New record set for data-transfer speeds

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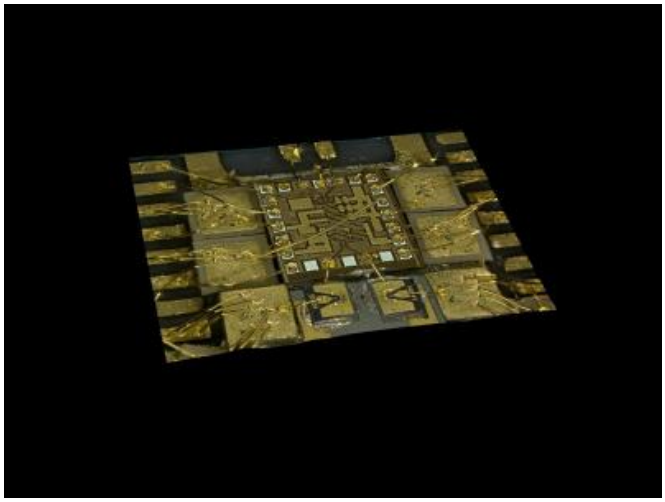

In the foreground are two Chalmers VCSELs. The one on the left has a 6um aperture and could operate error free up to 62Gb/s while the one on the right has a 5um aperture and set the equipment limited record of 64Gb/s. Behind the two VCSELs is IBM's BiCMOS8HP VCSEL driver IC. On either side of the IC are the decoupling capacitors and connecting wirebonds. Credit: IBM

Researchers at IBM have set a new record for data transmission over a multimode optical fiber, a type of cable that is typically used to connect nearby computers within a single building or on a campus. The achievement demonstrated that the standard, existing technology for sending data over short distances should be able to meet the growing needs of servers, data centers and supercomputers through the end of this decade, the researchers said.

Sending data at a rate of 64 gigabits per second (Gb/s) over a cable 57 meters long using a type of laser called a vertical-cavity surface-emitting laser (VCSEL), the researchers achieved a rate that was about 14 percent faster than the previous record and about 2.5 times faster than the capabilities of today's typical commercial technology.

To send the data, the researchers used standard non-return-to-zero (NRZ) modulation. "Others have thought that this modulation wouldn't allow for transfer rates much faster than 32 Gb/s," said researcher Dan Kuchta of the IBM T.J. Watson Research Center in New York. Many researchers thought that achieving higher transmission rates would require turning to more complex types of modulation, such as pulse-amplitude modulation-4 (PAM-4).

"What we're showing is that that's not the case at all," Kuchta said. Because he and his colleagues achieved fast speeds even with NRZ modulation, he added, "this technology has at least one or two more generations of product life in it."

Kuchta will describe these results at the 2014 OFC Conference and Exposition being held March 9-13 in San Francisco.

To achieve such high speeds, the researchers used the VCSEL lasers developed at Chalmers University of Technology in Sweden and custom silicon-germanium chips developed at IBM Research. "The receiver chip is a unique design that simultaneously achieves speeds and sensitivities well beyond today's commercial offerings," Kuchta explained. "The driver chip incorporates transmit equalization, which widens the bandwidth of the optical link. While this method has been widely used in electrical communication, it hasn't yet caught on in optical communication," he said.

"Researchers typically rely on a rule of thumb that says the usable data-transfer rate is about 1.7 times the bandwidth," Kuchta explained. "That means that with the VCSEL laser, which has a bandwidth of about 26 GHz, the rate would be only about 44 Gb/s."

"What we're doing with equalization is we're breaking the historical rule of thumb," Kuchta said.

The fast speeds only worked for a distance of 57 meters, so this technology isn't designed for

sending data across continents. Instead, it's most suitable for transmitting data within a building, he said. About 80 percent of the cables at data centers and most, if not all, of the cables used for typical supercomputers are less than 50 meters long.

This new technology, Kuchta added, is ready for commercialization right now.

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