Digital Dolphins May Improve Telecom

By Mike Martin
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Multi-rate, ultra-short laser pulses -- with wavelets shaped like the sonar image of a dolphin's chirp -- could be used to carry voice, video and data information on line-of-sight, point-to-point laser beams, even in inclement conditions that hamper traditional laser-based communication systems.

Call it the Flipper Flash.

Multi-rate, ultra-short laser pulses -- with wavelets shaped like the sonar image of a dolphin's chirp -- are faster than lightning and zip through clouds, fog and adverse weather conditions, carrying huge amounts of digital information.

Using these laser pulses in optical wireless communication could find applications ranging from wireless exchanges between air and ground vehicles on the battlefield to short links between college campus buildings, say Penn State University (PSU) researchers.

Digital Dolphins

"The new Penn State approach embeds data in ultra-short pulses of laser light, shaped as wavelets, and then transmits the wavelets at various rates," said PSU spokesperson Barbara Hale.

Known as "Meyer's Type," the wavelets used by the Penn State team look like the sonar images of dolphin chirps.

Sending information on the backs of digital dolphins swimming at different rates through the stratosphere may trump traditional telecom.

The dolphin-emulating wavelets minimize bandwidth waste and, as ultra-short pulses, are less likely to interact with rain or fog that could degrade the signal.

Multi-Rate Approach

"The multi-rate approach offers many advantages," said Mohsen Kavehrad, the W. L. Weiss professor of electrical engineering and director of the Penn State Center for Information and Communications Technology Research. "For example, lower-rate signals can get through clouds or fog when high rate signals can't. By sending the same message at several different rates, one of them can probably get through."

Kavehrad and his team have shown that the multi-rate approach achieves an average bit rate higher than conventional optical wireless links operating at 2.5 Gigabits per second (Gbps).

It also provides an increased level of communication reliability by maintaining a minimum of one active link throughout varying channel conditions.

Windows and Wavelets

Optical wireless systems -- also known as free-space optics (FSO) -- carry voice, video and data information on line-of-sight, point-to-point laser beams.

Inclement conditions, however, can hamper traditional outdoor FSO systems, which have been used for over 30 years. Bad weather and other obstructions often prevent the transmitter and receiver from "seeing" each other.

But clouds and fog often clear abruptly, providing brief windows for transmission, Kavehrad told NewsFactor. The ability to get through these little windows makes pulsed delivery of wavelets better suited to FSO.

"The wavelets are easy to generate," said PSU research team member Belal Hamzeh. "We use holography to generate and separate the wavelets. You just generate the mother wavelet and then the others can be generated as a fraction of the transmission bit rate of the mother. They can all co-exist in the channel without interference."

Kavehrad and Hamzeh described the system November 1st at the Military Communications conference in Monterey, California.

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