Factsheet 03: Use Cases of 6GTandem

Background: The 6G Tandem project is pioneering a dual-frequency multiple antenna system, integrating sub-THz and sub-10GHz signals to meet the needs of future 6G applications. Sub-THz frequencies, known for their short wavelength, suffer from high propagation losses. Conversely, low-frequency signals (sub-10GHz) are less affected by obstacles like walls and are ideal for supporting Internet of Things (IoT) devices with lower data rate requirements. By combining these frequencies and densifying sub-THz deployments, we can achieve both high data throughput and reliable indoor coverage.

In the 6G Tandem project, sub-THz frequencies are deployed through plastic microwave fiber(PMF), which offers a flexible and cost-effective solution for indoor applications. Radio stripes, composed of Sub-THz radio units interconnected through PMF and installed on walls and ceilings, bring the radio units closer to users, effectively mitigating challenges with blocked line-of-sight and transmitted power. This setup supports high bandwidth and enables dense deployment of Sub-THz radio stripes. As a result, this project primarily focuses on indoor and semi-outdoor use cases, utilizing walls and ceilings as the infrastructure for radio stripe deployments.". These use cases primarily demand high throughput, such as extended reality (XR) applications in scenarios with numerous users, like digitized factories or crowded venues.

Use Case Analysis and Characterization: To identify future societal and industrial needs in health, entertainment, and industrial processes, the 6G Tandem project has analysed potential use cases that would benefit from its dual-frequency, highly reliable, and high-capacity network architecture.

The following deployment environments were characterized during this analysis:

- **Large venues:** Ideal for sport events and entertainment, ensuring high-quality, high-capacity connectivity
- **Industrial manufacturing sites:** Enhances connectivity in factories and warehouses, improving industrial processes
- **Public transportation stations:** Provides robust and reliable coverage in busy transit areas
- **Healthcare settings:** Improves communication and operation precision in care facilities. Including hospitals and surgery rooms
- **Educational Institutions:** supports advanced learning environments in classrooms and seminar settings

By considering these driver environments and the specific common characteristics or similar technical challenges of the individual use cases, 6GTandem's use cases were classified into the following four groups:

1

Augmented Reality (AR) / Virtual Reality (VR) / Extended Reality (XR)

Immersive technologies have rapidly evolved during the past decade following the advances in hardware and software the applications of which have expanded from niche markets into mainstream use in areas such as gaming, education, healthcare. In this regard, within 6GTandem project, use cases spread over the industrial, medical and recreational domain are proposed where a 6GTandem-like deployment could benefit the respective scenarios. Within an industrial context, both Mixed Reality (MR) offering X-ray-like capabilities and Virtual Reality (VR) for professional training are discussed. Remote surgery, enabled by VR telepresence and MR surgery are treated as a counterpart within the medical world. Perspective is also offered for social Extended Reality (XR) interaction, for example needed in an interactive classroom and future everyday XR, such as Augmented Reality (AR) applications at events or in public transport stations.

TECHNIKON · ERICSSON · KU LEUVEN · infineon · CHALMERS UNIVERSITY OF TECHNOLOGY · LINKÖPING UNIVERSITY · LUND UNIVERSITY · HUBER+SUHNER

Consortium
9 Partners
5 Countries

Budget
€ 5.3 Million
95,97% EU-funded

Duration
42 Months
01/2023 - 06/2026

Co-funded by the European Union
6GSNS

The 6GTandem project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101096302.

Factsheet 03: Use Cases of 6GTandem

2

Ultra-Reliable Low-Latency Communications (URLLC)

The future of manufacturing industries relies increasingly on 5G and, eventually, 6G connectivity. These advanced networks facilitate real-time data exchange to support technologies like the Internet of Things (IoT), artificial intelligence (AI), and digital twins. With these connections, operational efficiency improves through predictive maintenance, quality control, and optimized supply chains. Remote monitoring and control capabilities enable flexibility and agility in production processes. Moreover, 5G and 6G will play a crucial role in driving innovation and competitiveness by enabling AR and VR applications for training, design, troubleshooting in future manufacturing. Therefore, for the future manufacturing sites which may mean even more IoT devices and robots, ultra-reliable and low latency communications (URLLCs) is crucial

3

Positioning/tracking

Typically, companies manually control logistics and supply chains, leading to inefficiencies and bottlenecks. These can be significantly improved with new wireless access technology. With enhanced positioning accuracy and reliability across numerous devices, real-time information on the status of every item in the supply chain becomes achievable. This advancement aids in inventory management by providing precise location and identification status of goods, enabling real-time decision-making as users or robots interact with the items.

The 6GTandem project, with its dual connectivity and sub-THz bands, is expected to greatly improve location accuracy. This system can be used for monitoring crowd density in specific areas allows for effective crowd management. Other applications include visitor profiling and search-and-navigate functions. It's crucial to consider individual privacy, as not everyone wishes to be tracked. Low-cost passive tags can be used to address privacy concerns while still enabling these advanced tracking capabilities.

4

High Throughput (not latency critical – federated learning)

Large venues, such as stadiums, airports, and shopping malls, face the challenge of ensuring public safety and security. Moreover, the detecting and tracking of a suspect during sudden changes in lighting conditions or crowd movement in rush hour periods is crucial. Traditional video surveillance systems may raise privacy concerns, especially when collecting and analysing sensitive data in real-time.

Federated learning provides a solution by enabling the deployment of intelligent video surveillance while keeping data decentralized, especially for data-sensitive use cases (where data needs to be kept private). Federated learning tasks can be more effectively implemented using the dual frequency bands in 6GTandem.

Conclusion: The research and innovation within the 6GTandem project significantly advance technological capabilities to meet the challenging requirements of future wireless networks and infrastructure. The practical relevance of this work is underscored by several use cases that demonstrate the project's impact. These use cases highlight the project's potential to revolutionize various sectors, ensuring high-performance, flexible and low-cost solutions that address the evolving demands of our connected world.

TECHNIKON · ERICSSON · KU LEUVEN · infineon · CHALMERS UNIVERSITY OF TECHNOLOGY · LINKÖPING UNIVERSITY · LUND UNIVERSITY · HUBER+SUHNER

Consortium
9 Partners
5 Countries

Budget
€ 5.3 Million
95,97% EU-funded

Duration
42 Months
01/2023 - 06/2026

Co-funded by the European Union
6GSNS

The 6GTandem project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101096302.