5G / Network Modeling and Experimentation Services

Leveraging modeling and experimentation for information and communications technology solutioning, assessment and optimization

The Challenge

Technologies related to 5G wireless networks can be transformative, but their novel architectures are extremely complex. The benefits of 5G are made possible by virtualization, open standards and automation technologies such as network functions virtualization (NFV) and Software Defined Networks (SDN), in addition to the 5G core architecture, the 5G Radio Access Network, advanced antenna systems and new spectrum. This technology transformation includes the shift from static traffic management to a more agile, application-aware network, incorporating artificial intelligence (AI) and machine learning (ML).

To manage and leverage these complex networks, U.S. government agencies need the following:

- Hands-on, impartial assistance to navigate the complexities of 5G and virtualization technologies and enable the new vertical use cases during both normal and disaster conditions
- Research, modeling and experimentation to develop intelligent design and deployment strategies for key 5G architectural features such as network slicing and multi-access edge computing (MEC) that will provide these use cases with the required performance and security

The Noblis Solution

5G Modeling and Testing Services and Lab

Noblis telecom experts have developed hands-on testing capabilities leveraging technologies including 5G, MEC, SDN/NFV and internet of things (IoT) to test new architectures and concepts. This testbed allows us to study potential challenges and assess innovative solutions, ensuring government agency adoption of these technologies will be successful and non-disruptive. In addition, Noblis has developed custom modeling and simulation capabilities that allow for rapid evaluation of emerging technologies and increased scalability for scenarios with high traffic loads and massive numbers of devices.

Noblis Telecommunications and Connectivity COE Capabilities

Research, Testing and Experimentation:

- Private 5G/Citizens Broadband Radio Service (CBRS) network experimentation and evaluation
- Real-time positioning and spatial mapping that leverages and fuses 5G and sensor data
- Integration of network slicing, IoT and MEC
- SDN/NFV/software defined wide area network (SD-WAN) testing and emulation

Modeling and Simulation:

- Modeling and predicting network performance under various stress conditions
- Discrete-event simulation and analytic modeling, including Noblis' custom Wireless Access Event Simulator that models a heterogeneous network of large and small cells
- Network design to meet quality of service and resilience requirements
- Radio frequency (RF) propagation modeling
- Wireless and wired Networks

Application: 5G-based Real Time Location System (RTLS)

Noblis has prototyped a high-accuracy positioning system and applied it to a RTLS for vehicular navigation. This system intelligently combines multiple positioning technologies such as 5G, ultrawideband (UWB), a global positioning system (GPS) and an inertial navigation system (INS). The fusion of multiple technologies (figure 1) improves accuracy and allows seamless positioning even if one or more of these technologies are unavailable. This approach is unique in that it integrates 5G and UWB technologies with the more commonly used GPS and INS technologies. This system addresses the limitations of the existing positioning technologies and enables high-accuracy navigation and seamless indoor and outdoor asset tracking use cases for government agencies through innovations such as leveraging sensor fusion and AI/ML.

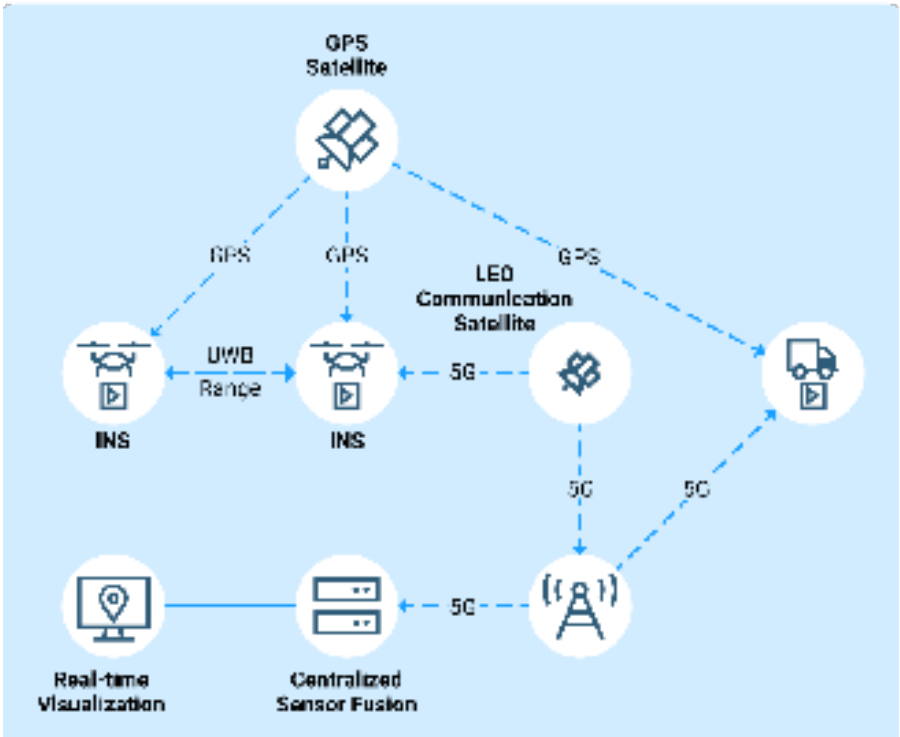

Figure 1: Conceptual diagram for the RTLS sensor fusion. The drones denote the navigation use case, and the truck represents the outdoor asset tracking use case. The system includes a graphical user interface to display the vehicle and asset positions in real-time on a geographical map.

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