Researchers boost efficiency of multi-hop wireless networks

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Multi-hop wireless networks can provide data access for large and unconventional spaces, but they have long faced significant limits on the amount of data they can transmit. Now researchers from North Carolina State University have developed a more efficient data transmission approach that can boost the amount of data the networks can transmit by 20 to 80 percent.

"Our approach increases the average amount of data that can be transmitted within the network by at least 20 percent for networks with randomly placed nodes – and up to 80 percent if the nodes are positioned in clusters within the network," says Dr. Rudra Dutta, an associate professor of computer science at NC State and co-author of a paper on the research. The approach also makes the network more energy efficient, which can extend the lifetime of the network if the nodes are battery-powered.

Multi-hop wireless networks utilize multiple wireless nodes to provide coverage to a large area by forwarding and receiving data wirelessly between the nodes. However, these networks have "hot spots" – places in the network where multiple wireless transmissions can interfere with each other. This limits how quickly the network can transfer data, because the nodes have to take turns transmitting data at these congested points.

Data can be transmitted at low power over short distances, which limits the degree of interference with other nodes. But this approach means

that the data may have to be transmitted through many nodes before reaching its final destination. Or, data can be transmitted at high power, which means the data can be sent further and more quickly – but the powerful transmission may interfere with transmissions from many other nodes.

Dutta and Ph.D. student Parth Pathak developed an approach called centrality-based power control to address the problem. Their approach uses an algorithm that instructs each node in the network on how much power to use for each transmission depending on its final destination.

The algorithm optimizes system efficiency by determining when a powerful transmission is worth the added signal disruption, and when less powerful transmissions are needed.

The paper, "Centrality-based power control for hot-spot mitigation in multi-hop wireless networks," is published online by the journal *Computer Communications*, and is in press for a print version of an upcoming issue of the journal. Pathak is lead author. The research was supported in part by the U.S. Army Research Office.

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