Coordinating Wi-Fi traffic

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Credit: Wi-5

The surge in demand for Wi-Fi networks has created a need to better coordinate the immense traffic. An EU initiative introduced an architecture to reduce interference and boost performance in very congested environments.

The EU-funded Wi-5 project tackled the issues of inefficient Wi-Fi spectrum usage and the increasing demand for wireless networks. To do so, it developed innovative technologies to evolve Access Points (APs) into a new state-of-the-art Wi-Fi network.

"More APs in the same area mean that Wi-Fi signals overlap with each other, lowering the overall bandwidth," explains project coordinator Prof. Qi Shi. Additionally, APs configured on the same channel interfere with each other's traffic. In Wi-5, APs become intelligent networking entities. "This is a classic case whereby everyone tries to get the greatest benefit from a shared resource," he says. "But, as demand overwhelms

supply, each individual who consumes directly harms others until no one can benefit."

Tools to enhance Wi-Fi coordination

Wi-5 developed an integrated system that can automatically detect and minimise interference in Wi-Fi networks and maximise performance for users. "Our system outperforms existing commercial solutions and can be deployed on a large portion of existing hardware," says Prof. Shi. "Moreover, it focuses purely on the AP and back-end system, and thus requires no modification to end-user devices."

Project partners integrated novel smart functionalities to enable coordination in helping to reduce radio interference and optimise spectrum usage. They improved packet grouping techniques for small-packet traffic such as voice services or gaming. Also, an inter-operator domain AP cooperation platform enables coordination between local APs of different operators.

The project team designed a novel suite of smart functionalities that comprehensively enhances current Wi-Fi APs and offers seamless handovers 20 times faster than the state of the art. This improves the experience for users who are walking and using real-time services. Team members implemented the Wi-5 system as an open-source proof of concept and deployed it in a range of environments, including real-world systems.

The main benefit of Wi-5, stresses Prof. Shi, "is fairness for users." A deployment of Wi-Fi APs coordinated by the Wi-5 system maximises the available spectrum and fairly distributes this to users based on their bandwidth requirements. "This means that users with a demanding application such as HD video streaming will have a similar experience to users simply checking their email or social media," he adds.

Yet another benefit of Wi-5 is that it's suitable for a range of deployment scenarios beyond dense environments. It's also applicable to sparse scenarios, such as large homes with limited coverage.

Toward a smart, flexible and stable Wi-Fi network

The expected impacts are manifold. Wi-5 increases the efficiency of wireless communication systems and improves spectrum usage. It enhances the performance and quality of experience of emerging real-time and video applications, facilitating coordination between neighbouring APs and offering seamless vertical and horizontal handover solutions. Wi-5 can dramatically reduce wireless energy consumption through a combination of dynamic power adaptation, load balancing and packet grouping. Its smart channel selection approach reuses channels as much as possible to ease the urgent requirement for an ever more expanded Wi-Fi spectrum.

While Wi-5 has concluded, there's still a significant amount of ongoing work to improve the system further and generate more results. Each partner is already actively making use of Wi-5 outcomes to develop their own products and services so that some aspects of the technology will be used commercially going forward.

"Thanks to Wi-5, the developed set of smart solutions will be able to solve real-world issues with today's Wi-Fi ecosystem," concludes Prof. Shi.

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