ETSI Research Conference 2023

Maximizing the Impact of European 6G Research through Standardization

6GTandem (A Dual-Frequency Distributed MIMO Approach for Future 6G Applications)

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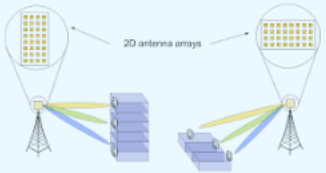
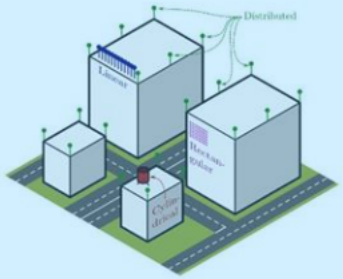
A Dual-frequency Distributed MIMO Approach for Future 6G Applications

Massive MIMO – Centralized vs distributed

Centralized



Distributed



All antennas in one place:

- Very large service variations
- Sensitive to blocking
- High heat concentration
- Large and visible installations
- Installation requires personnel with “radio skills”
- Power limited by SAR regulations

Distributing antennas:

- Reduces the previously-mentioned issues
- Power and backhaul is integrated in the “stripe” antenna design.
- Cell-free – no handovers, no planning required

Concept Essentials
High Level details – beamforming in Massive MIMO

Massive MIMO offering beamforming is a fundamental feature of 5G. Today development in Advanced Antenna systems (AAS) focus on central solutions...

Taking advantage of: The beamforming gain and spatial interference suppression capability of conventional massive MIMO with co-located arrays + the bigger chance of being physically close to a service antenna as offered in small cells

Initial study on 5G/6G stripes

Assuming we want to cover an office and provide >1Gbps throughput for several UEs using a digital interface

One bottleneck is the digital interface

- 10Gb Ethernet or fiber are both very power consuming

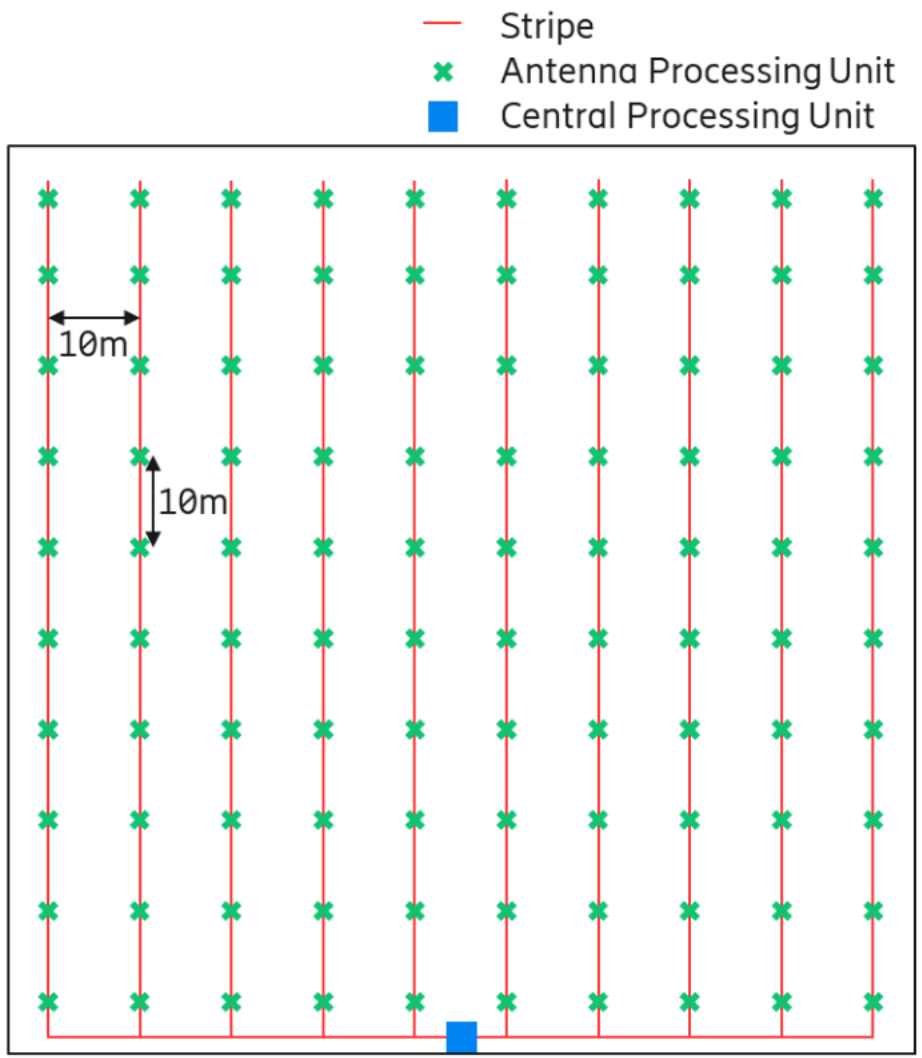
Another bottleneck is the digital processing in the APU/DU

- Need an ASIC in an advanced process node for a reasonable power consumption – very costly

6G is expected to deliver >10Gbps UE throughput – even more challenging

- **➔ We are looking for options using an analog interface**
  (Only feasible way to reach this capacity with few W/APU)

APU(antenna processing unit)=DU(distributed unit)



1. Project Overview

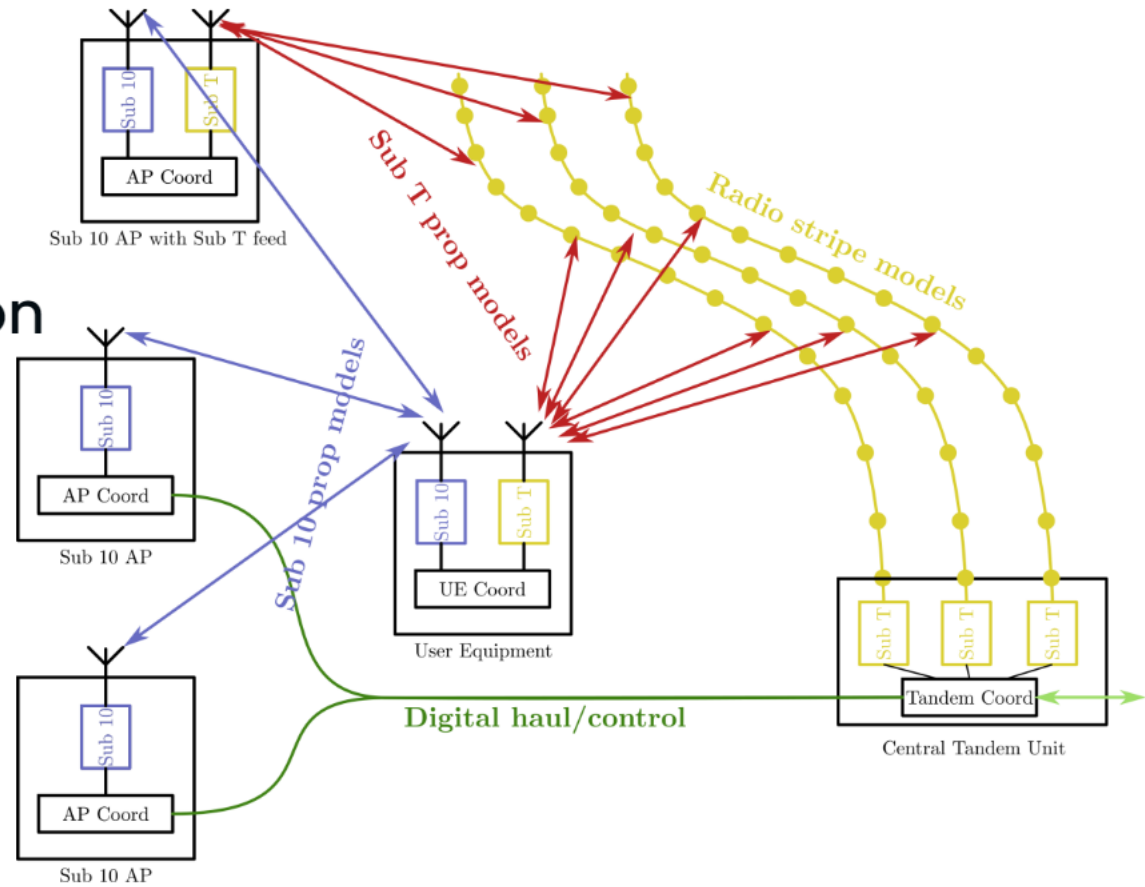
- **Project Name:** A Dual-frequency Distributed MIMO Approach for Future 6G Applications
  - **Project website:** https://horizon-6gtandem.eu/
- **Stream:** B-01-02
- **Members:** TEC, KUL, EAB, CHA, ULUND, LIU, IFAT, IFAG, H&S
- **Key info:** 6GTandem will co-design novel dual-frequency (at sub-10 GHz and sub-THz) operation and a new highly integrated and distributed radio transceiver architecture (radio stripe) to achieve superior value with respect to energy, service availability and cost of deployment.

Addressed Verticals:

Adaptive robotized factories, warehouses, retail and logistics, Immersive entertainment for crowds of people (e.g., arenas), Human-machine interaction in care environments, hospitals, assisted living, Public transportation

2. Technical Information

- **Project Key Objectives:**
  - 1: Develop the 6GTandem system concept driven by use cases requirements
  - 2: Modelling of the 6GTandem system
  - 3: Design of waveforms and communication strategies
  - 4: Development of sub-THz radio stripe hardware
  - 5: Propose new services enabled by the 6GTandem system
  - 6: Validation
- **Key technologies used/investigated:**
  - Cell-free M-MIMO, RF based positioning
  - sub-THz packaging technologies based on eWLB
  - Sub-THz radio over fiber



3. Planned Standardization Activities

- **Project activities / technologies that may lead to standardization:**
  - Radio interfaces and D-MIMO
  - Protocol design for dual-frequency operation
- **Targeted standardization bodies / groups:**

Ericsson:

  - 3GPP CT: specifying terminal interface and the Core network part of 3GPP systems.
  - 3GPP RAN: based on the results related to radio performance and physical layer aspects, including e.g., sub-THz and sub-10 GHz communications
  - ITU-T groups: SG13 - Future networks and emerging network technologies
  - ITU-FR groups: SG5 in its WP5D on 6G vision and requirements and SG 1 - Spectrum Management.
  - ETSI ISG mWT: ETSI mWT study group whose key mission is to promote the millimeter-wave bands beyond 100 GHz for wireless transport.

3. Planned Standardization Activities

- Infineon
  - is involved in multiple existing and emerging wireless and mobile communication standardization initiatives
  - 3GPP and ETSI standardisation effort, and it is a Partner Contribution to standards member of the IEEE standards association.
- HUBER+SUHNER
  - IEC standards for radio frequency and fibre optic connector interfaces.
- **Standardization planning:**
- WP6 is dedicated to the communication, dissemination, exploitation and standardisation of the project in order to maximise its impact and outcomes.