Project delivers low-cost future network architecture for mobile operators

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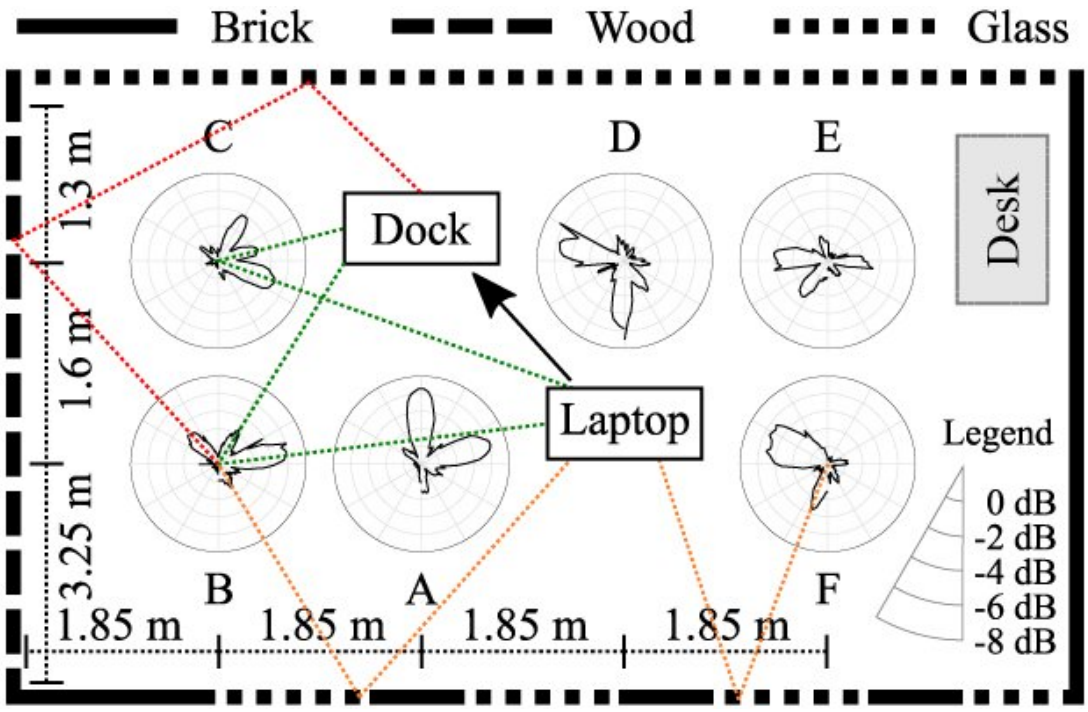

Fig. 1. Analysis of the impact of reflections patterns in a realistic mm-wave wireless setting (conference room). The dotted lines show examples of Line of Sight paths as well as first and second order reflections. The results of TIGRE5-CM highlight that these second order reflections can still be strong, hence MAC layer designs should take advantage from those to improve system performance. Credit: © IMDEA Networks Institute

The 4-year TIGRE5-CM project, coordinated by IMDEA Networks

Institute in Madrid, delivers an architecture designed for future mobile networks, based on the SDN (Software Defined Networking) paradigm. TIGRE5-CM simplifies deployment, configuration and management in both the access and core networks, integrating cutting-edge technologies.

Joerg Widmer, Research Director at IMDEA Networks and coordinator of TIGRE5, explains how the advantages offered by the system will directly benefit end-users: "TIGRE5 has the potential to greatly improve the quality of the end-user experience. The main focus of the project has been in making easier the deployment, configuration and management of the network. This allows, for example, new services to be rapidly rolled-out on the market while exposing an efficient and reliable network to the end users. One of the areas where we've made significant progress in TIGRE5 is in the efficiency and accuracy of position estimation in localization systems. Consequently, TIGRE5 systems would work very well in applications and services in environments where indoor localization is an essential component such as in transportation hubs, like airports and railway stations."

According to Widmer, the project has succeeded for three main reasons. The first has been tight cooperation between the project partners—the Wireless Networking Group at IMDEA Networks Institute and research groups at Universidad Carlos III de Madrid and Universidad de Alcalá - and the project's synergy with other ongoing research. Second, has been prototyping to demonstrate the real benefits of the proposed solutions. Third, he believes that researchers' minds were focused on asking the right research questions and conducting rigorous experiment design by the ambitious vision established at the outset. The results of this research have been published in leading scientific journals and conferences.

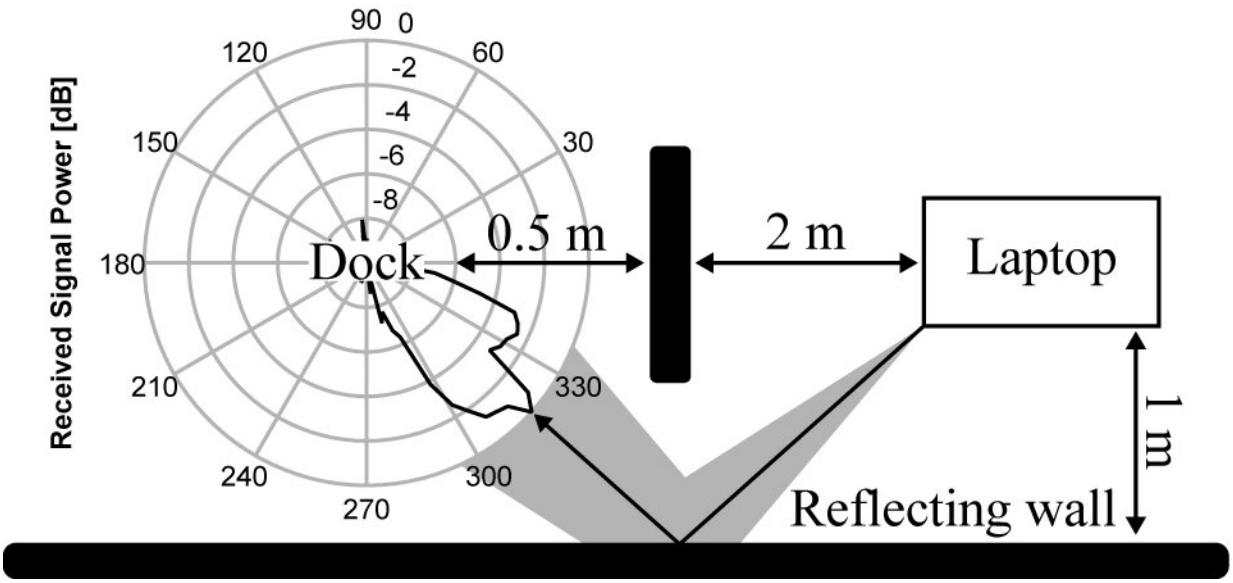

Fig. 2. Data transmission over a mm-wave channel exclusively via a reflected path. Please note that the angular energy profile does not include any lobe on the Line of Sight path Credit: © IMDEA Networks Institute

Prototyping threw up some of the project's biggest challenges, says Widmer. "Prototyping really tested our team as much as the technology. We needed endless patience, persistence and sheer hard work but ultimately we successfully developed and tested the correct operation of the platforms such as the location systems testbeds, openVLC, an FPGA-based prototype of a D2D-compliant cellular network and openLEON."

IMDEA Networks' researchers made pioneering contributions in the fields of mm-wave, visible light communications (VLC) and device-to-device communications. Widmer explains, "These technologies represent alternative solutions in the face of sharply increasing traffic demands that now challenge legacy solutions at sub-6GHz bands. We have also been able to pioneer techniques to measure and predict the future demands of mobile network traffic with the objective of optimizing

network resource utilization."

Work on the scientific research topics addressed by TIGRE5-CM will now continue with the TAPIR-CM project which aims to design artificial intelligence/machine earning-based 5G network architectural solutions.

Fig. 3. Deployment of multiple consumer-grade off-the-shelf (COTS) 60 GHz access points and clients. The high directionality of the mm-wave links should limit interference, allowing multiple transmissions to take place simultaneously. However, results from TIGRE5-CM highlight that the beam patterns of COTS devices are imperfect, and side lobes may create interference. This configuration setting makes it possible to analyze the actual degree of spatial reuse. Credit: © IMDEA Networks Institute

More information: Claudio Fiandrino et al. Scaling Millimeter-Wave

Networks to Dense Deployments and Dynamic Environments, *Proceedings of the IEEE* (2019). DOI: 10.1109/JPROC.2019.2897155

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