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JCAS-Enabled Sensing as a Service in 6th-Generation Mobile Communication Networks

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JCAS-Enabled Sensing as a Service in 6th-Generation Mobile Communication Networks

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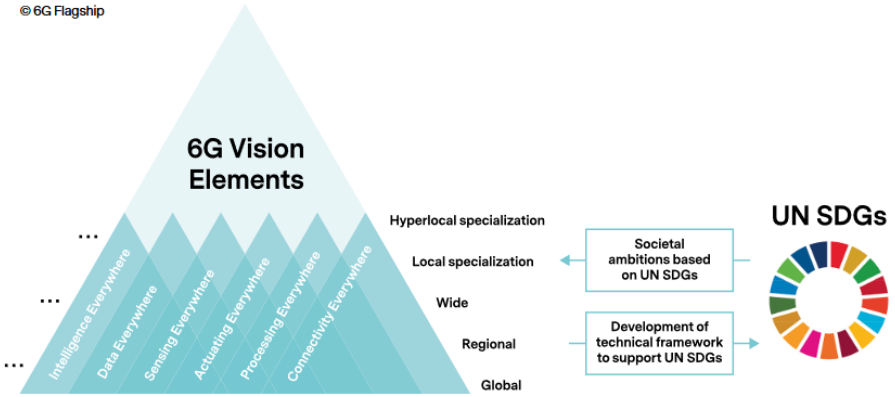
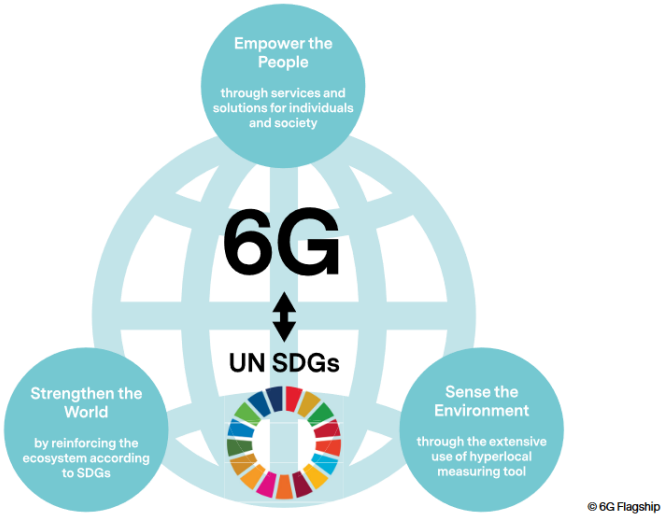
- Motivation
- Applications and Use Cases
- Enabling Technologies for Sensing-aaS in Mobile Networks
- Sensing-aaS in Mobile Networks
- Challenges and Future Directions

Motivation



Relationship between the UN SDGs and the elements of 6G vision. [1]



Three pillars linking 6G with the UN SDGs. [1]

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Applications and Use Cases - Healthcare

Created by Lisbie from Noun Project

Monitor Activity Level of Vulnerable People/Children

Created by Icons Cart from Noun Project

Monitoring of Hospital Patients

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Applications and Use Cases - Agriculture

Mapping and Monitoring Fields for Yield Forecasting

Providing Insights of Crops and Lead to Data Driven Decisions about Irrigation and Fertilization

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Applications and Use Cases - Public Sector

Provisioning of Information in Emergency Situations

Monitoring Room Occupancy

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Enabling Technologies - JCAS

Vegetation Monitoring - Cellular Network Signal Strength to Monitor Vegetation Characteristics

Rainfall Monitoring – Remote Sensing of Rainfall Using Microwave Links from Cellular Communication Networks

Fog Monitoring – Real-Time Fog Prediction with Cellular Networks in Higher Frequency Ranges

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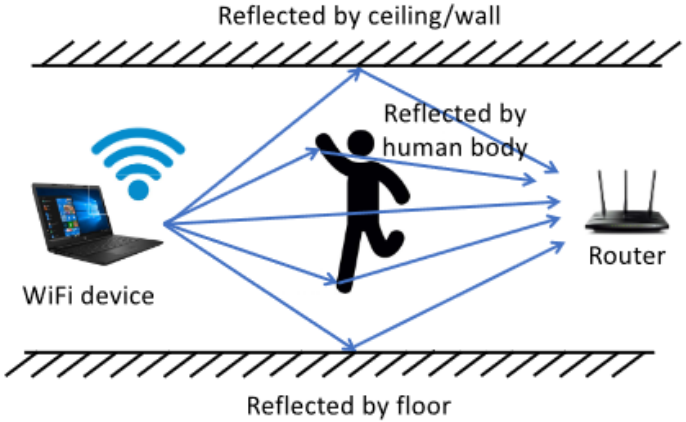
Enabling Technologies - WIFI

- Intrusion Detection
- Room Occupancy Monitoring
- Daily Activity Recognition
- Gesture Recognition
- Vital Signs Monitoring

- User Identification
- Indoor Localization and Tracking



[5]

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Enabling Technologies - Radar

Structural Health Monitoring – Automotive Radar Application for Structural Health Monitoring

Monitoring of Rotating Object in Industrial Scenarios - FMCW Radar for Vibration Sensing in Industrial Environments

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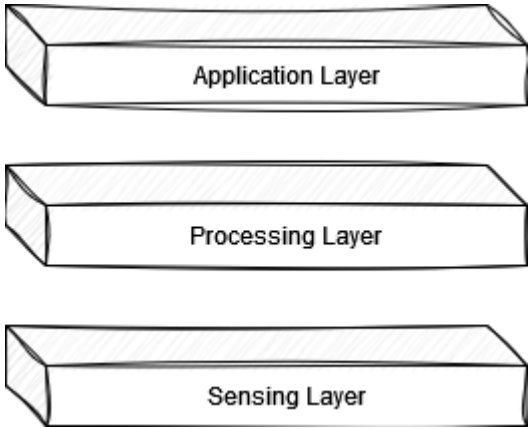
Sensing-aaS in Mobile Networks - Framework



Application Layer…

comprises applications that utilize the data collected by the sensors and processed by the edge computing infrastructure

functionality relies on the specific usage and requirements of the system.

is customized based on the intended use cases and system objectives

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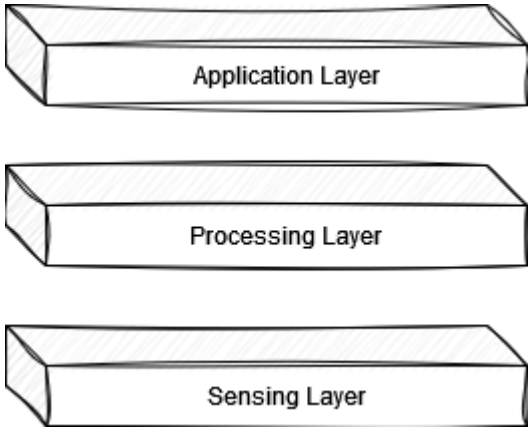
Sensing-aaS in Mobile Networks - Framework



Processing Layer…

consists of the edge computing infrastructure.

processes and analyzes the collected data.

runs machine learning algorithms and other analytical tools on the edge computing infrastructure.

performs processing and analysis based on the employed sensing concepts.

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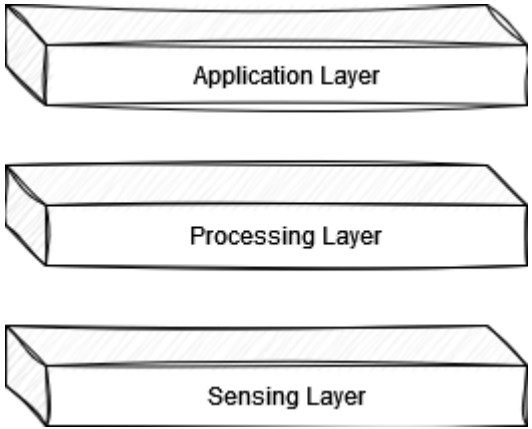
Sensing-aaS in Mobile Networks - Framework



Sensing Layer…

captures data from the physical environment.

implementations are:

- Communication-centric JCAS approach
- Joint design for communication and sensing

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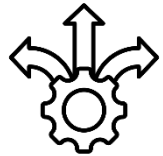
Sensing-aaS in Mobile Networks - Benefits

Created by Nithinan Tatah from Noun Project

Cost Effective

Created by Stefan Traistaru from Noun Project

Increased Scalability



Created by Puspito from Noun Project

Improved Flexibility

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Sensing-aaS in Mobile Networks – Important Aspects

Created by dDara from Noun Project

Edge computing and its role in enabling Sensing-aaS

Created by Akram from Noun Project

Privacy considerations

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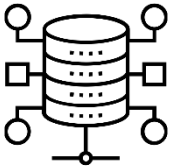
Challenges and Future Directions



Underlying network architecture

Development of new RF-Hardware

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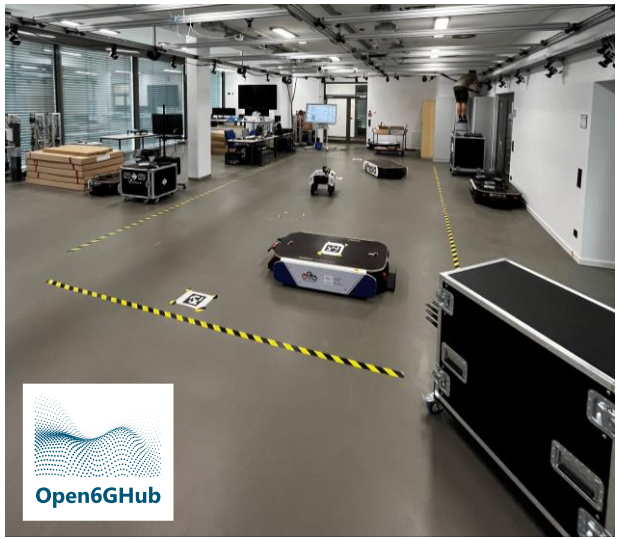
Open6GHub



- Sub 6 GHz
  24x24 MIMO OpenAirInterface (OAI) reference architecture [6]
  8x8 MIMO for phase coherent setups [7]
- 26 GHz
  Up to 64x64 MIMO and 2 GHz instantaneous bandwidth Open6GHub MIMO-Testbed [8]
- 140 GHz
  2x2 MIMO End-to-End system based on [9]

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