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Researchers test 100G copper transmissions

November 19, 2007 -- Working with cable manufacturer Nexans, a team of researchers at Penn State University "has examined the possibility of sending digital data at a rate of 100 Gbit/sec over 100 meters of Category 7 copper [Ethernet] cabling," according to Mohsen Kavehrad, the university's W.L. Weiss Endowed chair/professor of electrical engineering.

The Penn State researchers presented their system to the IEEE High Speed Study Group last week in Atlanta.

The university's technology seeks to enable copper cables within a room or building (perhaps being used to interconnect servers) to handle data rates typically reserved for fiber-optic links. The researchers say the key is to develop a transmitter/receiver that uses error correcting and equalizing methods to cancel interference better than traditional systems.

Using information on specifications and characteristics of the cables from Nexans, the researchers say they modeled their Cat 7 cable with all attributes including modeling crosstalk. They then designed a transmitter/receiver equipped with an interference canceller that could transfer up to 100 Gigabits using error correcting and equalizing approaches.

"A rate of 100 Gigabit over 70 meters is definitely possible, and we are working on extending that to 100 meters, or about 328 feet," says Ali Enteshari, a graduate student in electrical engineering at Penn State. "However, the design of a 100 Gigabit modem might not be physically realizable at this time, as it is technology limited. We are providing a road map to design a high-speed modem for 100 Gigabits."

The researchers note that all transmission cables are limited by the distance they can transmit data without degradation of the signal; and that before errors and interference make the signals non-recoverable, cable systems can use repeaters - similar to computer modems - to capture, correct or recover data, and resend it. The distance between repeaters depends on the cable and the approach used by the modem to correct errors, say the engineers.

The researchers believe that "two or three generations in the future," the technology of chip circuitry will allow these modem designs to be built. Currently, chip design is at about 65 nanometers, but the researchers expect "in the next two generations to get to what is required," according to professor Kavehrad.

Consisting of four pairs of twisted wires shielded to reduce crosstalk, Cat 7 cable is of heavier weight than Cat 5 cable; Kavehrad's group did similar work on Cat 5 cable four years ago.

"What we are offering is a less expensive solution and one that is easier to build," concludes graduate student Jarir Fadlullah, another member of the Penn State research team.

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