Power line data transmission capacity: Bigger than DSL or cable

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Penn State engineers have developed a new model for high-speed broadband transmissions over U.S. overhead electric power lines and estimate that, at full data rate handling capacity, the lines can provide bit rates that far exceed DSL or cable over similar spans. Dr. Mohsen Kavehrad, the W. L. Weiss professor of electrical engineering and director of the Center for Information and Communications Technology Research, led the investigation. He says, "Although broadband power line (BPL) service trials are now underway on a limited basis in some locations in the U.S., these trials run at DSL- comparable rates of 2 or 3 megabits per second.

"We've run a computer simulation with our new power line model and found that, under ideal conditions, the maximum achievable bit rate was close to a gigabit per second per kilometer on an overhead medium voltage unshielded U.S. electric power line that has been properly conditioned through impedance matching. The gigabit can be shared by a half dozen homes in a neighborhood to provide rates in the hundreds of megabits per second range, much higher than DSL and even cable."

Kavehrad adds, "If you condition those power lines properly, they're an omni-present national treasure waiting to be tapped for broadband Internet service delivery, especially in rural areas where cable or DSL are unavailable."

The researchers say they are the first to evaluate data rate handling capacity for overhead medium voltage unshielded U. S. electric power lines and will outline their findings at the IEEE Consumer Communications & Networking Conference in Las Vegas, Nev., Jan. 5. Their paper is titled, "Transmission Channel Model and Capacity of Overhead Multi-conductor Medium-Voltage Power-lines for Broadband Communications." The authors are Pouyan Amirshahi, a doctoral candidate in electrical engineering, and Kavehrad.

In their paper, the authors note that the junctions and branches in the U.S. overhead electrical grid cause broadband signals to reflect and produce multipath-like effects on these lines. This causes degradation in power-line broadband transmission performance and decreases transmission capacity.

Kavehrad explains, "The signal can bounce back and forth in the lines if there is no proper impedance matching. The bouncing takes energy away from the signal and the loss is reflected in the ultimate capacity.

"In service, performance will depend on how close the power company chooses to place the repeaters," he adds.

The researchers are continuing their studies. Kavehrad predicts that the engineering issues to make BPL a technical alternative to DSL and cable will be solved. Whether it will be an economical alternative remains to be seen since there are interference issues that have to be overcome.

Source: Penn State