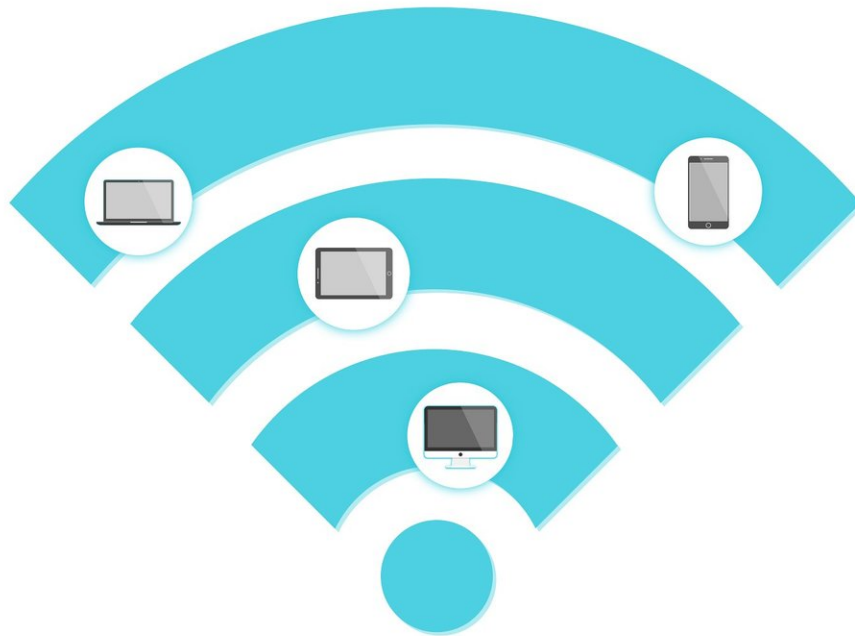


Researchers test smart surfaces to improve wireless communication and localization

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Credit: CC0 Public Domain

It's happened to anyone with a cell phone—dropped calls or dead air because suddenly there is no service available. Or worse, the location pin drops on the navigation app.

Researchers at UBC Okanagan are looking at ways to improve [cell phone](#) connectivity and localization abilities by examining "smart" surfaces that can bounce signals from a tower to customers to improve the link. A smart [surface](#) involves installing reflective elements on windows or panels on buildings in dense urban environments.

The goal, says Dr. Anas Chaaban, is to improve wireless services for millions of Canadians. Currently, he says, there are more than 12,000 wireless antenna towers. And yet, a lack of cell service is a common problem.

"The increasing use of mobile technologies across the world is necessitating research that unlocks potential new approaches within our existing infrastructure," says Dr. Chaaban, an Assistant Professor at UBC Okanagan's School of Engineering. "Even though cellphone towers line the rooftops of major cities, and handle the data and phone traffic of millions of Canadians each day, there are still gaps in service."

Dr. Chaaban and his team at UBCO's Communication Theory Lab have developed transmission schemes that would incorporate reconfigurable intelligent surfaces—smart surfaces—throughout urban centers to serve as reflectors within existing wireless networks.

A reconfigurable intelligent surface (RIS) is a panel of many individual reflective elements, each of which can modify an incoming signal and reflect it. This modification can be controlled with an [electrical signal](#), which enables the RIS to improve the connection or generate signals that are useful for locating users in the network.

The researchers developed a new localization system where an RIS can work as a satellite to improve accuracy. By making a surface smart, it can bounce signals to cell phones which in turn can use these signals to generate an accurate estimate of location, he says. An accurate location

estimate is not only useful for location services but also to improve transmission from the tower to the phone using optimized location-aware transmission schemes that also leverage the RIS.

"Users never expect to have a call drop, and they also expect lightning-fast data speeds," he says. "But to accomplish this, the networks require constant updating."

The researchers tested their theory using multiple modulated RISs that allow for the simultaneous localization of multiple users with low complexity for each RIS. They also developed and tested RIS-enabled transmission schemes that outperform existing schemes.

"We simulated the proposed localization protocol and demonstrated its effectiveness in an urban micro-cell street canyon scenario as an example," he explains. "And the protocol works for multiple users simultaneously. Even in areas with intermittent service, data can be shared and users can be located and enjoy a reliable connection."

Dr. Chaaban and his team have published several papers on this work, which appear in the *IEEE Communications Letters*, *IEEE Open Journal of the Communications Society*, and *IEEE Transactions on Wireless Communications*.

More information: Connor Gaudreau et al, Localization by Modulated Reconfigurable Intelligent Surfaces, *IEEE Communications Letters* (2022). [DOI: 10.1109/LCOMM.2022.3208803](https://doi.org/10.1109/LCOMM.2022.3208803)

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