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Penn State engineers present expanded view of broadband by power lines Tech Talk

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As leading technology companies unveiled dazzling new computing and electronic products at the Consumer Electronics Show (CES) in Las Vegas earlier this month, engineers from **Penn State University** captured the research spotlight for presenting an innovative solution for broadband delivery over power lines.

Coinciding with the CES in Las Vegas to highlight technology research, the IEEE Consumer Communications & Networking Conference showcased the research paper of engineering professor Dr. Mohsen Kavehrad and engineering doctoral student Pouyan Amirshahi, who outlined how power lines can transmit data to homes at rates far faster than high-speed Internet connections from cable and telephone companies.

"If you condition those power lines properly, they're an omnipresent national treasure waiting to be tapped for broadband Internet service delivery, especially in rural areas where cable or digital subscriber line (DSL) are unavailable," Kavehrad says.

Residential broadband, or the delivery of high-speed Internet service, via cable television or telephone lines has been the dominant means by which millions of Americans have increasingly accessed the Internet. In recent years, federal government officials have promoted broadband service as an economic and education priority and

have undertaken steps to stimulate its use among Americans.

"This country needs a national goal for broadband technology, for the spread of broadband technology. We ought to have a universal, affordable access for broadband technology by the year 2007, and then we ought to make sure as soon as possible thereafter (that) consumers have got plenty of choices when it comes to purchasing the broadband carrier," said U.S. President George W. Bush last spring.

Touted by industry and government officials, broadband service over power lines has been promoted as a possible competitor to cable and telephone services. Cable and telephone services currently handle nearly all of the 30 million U.S. residential broadband connections. Yet despite dozens of experiments, few electric utilities have attempted to sell the service to customers, citing cost and technical problems as obstacles.

Typically, power-line broadband systems offer data speeds of roughly one megabit to three megabits per second, which is similar to cable and DSL services. In their paper, "Transmission Channel Model and Capacity of Overhead Multi-Conductor Medium-Voltage Power-Lines for Broadband Communications," Amirshahi and Kavehrad have contended that their system could deliver data at close to one gigabit per second over medium-voltage electrical lines in ideal conditions, with speeds of hun-

dreds of megabits per second available to home users. A gigabit data connection conveys information one thousand times larger than a megabit connection.

"Our research shows that power lines have much greater broadband capacity than previously envisioned," Kavehrad says, but cautions that increases in interference with other communications require additional technical solutions.

Officials say the researchers are the first to evaluate data rate handling capacity for overhead medium voltage unshielded U.S. electric power lines. The **Penn State** system would use repeaters placed every one kilometer, (0.62 miles) and requires modified power lines to reduce interference with the data signals, according to the researchers. Their estimates are based on computer models, and that the data speeds available in a real-world version would depend on how many repeaters a power company used.

The researchers say they will continue their studies into power-line broadband transmission. Kavehrad believes that the engineering issues to make broadband by power lines 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, he adds.

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