Spreading high-speed Internet to rural areas

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To cut the cost of bringing high-speed Internet to rural areas, Dr. Ka Lun Lee and colleagues at the University of Melbourne and NEC Australia in the state of Victoria are experimenting with a way to boost the reach of existing technology. Their results, which show a new way to cheaply cover 99 percent of those living in this province, will be presented during the Optical Fiber Communication Conference and Exposition/National Fiber Optic Engineers Conference (OFC/NFOEC), taking place March 22-26 in San Diego.

The 21st century has seen a big push to close the digital divide that separates people in cities from people in rural areas. Even as this divide has closed somewhat in recent years, high-speed Internet is often unavailable, or too costly, for those who live far from the city. According to a 2008 report by the Pew Internet and American Life Research Project, the number of broadband users in rural areas is still about a third less than in urban areas in the United States.

Traditional high-speed services used by city-dwellers -- like DSL or cable -- require extensive networks of equipment and lines out in the field. The cost of this infrastructure increases rapidly as the size of the covered area increases. Other technologies like satellite and fixed wireless offer wider coverage, but are often unreliable and expensive.

Gigabit passive optical networks (GPON) -- used, for example, by Verizon's FiOS service -- provide the lowest cost at higher bitrates, says Lee. These networks carry data long distances over optical fibers to passive optical splitters, which split the signal to individual households.

Currently, the reach of this technology into rural areas is limited by the loss in signal strength along the optical fiber, and each line can only radiate out approximately 19 miles from a central office.

According to Lee's calculations, 19 miles is not enough to reach rural areas. In Victoria, Australia's most densely populated state, this reach would leave a large fraction of the rural population off of the grid. In other more spread out parts of Australia and the world at large, this number of people on the wrong side of the digital divide is likely to be even higher. Current strategies for increasing the area covered require the installation of new, costly components in the field or a switch to other systems not compatible with current standards.

To boost the reach of GPON, Lee and his team use a device called a Raman amplifier. Installed in the central office of a network provider, this high-powered laser feeds the optical signal that carries information with energy as it heads out over a fiber. This increases the power and reach of the signal by a factor of almost ten.

To see how far such a network could reach, Lee's team built a mock network with a signal transmitter, a simulated splitter, and a receiver at the other end. Their proof-of-concept experiment successful transmitted data over 37 miles of single mode fiber, error-free, at a speed of 2.5 Gb/s.

According to Lee's data, a reach of 37 miles would allow the existing offices of network providers to service 99 percent of all Australians living in Victoria. The technology may have an added cost benefit for urban areas. With added reach, a number of central offices of network providers could be closed down to save money on real estate, says Lee.

The biggest drawback of the system in its current form is the question of safety. The supercharged signal will require additional safety measures,

and a more careful inspection for breaks in fibers.

"We have proven that long-reach PON is cost-competitive with other broadband technologies in rural areas and can easily provide much higher access speeds," says Lee. He believes that the technology may also be useful in other countries like the United States. The next steps are to investigate ways to enhance the system performance further and to construct a prototype.

Source: Optical Society of America (news : web)