What's the Buzz? Harnessing Static to Improve Wireless Signals

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Can network interference be used to expand and enhance communication for wireless devices such as cell phones, computers and personal digital assistants?

Daniela Tuninetti, assistant professor of electrical and computer engineering, explained that this seemingly illogical concept is not all that strange if you take a closer look at what is going on. She has received a five-year, $400,000 National Science Foundation CAREER Award to establish a theoretical foundation for putting this idea into use through a concept called collaborative communications.

"Interference due to other communications devices is not just noise," Tuninetti said. "It's structure -- it's a communication going on between a pair of devices. I want to investigate if making the interference partly understandable at other transmitters can be used to do collaborative communications. I'm proposing that we think of interference as something potentially useful in a wireless channel, if appropriately exploited."

The idea is to pool communication resources to help mobile devices get an operating signal in places and times where the signal would normally cut out, or to enhance the bandwidth of a signal in a limited zone to provide clear voice communication or enhanced data flow. The technique may also improve communication when a mobile device's battery is getting weak.

With collaborative communication, Tuninetti says, what you are actually achieving is a "virtual antenna array" for your communications.

"So you can reach farther away and extend the communication range, or achieve the same communication quality at a reduced power."

Her research will focus on developing new coding and signaling techniques to improve the overall system capacity, as well as designing efficient and distributed multi-access and routing protocols to maximize the potential benefit of collaborative communication. She also hopes her research will reveal what limitations and tradeoffs may have to be considered.

"We need to understand that while this idea may sound cool, we need to understand whether we can make it practical. What will happen in big networks with potentially hundreds of users? Will the gains be scalable? Will the cost of coordination among transmitters remain acceptable?"

Tuninetti plans to teach a new multidisciplinary course that bridges ideas from information and networking theory in the design of collaborative communications networks. Part of her NSF grant will be used to hire a full-time graduate assistant to help with the research.

Tuninetti received her laurea and master's degrees in electrical engineering from the Politecnico di Torino in Italy and her Ph.D. in electrical engineering from the Ecole nationale supérieure des télécommunications de Paris in France.

NSF CAREER awards are the foundation's most prestigious honor for junior faculty. Established in 1995, the program helps top scientists and engineers who early in their professional careers develop simultaneously their contributions and commitment to research and education.

Source: University of Illinois at Chicago