Press release

TeraGreen

TOWARDS ENERGY-EFFICIENT TBPS WIRELESS LINKS

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6GSNS Co-funded by the European Union

Announcing the Kick-off of the TeraGreen Project

We are thrilled to announce the official kickoff of the TeraGreen project, funded by the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement N° 101139117.

The TeraGreen consortium has aligned the project goals, objectives, innovation level, and expected achievements (KPIs and KVIs) with the design of the Smart Networks and Service Joint Undertaking (SNS R&I Work Programme), the Key Digital Technologies Joint Undertaking (KDT JU Work Programme) and the Horizon Europe (HE) Strategic Plan.

Key Objectives of TeraGreen:

TeraGreen will establish the foundations for future Tbit/sec communications systems by providing the understanding and proof-of-concept demonstrations of how the generation, detection and multiplexing of multiple ultra-wideband THz signals can be realized with highly energy-efficient and scalable technological solutions.

TeraGreen targets high-speed, energy-efficient wireless communication systems for line-of-sight (LoS) backhauling and purpose-built fixed wireless access applications in future 6G networks, with key objectives described below.

- TeraGreen develops ultra-wideband and low-power consumption BiCMOS transmitters and receivers at 300 GHz integrated with dual-polarized lens antennas.

- TeraGreen develops quasi-optical MIMO architectures at 300 GHz based on lens arrays to reach low radiated energy levels and a high degree of spatial multiplexing.

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- TeraGreen develops zero-crossing modulation waveforms and baseband algorithms to reach beyond 100 Gbps per spatial channel suitable for energy-efficient 1-bit analog-to-digital (A/D) conversion.

- TeraGreen performs two link demonstrations to show beyond 200 Gbps capacities in medium-range links and a practical path towards beyond Tbps capacities with an energy-efficient solution for the first time.

Innovation Strategy:

Achieving a leading position in infrastructure and key service areas would offer Europe the unique opportunity to seize its competitive know-how advantage and allow it to define/shape future 6G infrastructures, standards, environmental strategies, and regulations in the communication-computing domain.

TeraGreen will contribute to this mission by ensuring that:

1) the project outcomes will provide key technologies having a long-term impact on RAN evolution making it more energy-efficient, more flexible and scalable than present deployments,

2) the project outcomes will support EU suppliers in communication and computing markets to be competitive in the global market by offering hardware solutions and software algorithms which are reaching a forefront level in terms of capacity, cost efficiency, spectrum efficiency, and energy efficiency.

Expected impact on European leadership:

TeraGreen will help to put European telecommunications and microelectronics industries at the forefront in the coming decade, strengthening an already strong position and enabling an array of new business opportunities that could be exploited both by the main vendors and operators, as well as by emerging SMEs and startups. Europe has a direct need to regain

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leadership in semiconductor development and manufacturing and to secure the supply of electronics equipment that both underpins critical functions in society and enables competitiveness in new business areas. The project focuses on combining new disruptive technology with experts from leading teams in Europe, all bringing complementary skills and knowledge to the project.

The success of TeraGreen will bring significant advances in the evolution of communications networks in 6G. TeraGreen will serve as a key enabler for this evolution in a long-term time horizon, i.e. 5-10 years from the end of the project. TeraGreen can serve as a complete backhaul solution for small-cell dense urban networks and for purpose-built fixed wireless access applications where backhaul capacity will be in the range of 200-1000 Gbps. In particular, the backhaul technology of TeraGreen can be used as an alternative to the wired fiber or microwave backhaul link of dense cells and microcells. In this way, TeraGreen will enable the densification of cells in a cost-effective manner, since it will downscale the need to deploy wired backhaul links (i.e. only to those small-cell base stations that do not have a LoS). Thanks to the energy efficiency of the proposed technologies, this densification will also be possible in a power-friendly and eco-friendly manner.

Success Metrics and Insights in TeraGreen Use Cases:

TeraGreen considers four use cases:

a) Fronthaul in ultra-dense small cell networks
b) High throughput fixed wireless access (FWA)
c) Live immersive XR in large-scale events
d) Wireless data centers.

In the context of ultra-dense small cell networks, TeraGreen addresses the critical challenge of providing energy-efficient and high-capacity fronthaul solutions using terahertz (THz) communication. Small cells are essential for delivering high data rates and low latency in 6G networks, especially in dense urban environments. However, the fronthaul links must handle

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massive amounts of data traffic. TeraGreen's THz-based solutions offer ultra-high bandwidth for these fronthaul links, ensuring seamless communication while significantly reducing energy consumption. TeraGreen's use case on high-throughput Fixed Wireless Access (FWA) focuses on delivering ultra-fast, energy-efficient internet connectivity to homes, businesses, and remote areas using THz communication.

By leveraging THz spectrum, TeraGreen enables multi-gigabit per second (Gbps) data rates, allowing users to experience fiber-like speeds wirelessly without the need for costly physical infrastructure like fiber optic cables. TeraGreen's use case for live immersive extended reality in large-scale events focuses on delivering seamless, high-bandwidth experiences that enable participants to interact in real time with virtual elements, no matter the scale of the audience. Using THz communication, TeraGreen provides the ultra-low latency and high data rates required to support immersive technologies such as augmented reality (AR) and virtual reality (VR) at events like concerts, sports games, or conferences.

Finally, TeraGreen's use case for wireless data centers aims to revolutionize the efficiency and scalability of next-generation data centers by utilizing THz communications. With the increasing demands of cloud computing, AI, and big data analytics, traditional wired infrastructure can become a bottleneck in terms of speed, flexibility, and energy consumption. TeraGreen offers ultra-high throughput, low-latency wireless links that can replace or complement fiber-optic connections within data centers, enabling faster data transmission between servers, storage units, and other critical components.

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