Optical wireless and broadband over power lines: High speed, secure Wi-Fi alternative

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Penn State engineers have shown that a white-LED system for lighting and high data-rate indoor wireless communications, coupled with broadband over either medium- or low-voltage power line grids (BPL), can offer transmission capacities that exceed DSL or cable and are more secure than RF.

Colored LEDs or light emitting diodes are currently found in the numbers on digital clocks, remote controls, traffic lights and other applications. Recently, white LEDs have emerged in the market and the tiny white lights are being considered as replacements for incandescent and fluorescent bulbs.

Some researchers predict that by 2012, tiny white LEDs will deliver light brighter than a 60 watt-bulb yet draw only as much current as provided by four D-size batteries. A Japanese team recently suggested using white LEDs not only for lighting but also as light sources for wireless in-house communications.

Now, Dr. Mohsen Kavehrad, the W. L. Weiss professor of electrical engineering and director of the Center for Information and Communications Technology Research, and his team have shown that, in the system they designed, coupling white LEDs to BPL can deliver secure, wireless bit rates of a gigabit per second, a rate only exceeded by fiber.

Kavehrad will detail the Penn State system and its performance in

simulation in a paper, "Hybrid MV-LV Power Lines and White Light Emitting Diodes for Triple-Play Broadband Access Communications," at the IEEE Consumer Communications and Networking Conference in Las Vegas, Nev., Tuesday, Jan. 10. His co-author is Pouyan Amirshahi, a doctoral candidate in electrical engineering.

In the Penn State system, white LEDs are positioned so that the room is lit as uniformly as possible. Since the LEDs are plugged into the room's electrical system, broadband data, voice or video delivered via the power lines can piggyback on the light that fills the room to reach any wireless receiving devices present.

Since light does not penetrate walls, as do the microwaves used in RF, the white LED system is more secure. In addition, there are no known health hazards associated with exposure to LED light.

Kavehrad notes, "Optical path differences can cause signal distortion in high-speed data transmission. This distortion is highly dependent on the room's dimensions and system configuration. However, if a system is designed appropriately, this distortion can be minimized. For example, in our proposed system, at worst, distortion limits the data rate to one gigabit."

Although white LEDs are not yet commercially available for this type of application, Kavehrad is confident that they will be. He says, "White LEDs are not there yet but by 2010, they will be available and economical. Their low-energy consumption will make them especially attractive. In the future, when you turn on the lights for indoor low-cost lighting, you could receive broadband via the same white light LED. "

Source: Penn State