Bell Labs breaks optical transmission record, 100 Petabit per second kilometer barrier

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Alcatel-Lucent today announced that scientists in Bell Labs, the company's research arm, have set a new optical transmission record of more than 100 Petabits per second.kilometer (equivalent to 100 million Gigabits per second.kilometer).

This transmission experiment involved sending the equivalent of 400 DVDs per second over 7,000 kilometers, roughly the distance between Paris and Chicago. This is the highest capacity ever achieved over a transoceanic distance and represents an increase that exceeds that of today's most advanced commercial undersea cables by a factor of ten. To achieve these record-breaking results the Bell Labs researchers made innovative use of new detection techniques and harnessed a diverse array of technologies in modulation, transmission, and signal processing

High speed optical transmission is a key component of Alcatel-Lucent's High Leverage Network architecture, key elements of which have already been selected by leading service providers.

To achieve these record-breaking results researchers from the Bell Labs facility in Villarceaux, France used 155 lasers, each operating at a different frequency and carrying 100 Gigabits of data per second, to dramatically enhance the performance of standard Wavelength Division Multiplexing (WDM) technology.

"There is no question that this record breaking transmission is a milestone in achieving the network capacity and speeds and a key step

forward in satisfying the ongoing explosion in demand," said Gee Rittenhouse, head of Bell Labs Research. "This is a prime example of Bell Labs preeminent research and demonstrates the ability of our researchers to solve complex problems," he explained.

The record-breaking figure was derived by multiplying the number of lasers by their 100 Gigabit per second transmission rate and then multiplying the aggregate 15.5 Terabit per second result by the 7000 kilometer distance achieved. The combination of speed and distance expressed in bit per second.kilometers is a standard measure for high speed optical transmission.

The transmissions were accomplished over a network whose repeaters, devices used to sustain optical signal strength over long distances, were spaced 90 kilometers apart. This spacing distance is 20% greater than that commonly maintained in such networks. The challenge of maintaining transmission over these distances was significantly heightened in these experiments because of the noise -perturbation of signals- that is introduced as transmission speeds increase.

The researchers also increased capacity by interfacing advanced digital signal processors with coherent detection, a new technology that makes it possible to acquire details for a greater number of properties of light than the direct detection method commonly applied in today's systems. Using this technique the researchers were able to effectively increase capacity by increasing the number of light sources introduced into a single fiber yet still separate the light into its constituent colors when it reached its destination.

Details of the breakthrough were presented in a research paper that was reviewed in an exclusive and highly-competitive post deadline session of ECOC 2009, a prestigious European optical communications conference.

This transmission record is just the latest in a long series of Bell Labs optical networking breakthroughs that have become market-changing solutions and generated substantial growth opportunities for Alcatel-Lucent: the invention of Dense Wave Division Multiplexing (DWDM), introduction of non-zero dispersion fiber, 100 Gigabit Ethernet field trials and Differential Phase-Shift Keying (DPSK) at 40 Gigabits per second, the most widely used in 40 Gigabit per second systems worldwide.

Provided by Alcatel-Lucent