Defence by providing deep and clear insights and answers on advanced mobile (5G/6G) technologies (e.g., network slicing, optimal spectrum usage, virtualisation) for future crisis management applications. The project's outcome will provide knowledge of the advantages, constraints, and risks of zero-touch deployment and end-to-end (E2E) operational aspects of B5G tactical networks.

The activities within the project will be carried out in different identified phases that are reflected in the work plan structure, and the achieved results will be reported in the deliverables. Initially, the use cases and their requirements will be clearly defined and used as input for creating the overall system architecture. The different building blocks will be identified, developed, evaluated, and optimised from this architecture. Then, during the integration phase, the individual components will be combined, and the resulting system will be assessed and optimised in an E2E way. A PoC will be demonstrated in a realistic environment that mimics actual operating conditions in the case of a calamity.

Citymesh plans to valorise the deployable mobile unit with 5G connectivity in the longer term for Defence and PPDR and civilian markets (e.g., large events and private deployments). Mobile base stations are envisaged to constitute a pivotal component in the strategy of Citymesh due to their flexible and highly mobile nature. Another valorisation path is offering ultra-high reliability and low-latency connectivity in a private, ad hoc mobile 5G network, thereby reducing the margin of error that could happen during drone flights, e.g., crises. This low latency is especially useful in navigation scenarios, where drones fly in GPS-denied environments or Beyond Visual Line of Sight (BVLOS).

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