Realizing the Next Generation of 6G Radio Systems and Devices

Advanced MIMO and THz/SubTHz

To build upon and extend the 5G multiple-input and multiple-output (MIMO) framework and leverage the abundance of spectrum at sub-THz (100 GHz to 300 GHz) and THz (300 GHz to 3 THz) frequencies can enable new use cases such as holographic services.

- XTI: THz interconnects, data center inter-rack connectivity
- UBI, high positioning accuracy, critical medical communication, non-invasive health monitoring
- Smart vehicle keys, peer-to-peer SOS messaging, device-to-device based mesh networking, swarm communications

New areas of THz/sub-THz communications would further extend North American leadership into the next generation and help usher wireless communications into the Tbps regime.

6G Air Interfaces

Radio technologies for new topologies and networking such as User Equipment (UE) cooperative communication, Non-Terrestrial Network (NTN), and mesh networking will support new types of connectivity.

- Coexistence of TN with NTN
- Indoor deployment models
- Full duplex, mmWave, cmWave, and subTHz deployments

Air interface enablement for distributed computing and intelligence is a key enabler for incorporating mobile device computing into the 6G wide-area cloud and allowing efficient computing and workload distribution.

Joint Communications and Sensing (JCAS)

JCAS is envisioned as a key technology for 6G communication systems to improve mutual performance with coordinated operation of communications and sensing.

- Coexistence for spectrum sharing, hardware reuse, and interference management
- Visualization of the environment among many sensing nodes
- Physical layer should be capable of detailed sensing for characterization and pass the details in real-time

Tradeoffs between sensing and communication performance, channel modeling for sensing, waveform-broadforming design, co-existence, cooperation and co-design between sensing and communication.

Spectrum Sharing

To alleviate bandwidth availability constraints for public and private networks advanced spectrum sharing approaches can also be employed when allocation of exclusively licensed spectrum is not feasible.

- New techniques that approach performance of exclusively licensed spectrum
- Near real-time sharing
- Expanded and efficient sharing
- Mechanisms for exchange for federal and commercial stakeholders

Develop techniques that improve spectrum-sharing efficiency and predictability of radio resources of 6G use in a manner that they approach the performance of exclusively licensed spectrum.

Component Technologies

Semiconductors are the enablers of digital wireless communications. Information and signal processing occur in digital, analog, and Radio Frequency (RF) domains.

- Semiconductor technology, circuits and sub-systems, antennas, packaging, and testing, and holographic technologies
- Handling and testing parts with conducted low frequency ports with radiated-only access for the RF ports
- 6G will require advanced 3D display technology (holographic capability) and continued advancements in semiconductor packaging, antennas and RF components.