Radio-over-fiber compression poised to advance 5G wireless networks

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Although new 5G networks can offer much faster and more efficient wireless data transfer, the fiber optic networks currently used to connect wireless devices to the internet cannot easily support the increased load. A new study shows that a compression scheme for radio-over-fiber links could help solve this problem for a variety of 5G formats.

Paikun Zhu from The Graduate School for the Creation of New Photonics Industries in Japan will present the new results at The Optical Society (OSA) 2020 Advanced Photonics Congress, an all-virtual meeting to be held 13-16 July Eastern Daylight Time.

"This new compression approach could be helpful in 5G large-scale MIMO scenarios where many devices are to be served, but only inexpensive and low-bandwidth fiber links are affordable while low latency is needed," said Zhu.

Connecting a wireless device to a network or the internet requires a radio access network. The newest radio access network architecture consists of centralized units that use fiber optic links—referred to as fronthaul—to connect to standalone radioheads that transmit radio signals from cell sites some distance away. Traditional 4G fronthaul schemes cannot support 5G radio access networks at a reasonable cost because it would require extremely high fiber bandwidths.

To cope with this bandwidth problem without upgrading the fronthaul fiber links, Zhu and colleagues previously developed an analog-to-

digital, radio-over-fiber compression scheme designed to reduce frontload bandwidth by about 10-fold. Radio-over-fiber technology is used to transmit cellular radio signals over optical fibers.

Real-time, multi-format experiments

In the new work, the researchers tested their compression approach in real-time experiments using multiple 5G formats. They did this by using a field programmable gate array integrated circuit to perform compression on three 5G radio formats: orthogonal frequency division multiplexing (OFDM), single-carrier FDM (or discrete-Fourier-transform-precoded OFDM) and filtered OFDM.

They found that the compression scheme successfully reduced fronthaul bandwidth by nearly 90 percent. The compression maintained high signal fidelity regardless of the radio format, showing that the approach is compatible with various candidate radio formats in 5G and could work with other formats developed in the future.

Overall, the experimental results indicate that new analog-to-digital-compression scheme for radio-over-fiber has the potential to be deployed in multiple scenarios or areas with 5G networks without requiring hardware modifications.

Future interests include generalizing the compression approach for other wireless channels such as those obtained by real measurements, and investigating the combination with 5G multi-cell coordination technology.

Conference registration is free. You must register in advance to receive the web link for the conference. All registrants will receive access to the Technical Digest, the live technical sessions and recorded/archived content.

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